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Research desk study

The role of municipalities in monitoring and reporting for Baltic Sea Action Plan and The Water Framework Directive

Commissioned by SIWI Swedish Water House

Author: Helene Ejhed

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IVL Swedish Environmental Research Institute Ltd.,
P.O Box 210 60, S-100 31 Stockholm, Sweden
Phone +46-(0)10-788 65 00 // Fax +46-(0)10-788 65 90 // www.ivl.se

This report has been reviewed and approved in accordance with IVL's audited and approved management system.

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1 Summary

The implementation of the HELCOM Baltic Sea Action Plan (BSAP) and the Water Framework Directive (WFD; 2000/60/EEG) has led to increased need of monitoring and reporting of data regarding status and sources of load on the aquatic environment. However, due to the history of the monitoring programmes being established for different purposes and aims, the organization of monitoring and reporting is complex with many actors involved. The environmental work of the municipalities - particularly in light of their being the authority closest to the sources of pollution and possessing local knowledge on possible measures, as well as their knowledge of local benefits of positive environmental effects - is important for the success of the BSAP and WFD. Thus, the role of the municipalities in the process and organization of monitoring and data flow is important. This short study was performed as a brief investigation of the municipal view regarding the organization of reporting to the WFD and BSAP, their role in the monitoring of data that could be used for the reporting, and their view on the completeness of the monitoring in their municipality.

To get the view of the status of data reported for HELCOM to assess progress towards BSAP, several actions were made in this project; The HELCOM secretariat has been consulted for their view on the data and expectations on monitoring and reporting from municipalities. The national authorities around the Baltic Sea have been asked to describe how monitoring and reporting is organized in their country. They were also questioned about identified gaps in the monitoring. The gaps and progress in the HELCOM Pollution Load Compilation (PLC) reporting have been compiled in this study from evaluations in the "PLC5.5 report", reporting of riverine total load and point sources in 2012 and progress of the data reporting from notes provided to HELCOM Heads of Delegations meetings 50 and 51 in 2016.

To get an overview from the "local" level on their role in monitoring and reporting with respect to BSAP and WFD a questionnaire was directed to a select group of municipalities and cities located around the Baltic Sea to address questions about organization, monitoring networks and methods. This select group comprises 6 municipalities and one region around the Baltic Sea involved in the Baltic Sea City Accelerator program, an initiative of Zennström Philanthropies' Race For The Baltic foundation.

Conclusions from this study were;
HELCOM recognized the importance of the involvement of municipalities in the implementation of the BSAP and HELCOM agreements. The national authorities expect and need support from the regional and local authorities to contribute to the data of status and implementation and follow-up on measures needed to fulfil assessment of the development towards the targets in BSAP and to comply with requirements in the WFD.
While the municipalities are involved in the development of plans of measures today, they could be more involved in the monitoring, reporting and implementation of measures to reach BSAP targets.
Coordination and communication of the important role municipalities play, as well as feedback to municipalities on how their reported data is used, can lead to a higher prioritization of environmental work at the municipality level. Further, using harmonized and cost-efficient measures can build up the foundation required to reach WFD and BSAP targets.
Additionally, using harmonized and cost-efficient measures increases the ability for comparison of the results on the municipality level – which could be helpful for regional planning and determining best practices on the local level.

2 Background

The implementation of the HELCOM Baltic Sea Action Plan (BSAP) and the Water Framework Directive (WFD; 2000/60/EEG) has led to increased need of monitoring and reporting of data regarding status and sources of load on the aquatic environment. However, due to the history of the monitoring programmes being established for different purposes and aims, the organization of monitoring and reporting is complex with many actors involved. Further, these programmes now also are reused for the monitoring and reporting for HELCOM and WFD.

The environmental work of the municipalities - particularly in light of their being the authority closest to the sources of pollution and possessing local knowledge on possible measures, as well as their knowledge of local benefits of positive environmental effects - is important for the success of the BSAP and WFD. Thus, the role of the municipalities in the process and organization of monitoring and data flow is important, and coordination and communication is needed regarding:

- What the data from the municipalities is used for
- What methods they can use
- What is expected of them
- What role they have in international reporting obligations

This short study was performed as a brief investigation of the municipal view regarding the organization of reporting to the WFD and BSAP, their role in the monitoring of data that could be used for the reporting, and their view on the completeness of the monitoring in their municipality.

2.1 Reporting according to HELCOM PLC Guidelines

The progress of the countries' measures to reach the targets of nutrients input to the Baltic Sea according to the HELCOM BSAP is assessed on the national data reported for HELCOM Pollution Load Compilation (PLC). Thus, the view of the monitoring, reporting and responsibilities of the municipalities is reviewed in this study in relation to the PLC reporting and on identified gaps in PLC reporting.

The requirements for national reporting of nitrogen and phosphorous load on the Baltic Sea to follow up on the development towards the Maximum Allowable Input (MAI) and Country Allocated Reduction Targets (CART) set in the Baltic Sea Action Plan (BSAP) are described in the HELCOM PLC (Pollution Load Compilation) guidelines. The HELCOM PLC Guidelines 2016 is available on the HELCOM website: http://www.helcom.fi/Lists/Publications/PLC-Water%20Guidelines.pdf.

In implementing the objectives of the Convention and the BSAP nutrient reduction scheme, the Helsinki Commission (HELCOM) needs reliable data on inputs to the Baltic Sea from land-based sources to be able to:

- Assess the effectiveness of measures taken to abate the pollution in the Baltic Sea catchment area
- Follow-up on progress towards MAIs and CARTs
- Identify further cost-effective measures for reducing pollution

Such data also supports assessments of the state of the open sea and coastal waters.

According to the Guidelines HELCOM recognizes the importance of using harmonized and comparable methodology, and the reporting of quality-assured data to the PLC-database.

Data is to be reported by all contracting parties on both an annual and periodic basis:

- Annually: total inputs of nutrients and hazardous substances to the sea should be reported by quantifying inputs from monitored rivers, unmonitored areas, and point sources discharging directly to the sea.
- Periodically (every six years): in addition to the total inputs to the sea (annual reporting), waterborne discharges from point sources, losses from diffuse sources, as well as natural background losses, should also be reported for inland surface waters within the Baltic Sea catchment area.

Annually, data are thus reported of total load (not source apportioned) for monitored and un-monitored rivers and point sources with direct discharges to the sea.

Periodic data are reported according to the following classifications:

- **Source oriented approach** = source apportionment of load to inland waters
- **Load oriented approach** = source apportionment of load in river mouth and direct point source discharge to the sea, accounting for loss during transport to the sea due to retention

The objectives of periodic waterborne pollution input compilations (PLC-Water) regarding pollution of the Baltic Sea from land-based sources are to:

- Compile information on the waterborne inputs via rivers and direct discharges of important pollutants entering the Baltic Sea from different sources in the Baltic Sea catchment area based on harmonized monitoring and modelling methods.
- Follow-up the long-term changes in the pollution input from various sources by normalizing data and making trend analysis with standardized methodologies.
- Identify the main sources of pollution to the Baltic Sea to support prioritization of measures.
- Assess overall effectiveness of measures taken to reduce the pollution inputs into the Baltic Sea catchment area.
- Assess the development of waterborne and airborne nutrient inputs from different countries to the different Baltic Sea sub-basins to evaluate progress in fulfilling nutrient reduction targets of the Baltic Sea Action Plan.
- Provide pollution input information for assessment of long-term changes and the state of the marine environment in the open sea and the coastal zones.

Discharges from point sources

The point sources that are to be reported within PLC are:

- Wastewater treatment plants (<2,000-9,999 pe, 10,000-49,999 pe, ≥ 50,000 pe)
- Storm water treatment plants
- Industrial plants
- Aquaculture

Diffuse sources

Natural background sources include:

- Losses from unmanaged land
- Part of losses from managed land that would occur irrespective of anthropogenic, e.g. agricultural, activities.

Anthropogenic diffuse sources include:

- Agricultural land
- Managed forestry and other managed land
- Atmospheric deposition directly on inland surface waters
- Scattered dwellings
- Rainwater constructions (e.g. paved surfaces without a distinct outlet)

The monitoring of river mouths draining to the Baltic Sea and point sources is usually possible to perform through sampling in a well-defined river sampling station and in point source outlet. Guidance on sampling frequency and data quality assurance is presented in the PLC guidelines. However, the different loss processes and pathways of diffuse sources are complex and variable, and the significance of their effects also varies between nitrogen and phosphorus. Therefore, it is difficult to accurately quantify diffuse losses. The PLC guidelines do not include a methodology for quantifying diffuse sources or delivery pathways. In the absence of comprehensive measurements, it is necessary to apply calculation methodologies (e.g. computer-based modelling techniques).

2.2 Monitoring and reporting according to the Water Framework Directive

The requirements of monitoring and reporting are defined in the Water Framework Directive (2000/60/EG) and implemented in the national regulations, where also responsibilities and methods should be stated. EU Common Implementation Strategy projects have been performed to identify common guidelines in the implementation of the Directive.

3 Methods

3.1 Evaluation of the role of the municipalities in monitoring and reporting for BSAP and WFD.

The HELCOM secretariat has been consulted for their view on the data and expectations on monitoring and reporting from municipalities. Specifically, the HELCOM secretariat was asked to comment on what data are the most challenging for national PLC reporting within HELCOM and to describe a potential contribution of municipalities into nutrient reductions to reach BSAP.

The national authorities around the Baltic Sea have been asked to describe how monitoring and reporting is organized in their country, e.g. which organization(s) is responsible for monitoring and reporting, what is the work flow and accessibility of data for reporting to HELCOM BSAP and EU WFD. They were also questioned about identified gaps in the monitoring. (Due to a very limited response time and possibly that the questions were not directed to the most appropriate authorities, replies to this question were only received from the Swedish Agency for Marine and Water.)

3.2 Reporting needs according to HELCOM PLC Guidelines

The progress of the countries' measures to reach the targets of nutrients input to the Baltic Sea according to the HELCOM BSAP is assessed mainly on the reported data for HELCOM Pollution Load Compilation (PLC). Thus, the view of the monitoring, reporting and responsibilities of the municipalities is reviewed in this study in relation to the PLC reporting and on identified gaps in PLC reporting.

The gaps of the data in the PLC reporting have been compiled in this study from the summary presented by HELCOM on PLC5 year 2006 data, evaluations in the "PLC5.5 report". Before reporting on the progress towards the BSAP reduction targets and revising the targets in 2013, HELCOM made a review on missing data and thereafter attempted to complete the data with additional information compiling it into the PLC 5.5 report. HELCOM has conducted several surveys of all contracting parties in 2015-2016 regarding the data available for PLC reporting. A summary table is available on the HELCOM website regarding reporting of riverine total load and point sources in 2012. Observations from the results of that questionnaire have been compiled in this study.

3.3 Questionnaire study - pioneer municipalities

A questionnaire was directed to a select group of municipalities and cities located around the Baltic Sea to address questions about organization, monitoring networks and methods to get an overview from the "local" level on their role in monitoring and reporting with respect to BSAP and WFD. This select group comprises 6 municipalities and one region around the Baltic Sea involved in the Baltic Sea City Accelerator program, an initiative of Zennström Philanthropies' Race For The Baltic foundation. As participants in this programme, they work on developing and adopting local Baltic Sea Action Plans, among other activities. This small group of cities is too limited to generate statistically significant measures and, given their interest in Baltic Sea issues and the work they have initiated on their local BSAP, they may have an inherent bias. However, the responses do provide an accurate indication of their current situation. The questionnaire was in the field from December 2016-January 2017.

The following areas were addressed in the questionnaire:

- Organization of monitoring and reporting
- Monitoring methods, analysis and stations
- Sources of pollution
- Impact of monitoring and reporting
- Publishing of data

4 Results

4.1 Evaluation of the role of municipalities in monitoring and reporting for BSAP and WFD.

HELCOM reporting needs

There are many challenges and obstacles to compile a sufficient dataset on input of nutrients. But they lie beyond the mandate of municipalities. These problems include modelling of input from diffuse sources, transboundary input, and retention coefficients.

HELCOM 38[1] which recently was held in Helsinki, highlighted the importance of the involvement of municipalities in the implementation of HELCOM agreements. In connection with that the HELCOM secretariat informed that HELCOM priorities in addition to reduction of input of nutrients also include marine litter, hazardous substances, etc. and that municipalities and

[1] HELCOM 38-2017 high-level segment on ocean-related Sustainable Development Goals and regional issues important for the Baltic Sea. Helsinki, Finland, 28 February 2017.

particularly cities could contribute also to the implementation of the BSAP, but not only monitoring of inputs of nutrients. According to the Secretariat, municipalities could contribute to national reporting on the effectiveness of measures on reduction of input of nutrients, the implementation of HELCOM Recommendations related to waste or storm water management, and the newly adopted Recommendation on sewage sludge handling.

The Swedish Agency for Marine and Water Management view on monitoring and reporting for HELCOM and WFD

Due to the history of the monitoring programs being established for several different purposes and aims, the organization of monitoring and reporting is complex with many actors involved. The largest challenge today is that the current monitoring network, methods and frequency has not been designed based on the series of directives and conventions and the different requirements they place on the monitoring.

Regarding the Water Framework Directive (WFD), the River basin district authorities shall ensure that monitoring programs are established and that monitoring is performed. This is evident from Regulation (2004: 660) on the management of the quality of the aquatic environment, Chapter 7. The implementation will be done in collaboration with the authorities, municipalities, organizations and other actors that the River basin district authority considers appropriate. The Swedish Agency for Marine and Water Management is responsible for reporting to the European Commission. This is evidenced by the above Regulation, Chapter 9. Reporting from the monitoring of surface and ground water is done by metadata monitoring, not in the form of raw data analysis. Reporting of load data will be in the form of a register of emissions and waste. Today, monitoring is financed by public funds (national and regional environmental monitoring) or by point source operators' recipient monitoring. For this to work, the responsible authorities, The Swedish Agency for Marine and Water Management and the Geological Survey of Sweden (SGU), need to clarify requirements. Work is now underway in Sweden to clarify what monitoring is required (https://www.havochvatten.se/hav/samordning--fakta/miljoovervakning/full-koll-pa-vara-vatten.html). Additionally, there is an ongoing project at The Swedish Agency for Marine and Water Management to develop guidelines for regulatory authorities with focus on environmental standards, sources of pollution of nutrients and operators causing discharges of nutrients. Actors involved in the Swedish water management according to the River basin district authorities is presented in **Error! Reference source not found.**, with the addition of HELCOM and additional ctors (data rapporteur and national monitoring operator) involved in the reporting to HELCOM.

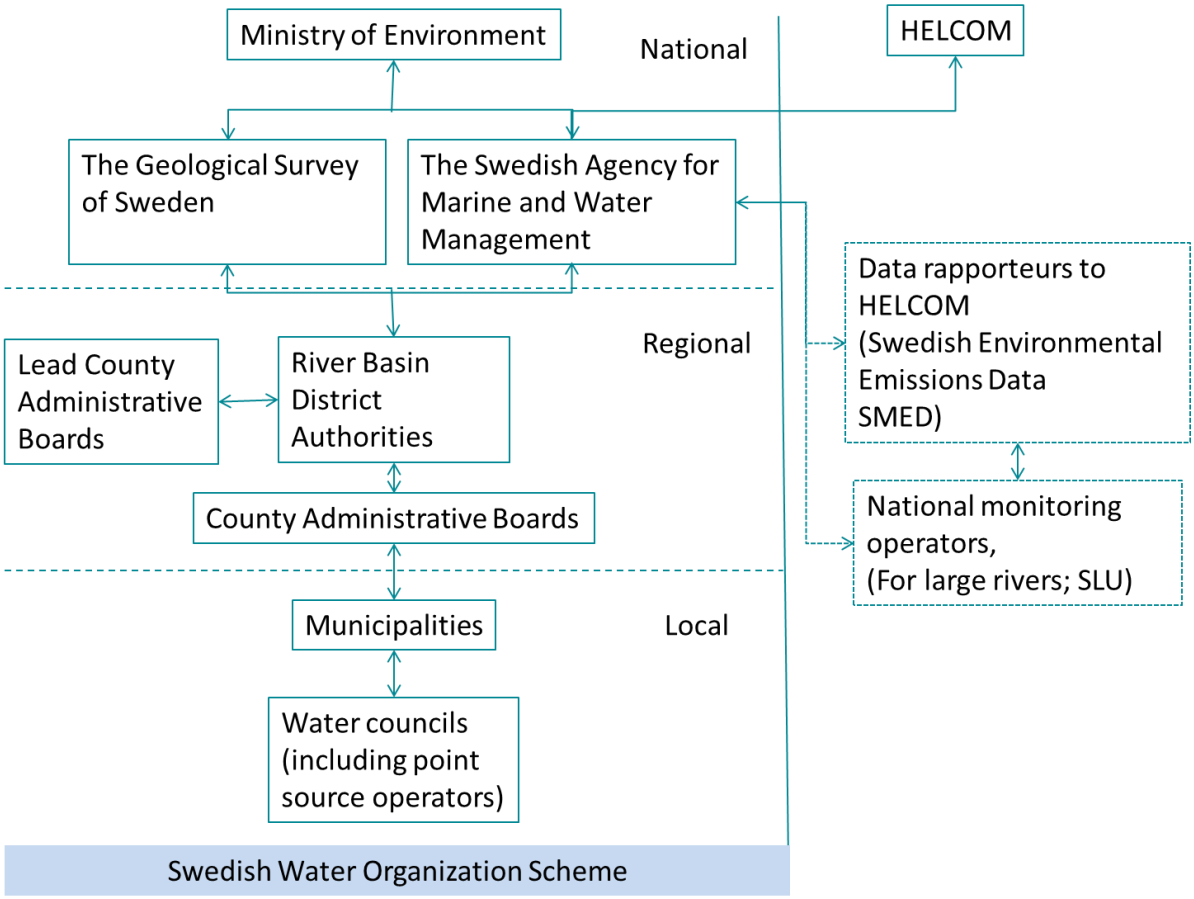


Figure 1. Actors involved in the Swedish water management with the addition of HELCOM and actors involved in HELCOM reporting.

Based on how the system is structured today, Sweden relies considerably on the voluntary reporting of monitoring data by municipalities and point-source operators. Reporting of load data is however required for operators covered by the European Pollutant Release and transfer Register (Regulation (EC) No166/2006 of the European Parliament and of the council).

The actors reporting monitoring data need to be informed about both the desire that they deliver the required data and the requirements on this data. For this to work effectively, we need more efficient data flow from the operators of monitoring to national data providers, and data presentation. This is something the Swedish Agency for Marine and Water Management plan to work with. The Swedish Agency for Marine and Water Management judge that through ongoing investigations they have / will get a good overview on requirements from the Water Framework Directive, The Marine Strategy Framework directive, and HELCOM / OSPAR, and on how monitoring should be carried out to meet these requirements. There are several other directives, such as the Nitrates Directive and the Urban Wastewater Treatment Directive, where there is a need for further coordination. However, the main responsibility for these directives rests with the Board of Agriculture and the Swedish Environmental Protection Agency. It is of importance to review all the requirements concerning the monitoring of nutrients and produce an optimal program for Sweden. Coordination possibilities need to be investigated more.

The Swedish Agency for Marine and Water Management has suggested to the Swedish Ministry that a Water Control system should be considered as a way to finance the monitoring of environmental quality standards.

4.2 Gaps in HELCOM PLC reporting

The HELCOM pollution load compilation PLC is a data reporting instrument which aims to assess the progress of the countries' efforts in reducing their input to the Baltic Sea according to the PLC guidelines. Data on the sources of waterborne discharges from point sources, diffuse sources, as well as natural background losses also for inland surface waters, requires local information. Information of scattered dwellings, storm water, municipal wastewater treatment plants and recipient control data is part of the PLC data report and background information to the reporting and, as a result, municipalities can contribute to the assessment of the effectiveness and impact of the BSAP.

PLC5 year 2006 data, evaluations

The PLC 5.5 work focussed on updating, correcting, gap-filling and quality assuring the PLC 5 data set. Most countries updated or revised old PLC data, covering the period 1994-2008, by providing missing data and/or correcting previously reported data. The main changes that were noted when comparing the PLC-5.5 data set with the PLC-5 data set, was for waterborne inputs to the Gulf of Finland, Gulf of Riga and southern parts of the Baltic Proper, while only minor changes were noted for the remaining parts of the Baltic Sea. **However, only riverine load, point source load, and atmospheric deposition were addressed, thus gaps in the source apportionment data were not completed.**

- In general, water flow, nitrogen and phosphorous riverine concentrations were missing completely or partly from Latvia and Russia.
- Some countries were missing data (in part or in full) from direct wastewater treatment plants and industry discharges for one or several years (water flow, nitrogen, phosphorus).
- Some countries only monitored and reported inorganic (dissolved) nutrient fractions for some years.
- There were no obvious explanations for very high inputs for some years in several rivers (the Odra and Vistula in Poland and the Neva in Russia).
- The information of direct point source loads was included in unmonitored or coastal loads for some years; however, this does not affect the total waterborne inputs.

PLC6 evaluations

PLC6 reporting was due in December 2015, but the assessments of data are still going on in the HELCOM PLC6 working group. HELCOM has conducted a survey regarding the data available for PLC reporting. A summary table is available on the HELCOM website regarding reporting of riverine total load and point sources in 2012. Below are some observations made from that 2012 list (in the discussion we will relate this information to the data provided by the municipalities):

- Riverine load: This is monitored and reported in all countries. The percentage of land area covered by monitoring is not addressed in the questionnaire. Only Finland and Estonia do biased sampling to monitor high- and low-flow occasions.
- Wastewater treatment plants: Information from Finland is lacking in the questionnaire table (but they have reported to the PLC6 database), information from Germany is missing. Estonia only report 4 samples and Latvia report 4 of up to 12 samples, thus it may be interpreted that they do not comply with the Urban Wastewater directive for large wastewater treatment plants. Poland shows variable amounts of samples thus partly complying with the Urban Wastewater directive. According to Russian legislation,

individual information about discharge for each source is confidential, but aggregated information about total loads to sub-basins is available.

- Industrial plants: The industries are not regulated in any common directive which means that the reporting is individually determined by permits. Denmark remarks that the industries themselves collect according to the conditions of their environmental approvals and that this is collected nationally. Parameters and frequency of the sampling depends on the specific industries and varies greatly. These data are available for HELCOM. A similar situation applies for Sweden. Estonia answers that industrial effluent is finally treated within the municipal wastewater treatment plants.
- Aquaculture: Denmark, Germany, Lithuania and Poland present data on fish farms in the questionnaire. Sweden replied with respect to the industrial load data; there are no common regulations that specify sampling frequency and parameters of fish farms.

The pollution load compilation data reported annually and periodically has been continuously reviewed for HELCOM meetings;

- Heads of Delegation 50 meeting 15-16 June 2016 (status of PLC6 reported data May 2016): annual data of 2013 was almost complete while 2014 was not complete and periodical data 2014 was not completed,
- Heads of Delegations 51 meeting: all countries had inserted 2014 annual data to the HELCOM database but Denmark, Estonia and Russia had uploaded and inserted only partly the periodical data.

A conclusion that can be drawn from the progress of the pollution load compilation data reporting is that it is a continuous improvement of data available for reporting and big efforts are being made from all countries to provide complete data of high quality. But another conclusion from the long time it takes to complete each reporting year is that the data is not easily compiled for the countries.

4.3 Questionnaire results

The questionnaire was performed during a very limited time frame and responses were provided by 5 municipalities and 1 region (Table 1). Three of the municipalities that have answered the questionnaire are situated in Sweden, which biases the answers to a Swedish domination. Slupsk only answered 6 questions, all regarding methods, due to the lack of knowledge on the rest of the questions, and the questionnaire should possibly have been directed elsewhere in the organisation.

Table 1 Table of the municipalities and the number of questions they have responded on.

Municipality	Organisation N replies	Methods N replies	Sources N replies	Impact N replies	Publishing N replies	Total N replies
Mariehamn	11	15	12	4	7	49
Panevezys	11	17	11	4	6	49
Slupsk	0	6	0	0	0	6

Vaxholm	10	17	13	5	7	52
Västervik	11	17	13	5	7	53
Kalmar	10	17	12	5	7	51

A selection of questions has been picked out in this report to highlight the municipalities' view on responsibilities, knowledge and possible gaps in monitoring. Complete answers to all the questions are available in Annex 1. Colours in the pie charts presented in the results section are displayed in the order of the legend from left to right, starting on the top of the pie, dividing the chart clockwise.

Organization of monitoring and reporting

Questions

The questions that were included related to the organization of monitoring and reporting were the following:

Questions
1. Do you know who is responsible for your countries' reporting to HELCOM?
2. Name of responsible organisation/institution for HELCOM reporting:
3. Do you know who is responsible for reporting to EU Water Framework Directive (WFD)?
4. Name of responsible organisations/institution for WFD reporting
5. How is monitoring and reporting organised to HELCOM and WFD and which role does your city have?
6. Who determines the status classification and plan of measures of waterbodies in your city/municipality that is reported to WFD?
7. Do you know which data is needed for reporting to HELCOM?
8. Do you know which data is needed for reporting to WFD?
9. Name of the organisation/institution you report monitoring data to:
10. Do you know what your monitoring data is used for in the reporting to HELCOM and WFD?
11. Name and contact information to responsible organisation for monitoring in your municipality:

Results

The results show that the knowledge is different between the organization for reporting to HELCOM and for WFD (**Error! Reference source not found.**). The organization of reporting for ELCOM is not known by two out of five of the municipalities, while all the municipalities know fully or partly who is responsible for the WFD reporting. The Swedish municipalities report to the County level or Water district authorities specifically regarding implementation of WFD measures (Table 2), but the responsible authority for HELCOM reporting is the Swedish Agency for Marine and Water Management. In Mariehamn, there are two different national authorities responsible for the reporting to HELCOM and WFD, and the municipality reports to the local water authority. Thus, the organization has been fully communicated to Mariehamn even though several authorities are involved. In Panevezys, there is only one authority responsible for both HELCOM and WFD reporting (Ministry of the Environment), while the municipality reports to the

Environmental Protection Agency. These are national organizations which means that they have a flat organization for reporting and a manageable overview.

Further, the results show that the data which is needed for HELCOM reporting is not known in any of the municipalities, while the knowledge of data needed for WFD reporting is known in part only by Panevezys and maybe by Mariehamn (**Error! Reference source not found.**). The question s a broad one and could possibly be interpreted differently in different municipalities, but only Mariehamn chose to reply "maybe", thus the general data need is not clear.

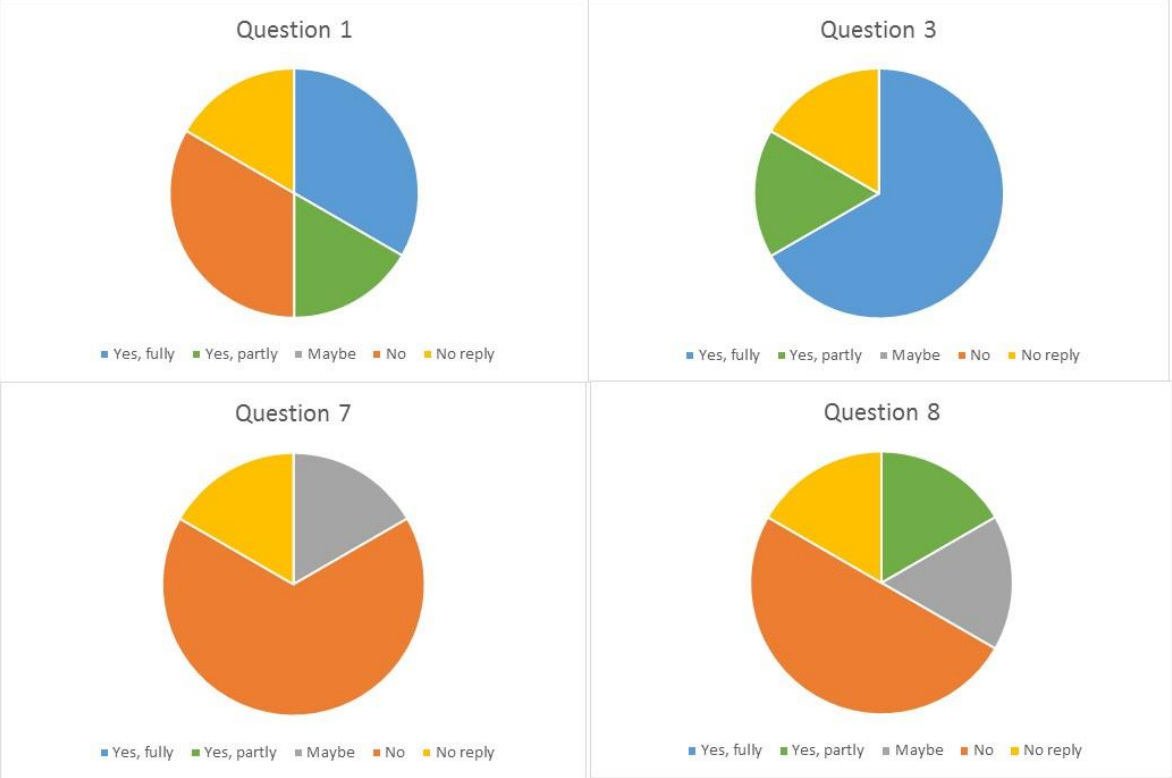


Figure 2. Selection of answers to questions regarding organization (Question 1. Do you know who is responsible for your countries' reporting to HELCOM?; Question 3. Do you know who is responsible for reporting to EU Water Framework Directive (WFD)?; Question 7. Do you know which data is needed for reporting to HELCOM?; Question 8. Do you know which data is needed for reporting to WFD?

Table 2. Answers to question 5: How is monitoring and reporting organized to HELCOM and WFD and which role does your city have?

ID#	Q5
Mariehamn	We collect data from our WWTP according to current terms in permit document and send it to our local water authority by the end of February each year.
Panevezys	Joint Stock company "Aukštaitijos vandenys" monitoring data from large municipal wastewater treatment plants (MWWTP) (>100,000 pe) and industries submitted to the Environmental Protection Agency. Joint Stock company "Panevėžio gatvės" conducted surface water monitoring, determined nutrients,

	suspended oil concentration of 13 outlets in the river Nevezis and report submitted to the Environmental Protection Agency every year.
Slupsk	No reply.
Vaxholm	Every year Vaxholm reports to Vattenmyndigheten how the municipality is doing regarding water quality through "Kommunernas rapportering av genomförande av vattenmyndigheternas åtgärdsprogram".
Västervik	Västervik reports to Länsstyrelsen i Kalmar län och Vattenmyndigheten för Södra Östersjön
Kalmar	Kalmar Municipality reports the output of the national action plan to Vattenmyndigheten for the WFD. As far as we know, no our outputs are not reported to HELCOM.

Conclusions "Organization of monitoring and reporting"

The results show that:

- All the municipalities have a good view of the organization and their role in reporting to the WFD
- All the municipalities have a poor view of the data needed for reporting to HELCOM BSAP
- Most municipalities have a poor view of the data needed for WFD reporting
- All the municipalities are involved in the reporting of information regarding the WFD to their data collection organization

Monitoring methods, analysis and stations

Questions

The questions that were included related to the monitoring methods, analysis, and stations were the following:

Questions
12. Do you use standardized methods for laboratory analysis of nitrogen and phosphorous concentrations?
13. Do you require laboratories doing the analysis to be accredited/certified?
14. Do you require personnel doing the monitoring sampling to be certified?
15. What method do you use to determine total nitrogen?
16. Do you use sensor techniques for monitoring nitrogen and/or phosphorous?
17. Do you have real-time data for monitoring nitrogen and/or phosphorous?
18. How is data available today?
19. Does your monitoring stations network cover all waterbodies needed for surveillance monitoring?
20. If not - how large percentage of the number of waterbodies are not covered by needed surveillance monitoring?

21. Do you have enough stations for operational monitoring in all necessary water bodies? (It is required for water bodies identified as being 'at risk of failing' to meet their environmental objectives and in water bodies to monitor status as an effect of measures)
22. Do you have enough stations for investigative monitoring in all necessary water bodies? (It is required for water bodies where the reason for any excess is unknown and operational monitoring is not yet established.)
23. What is the reason for not having enough stations?
24. Do you have plans to increase the coverage for surveillance monitoring? How?
25. How large a percentage of the number of waterbodies with status "moderate or worse" is covered by operational monitoring?
26. What methods do you use to determine flow and runoff?
27. Do you consider your time-series and annual variations data good enough to determine status in all water bodies?
28. How long time-series are available of nitrogen and phosphorous concentrations?

Results

The results show that as far as the municipals know, the monitoring is performed using standardized methods both regarding the analysis of nitrogen and phosphorous concentrations and that the laboratories are required to be accredited or certified (**Error! Reference source not ound.**). These requirements on the laboratory analysis give reliable data for assessments of results. Further, four municipalities require certified personnel to do the sampling, which is an effort to produce data of good quality along the whole chain from sampling to results. Kalmar commented that sampling of wastewater treatment plants is performed by certified personnel, but not recipients monitoring. Only Mariehamn has answered "no" to the question whether sampling personnel are required to be certified.

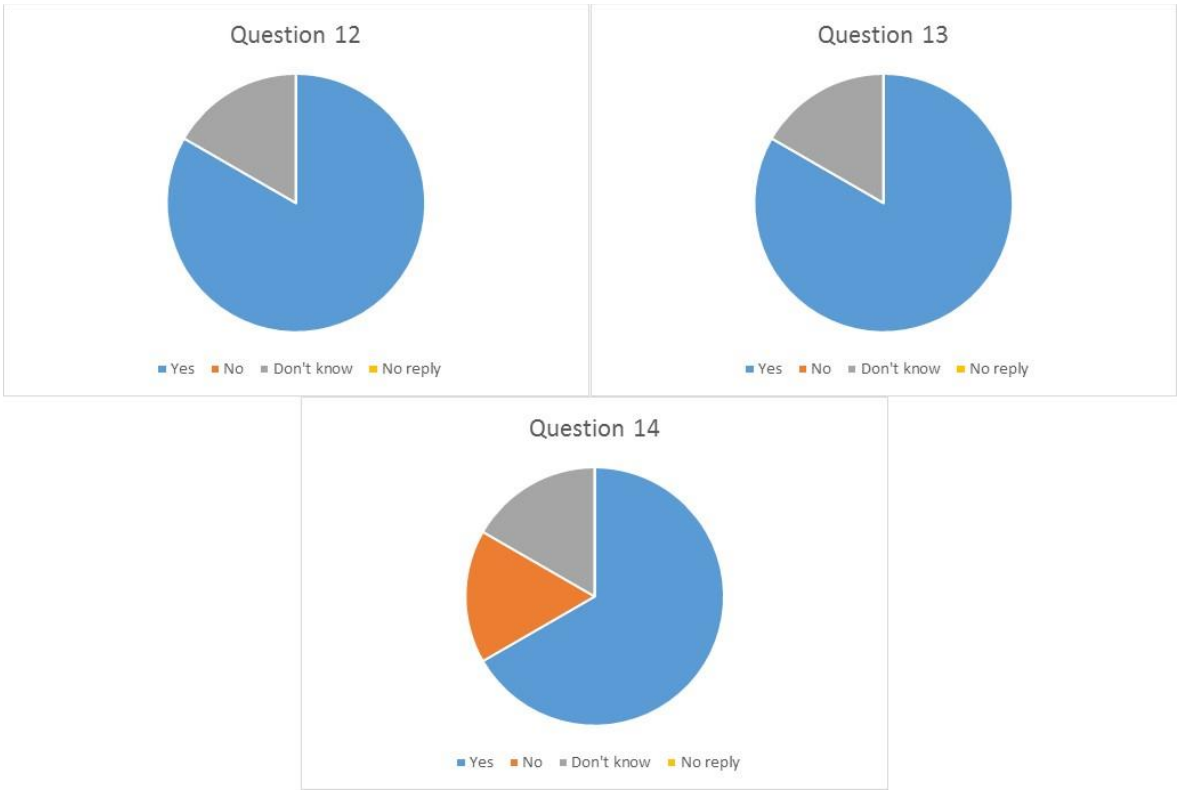


Figure 3. Selection of answers to illustrate the use of standardized methods, certified laboratory analysis and certified personnel to guarantee good quality data (Question 12. Do you use standardized methods for laboratory analysis of nitrogen and phosphorous concentrations?; Question 13. Do you require laboratories doing the analysis to be accredited/certified?; Question 14. Do you require personnel doing the monitoring sampling to be certified?).

There are several different standardized methods used for analysis of nitrogen and three which are widely applied; the Kjeldahl N + nitrate + nitrite, persulfate method and the catalytic oxidation method. The Kjeldahl method can produce about 20% higher total nitrogen concentrations compared to the oxidative digestion method while the persulfate method is limited in the concentration range and more uncertain in the high and low concentrations[2]. This is well-known and results need to be compared with regard to the method used. Five municipalities have answered the question about which method they use (Table 3).

Table 3. Responses to question 15: What method do you use to determine total nitrogen?

Municipality	Response
Mariehamn	catalytic oxidation
Panevezys	Oxidative digestion with peroxodisulfate method (ISO 11905-1)
Slupsk	Kjeldahl N + nitrate + nitrite
Vaxholm	Don't know
Västervik	Kjeldahl N + nitrate + nitrite
Kalmar	SS-EN ISO 11905 and ISO 29441:2010

[2] Karin Wallman, Stefan Löfgren, Lars Sonesten, Christian Demandt och Anna-Lena From, Totalkväveanalyser vid Institutionen för vatten och miljö. En genomgång av olika analysmetoder och deras betydelse för tidsserierna. Institutionen för vatten och miljö, SLU Box 7050, 750 07 Uppsala Rapport 2009:8

Further, the results show that the collection of monitoring data is also done using sensor techniques in four municipalities and that real-time data is available in three municipalities (**Error! eference source not found.**). Slupsk has commented in its response to question 16 that sensor technique and real-time data is available from monitoring wastewater treatment plants. However, in general, data is stored in different ways and may not be easily accessible (Table 4).

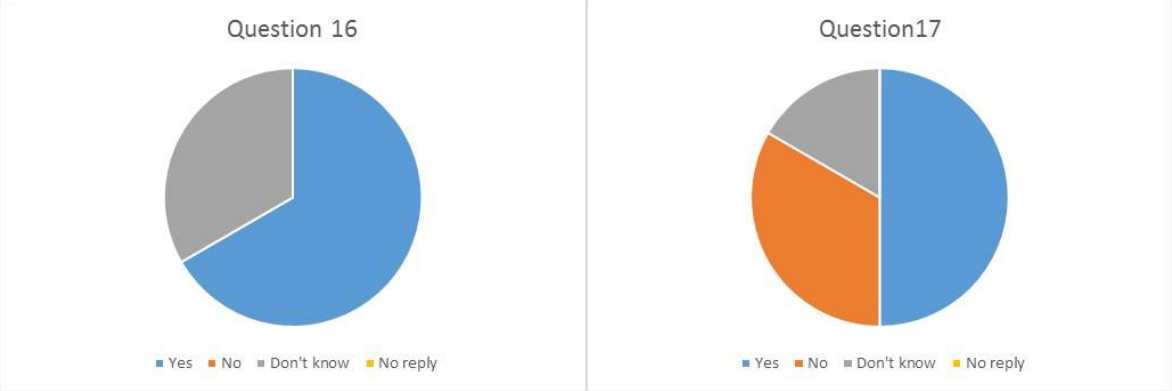


Figure 4. The results of question 16 and 17 regarding the use of sensor techniques and availability of real-time data. Mariehamn, Västervik, Slupsk and Kalmar use sensor techniques (Question 16. Do you use sensor techniques for monitoring nitrogen and/or phosphorous?; Question 17. Do you have real-time data for monitoring nitrogen and/or phosphorous?).

Table 4. Responses on question 18. How is data available today?

Municipality	**Response**
Mariehamn	In separate files
Panevezys	In separate files
Slupsk	No reply.
Vaxholm	Online on internet, web address: http://www.kustdata.su.se/skvvf/datauttag.html
Västervik	Online on internet, web address: www.kalmarlanskustvatten.org as well as Vattenmyndigheten VISS viss.lansstyrelsen.se and in separate files.
Kalmar	Online on internet, web address: www.eurofins.se for some monitoring of recipient and in separate files; for waste water monitoring and some recipient monitoring

The questionnaire included questions regarding the completeness of monitoring to comply with the WFD. The responses revealed that the municipalities consider that they do not have monitoring stations networks to cover the needs of the WFD (**Error! Reference source not found.**). However, ccording to the replies to question 44 below, Panevezys and Mariehamn consider that their municipalities collect all the monitoring data that is needed. Vaxholm is the only municipality that covers all water bodies by surveillance monitoring, but they don´t know if there are enough

stations for operational and investigative monitoring. Mariehamn only covers 50% of the water bodies by surveillance monitoring, but they cover all water bodies that need operational and investigative monitoring. Västervik covers less than 30% of the water bodies with status "moderate" or "worse" by operational monitoring. No municipality responded that they have plans to increase the coverage for surveillance monitoring.

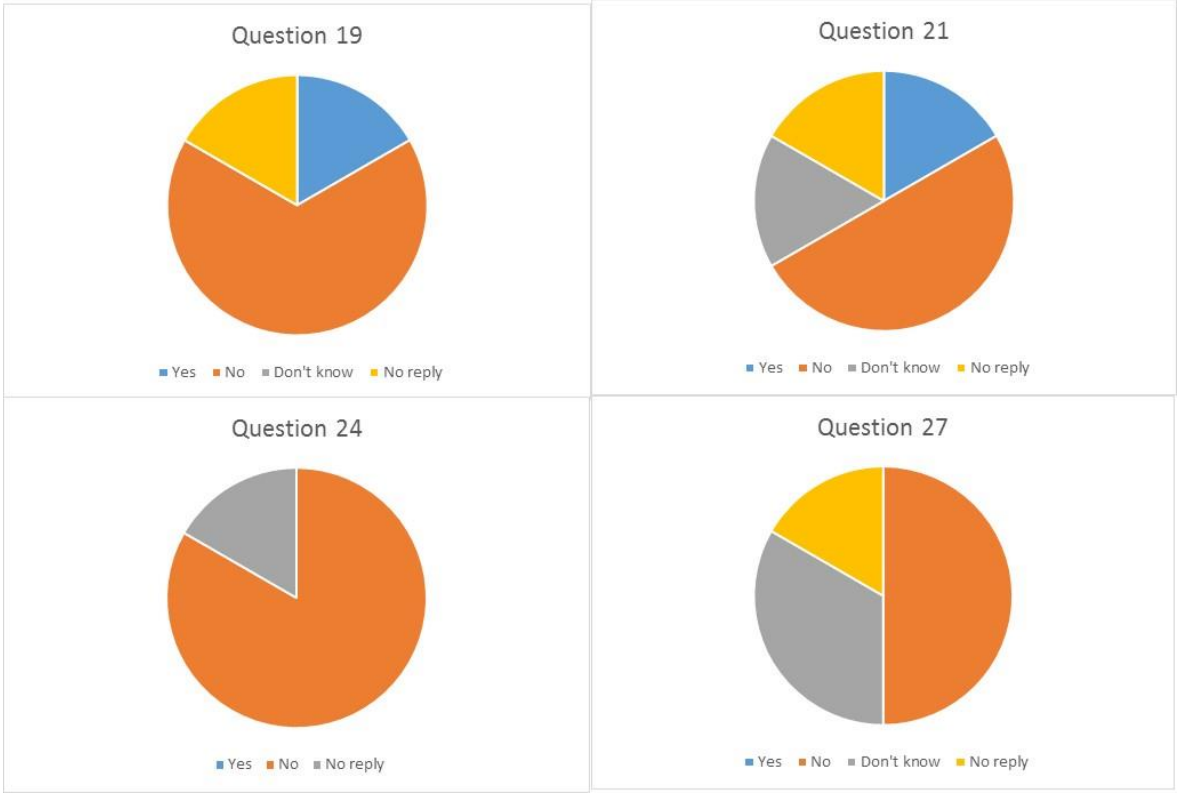


Figure 5. Charts illustrations of responses (Question 19. Does your monitoring stations network cover all waterbodies needed for surveillance monitoring?; Question 21. Do you have enough stations for operational monitoring in all necessary water bodies? (It is required for water bodies identified as being at risk of failing to meet their environmental objectives and in water bodies to monitor status as an effect of measures); Question 24. Do you have plans to increase the coverage for surveillance monitoring?, Question 27. Do you consider your time-series and annual variations data good enough to determine status in all water bodies?).

According to the answers from the municipalities, the reasons why the monitoring stations network is not built up are: lack of funding, political will, or unclear responsibilities (Table 5).

Table 5. Responses on question 23. What is the reason for not having enough stations?

Municipality	**Response**
Mariehamn	No reply.
Panevezys	Funding & Political will
Slupsk	No reply.
Vaxholm	Funding

Västervik	Funding
Kalmar	Uncertainty regarding responsibility

Conclusions "Monitoring methods, analysis and stations"

The results show that:

- The laboratory analysis give reliable data for assessments since the municipalities require standardized analysis methods from accredited laboratories.
- Four municipalities have worked to produce data of good quality along the whole chain from sampling to results using certified sampling personnel.
- Two different standardized methods are used for nitrogen, which is well-known and results can be compared provided the method is given.
- Monitoring data and sensor and real-time data are collected in the municipalities, but the storage of data differs and the data may not generally be easily accessible.
- The municipalities consider that they do not have monitoring stations network to cover the needs of the WFD, but Panevezys and Mariehamn collect the complete monitor data they need.
- Mariehamn has better coverage of monitoring of water bodies of "moderate" or "worse" status than of surveillance monitoring.
- No municipality responded they have plans to increase the coverage for surveillance monitoring.
- The reasons why the monitoring stations network is not built up are: lack of funding, political will or unclear responsibilities.

Sources of pollution

Questions

The questions that were included related to sources of pollution were the following:

Questions
29. Which are the most important sources of nitrogen and phosphorous load in your city/municipality? Specify percentage of total load.
30. How do you monitor load of nutrients from the most important sources of nitrogen and phosphorous?
31. Do you use models for source load descriptions? (Needed for WFD pressure analysis and HELCOM PLC periodical.)
32. Do you have information on what percentage of the storm water producing area is covered by treatment methods? Do you monitor load and reduction effects?
33. Do you have information on what percentage of storm water producing area is connected to municipal wastewater treatment plants through coupled sewer systems?
34. Do you have information on the percentage of population not connected to municipal wastewater treatment plants? (Definition of scattered dwellings according to HELCOM Pollution Load Compilations.)
35. Do you have information on what different techniques are used in small onsite wastewater treatment plants, and to what extend they are used (please specify the relative use of each technique in percent)?

36. Are you responsible for monitoring of effluent water from large municipal wastewater treatment plants (MWWTP) (>100,000 pe, >10,000 pe, >2,000 pe) and industries?
37. Are there monitoring data of nitrogen, phosphorous and flow available on large MWWTP?
38. How do you monitor nitrogen and phosphorous load from farming and agriculture?
39. Do you register, monitor and report effects of measures to reduce loss of nutrients on farming and agriculture? How and to whom?
40. Do you monitor nutrient footprint per citizen?
41. Do you collect data regarding water and pollution from citizens? If so please provide more info:

Results

The results show that the Swedish municipalities and Mariehamn are aware of the most important sources of nutrients pollution and in Sweden the municipalities specify how large the percentage of the load the sources are contributing with (Table 6). Panevezys and Slupsk do not know which the largest sources are; to implement cost-efficient measures, knowledge of the sources of pollution is crucial.

The monitoring of the most important sources is not completely done or done in different ways according to the answers (Table 7). Only Västervik specifies monitoring of four streams to follow the load of the diffuse source of agriculture. Kalmar has done some monitoring in one river according to their answer in question 38, but it has been done on a sporadic basis in projects and there is a lack of continuity according to their response in question 39 (**Error! Reference source not ound.**). While Mariehamn specifies the monitoring of wastewater treatment plants (WWTP) and recipient status, which is an indicator of status due to the load, they are not responsible for the monitoring of agriculture. Vaxholm monitors WWTP, but do not know about monitoring of other sources. Vaxholm also monitors status of recipients according to their response to question 19 (see the previous section on "Monitoring methods, analysis, and stations").

Table 6 Responses to question 29. Which are the most important sources of nitrogen and phosphorous load in your city/municipality? Specify percentage of total load.

Municipality	**Response**
Mariehamn	WWTP, agriculture
Panevezys	Don't know.
Slupsk	Don't know.
Vaxholm	Direct output point source 67 % nitrogen, 48% phosphorous.
Västervik	Agriculture 50% - Gamlebyviken.
Kalmar	Phosphorous: Agriculture 29%, Forest 17%, Storm water 17%. Nitrogen: Agriculture 57%.

Table 7 Responses to question 30. How do you monitor load of nutrients from the most important sources of nitrogen and phosphorous?

Municipality	Response
Mariehamn	Analysis of water samples from WWTP and recipient water body.
Panevezys	No reply.
Slupsk	No reply.
Vaxholm	The sewage plants monitor input and output. I don't know how the other sources are monitored.
Västervik	In Gamlebyviken area: water samples once a month in the four rivers. Water flow from SMHI water web. In coast water see link to Kalmar läns kustvattenkomitte http://www.kalmarlanskustvatten.org/index.php?option=com_content&view=article&id=2&Itemid=4.
Kalmar	Using PLC modelling.

The range of response in monitoring possibly reflects both differences in knowledge of the largest sources and the responsibility each of the municipalities has (**Error! Reference source not found.**). ll three municipalities in Sweden and Panevezys know the percentage of the storm water producing area connected to WWTP through coupled sewer systems, but only Vaxholm and Kalmar know what percentage of the non-coupled storm water producing area that is covered by treatment methods. In Vaxholm, no treatment other than natural wetlands are used for non-coupled storm water treatment and in Kalmar 50% of the area is covered by storm water treatment methods and 17% is treated in WWTP. Vaxholm mentions that the monitoring of all water is done by the coastal water council in their region and they know the details. The information of the storm water producing area, coupled to WWTP and separate treatment methods is used for HELCOM periodical reporting on diffuse sources and the answers from the municipalities in this study confirm that there is a lack of this information.

All municipalities, with the exception for Slupsk, have information on the percentage of population not connected to municipal WWTP (question 34, Figure 6). The percentage of population not connected to WWTP is another piece of information that can be used to produce data for the HELCOM periodical reporting of diffuse source scattered dwellings. In Sweden, municipal inventories have been done during the last 5-10 years focusing on scattered dwellings due to a focus on the national level on improving small onsite wastewater treatment. This is reflected in the responses where the Swedish municipalities have knowledge about which techniques are used, while Mariehamn, Panevezys (and Slupsk) do not know which techniques are used. The responsible party for the monitoring of large WWTPs is usually the municipal wastewater treatment company. The differing responses on the responsibilities of municipal WWTP in question 36 (**Error! Reference source not found.**) reflects whether the municipality considers itself ointly responsible for the municipal wastewater company or whether it is a separate unit. The improvement of both municipal and onsite small wastewater treatment systems is a long-term, on-going effort that requires considerable municipal effort and financing.

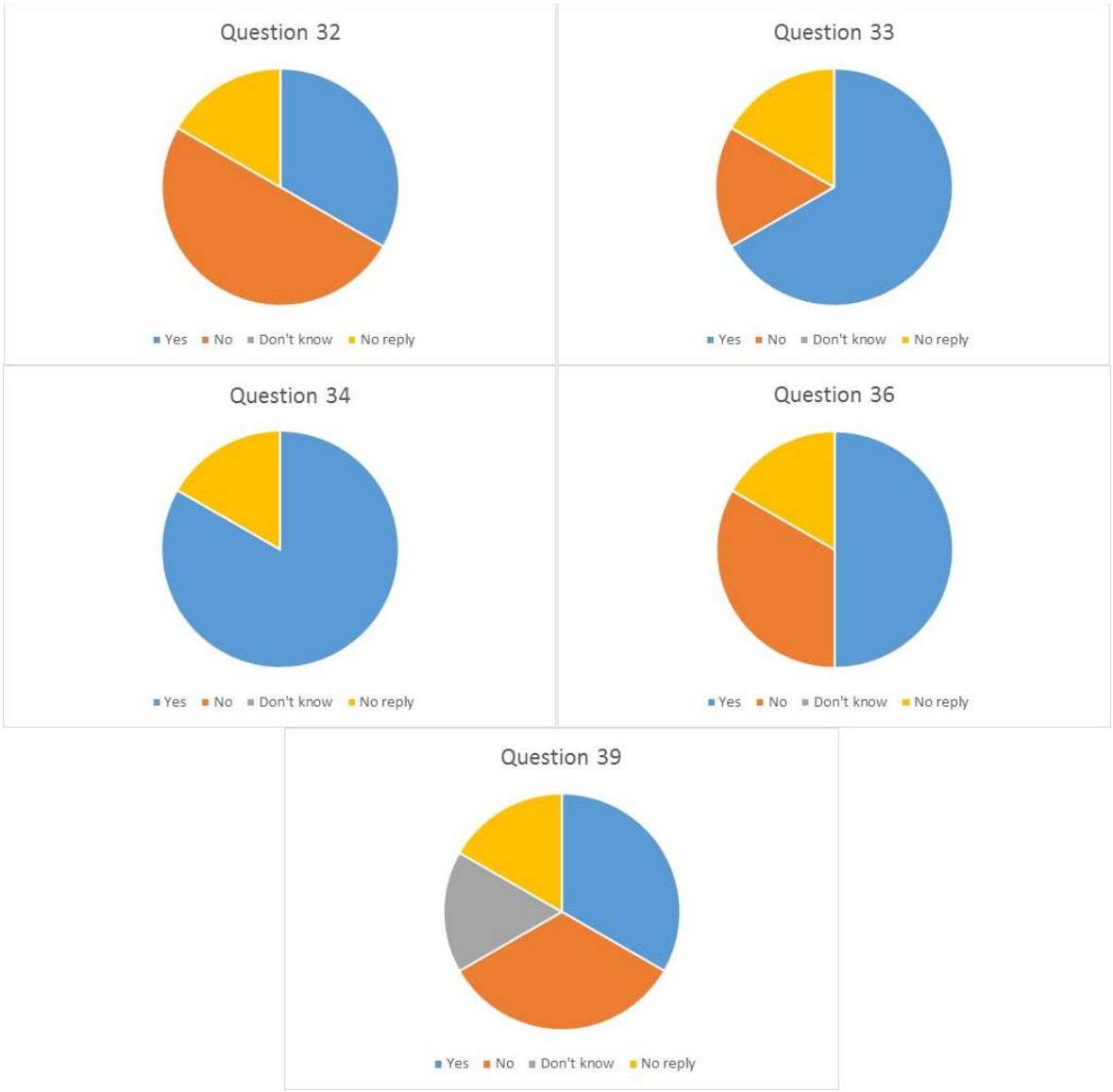


Figure 6 Responses to questions showing differences in knowledge and responsibilities between municipalities (Question 32. Do you have information on what percentage of the storm water producing area is covered by treatment methods? Do you monitor load and reduction effects?; Question 33. Do you have information on what percentage of storm water producing area is connected to municipal wastewater treatment plants through coupled sewer systems?; Question 34. Do you have information on the percentage of population not connected to municipal wastewater treatment plants? (Definition of scattered dwellings according to HELCOM Pollution Load Compilations Question 36. Are you responsible for monitoring of effluent water from large municipal wastewater treatment plants (MWWTP) (>100000 pe, >10000 pe, >2000 pe) and industries?; Question 39. Do you register, monitor and report effects of measures to reduce loss of nutrients on farming and agriculture? How and to whom?).

No municipality is monitoring nutrient footprint per citizen (**Error! Reference source not found.**), nd the answer "don´t know" from Mariehamn may indicate that the method of monitoring nutrient footprints from citizens is not known to the municipalities. Nutrient footprints are not used for reporting to either HELCOM PLC or to WFD.

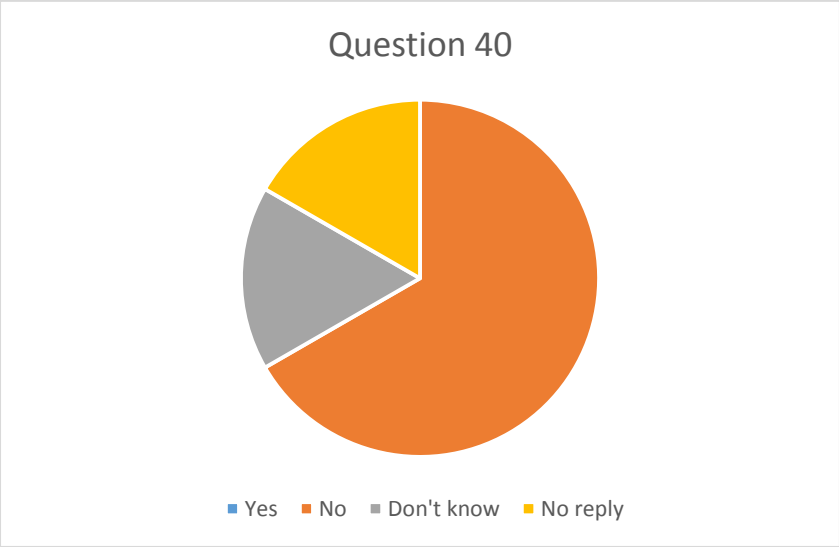


Figure 7. Showing the lack of monitoring of nutrient footprint per citizen (Fig. 40. Do you monitor nutrient footprint per citizen?).

Conclusions "Sources of pollution"

The results show that:

- The Swedish municipalities and Mariehamn are aware of the most important sources of nutrients pollution.
- Monitoring of the most important sources is not completely done or done in different ways.
- Västervik is the only respondent that continuously monitors the load of agriculture.
- Monitoring that is conducted reflects differences in knowledge of the largest sources and the responsibilities of the municipalities.
- There is a lack of information on storm water treatment in the municipalities, which consequently creates a gap in the HELCOM periodical reporting.
- Information on the percentage of population not connected to municipal WWTP is available and is possible to use for HELCOM periodical reporting.
- Only the Swedish municipalities have knowledge on which onsite small wastewater treatment techniques are used, due to national focus on this source. Outside of Sweden, there is a gap of this information for HELCOM periodical reporting.
- The responsible party for monitoring large WWTPs is usually a municipal wastewater treatment company.
- No municipality is monitoring nutrient footprint per citizen, which may be due to it being an unknown method and not required by HELCOM or WFD.

Impact of monitoring and reporting

Questions

The questions that were included related to impact of monitoring and reporting were the following:

Questions
42. Do you give and get feedback on measures suggested for water bodies in your city/municipality?
43. Do you report progress of implementation of measures?
44. Do you think that the complete monitoring data needed is collected?
45. What are the consequences, regarding that the monitoring isn't complete?
46. Do you have concrete nutrient reduction targets that you are working with in your city?
47. If not, is this something that you think your city should adopt?

Results

All the municipalities are involved in the development of measures suggested for water bodies in their region (Table 8). They report progress on the implementation of measures either to the public (Mariehamn, Panevezys and Västervik) or to the WFD, as reported through regional and national authorities (Vaxholm and Kalmar).

Table 8 Responses to question 42. Do you give and get feedback on measures suggested for water bodies in your city/municipality?

Municipality	**Response**
Mariehamn	Yes, the city is involved in the development of a plan of measures.
Panevezys	Yes, the city gives feedback on possible measures after the plan has been adopted.
Slupsk	No reply.
Vaxholm	Yes, the city is involved in the development of a plan of measures.
Västervik	Yes, the city is involved in the development of a plan of measures.
Kalmar	Yes, the city is involved in the development of a plan of measures.

Panevezys and Mariehamn consider that the complete monitor data is collected (**Error! Reference ource not found.**). The consequences the municipalities express from the lack of monitoring data is that it is hard for municipalities to describe how areas planned will affect the water quality and that the requirement on the prediction of environmental effects have increased since the "Weser judgement"[3]. The county board can deny spatial plans to be adopted if the municipality cannot predict that the effects will not deteriorate the quality of the water body. The municipalities further express that it gives rise to uncertainties in the status and assessment of the most successful measures. The reasons given for the incomplete monitoring are: financial, uncertainty of responsibility, and that it should be a national responsibility.

Figure 8. Only two municipalities have complete collection of monitoring data (Question 44. Do you think that the complete monitoring data needed is collected?).

The municipalities all have concrete nutrients targets (except for Slupsk) (**Error! Reference source ot found.**). This answer may be biased by the population of the municipalities being involved in the Race For The Baltic "Baltic Sea City Accelerator" programme where they have worked specifically on this issue.

[3] Court of Justice of the European Union PRESS RELEASE No 74/15 Luxembourg, 1 July 2015 Judgment in Case C-461/13

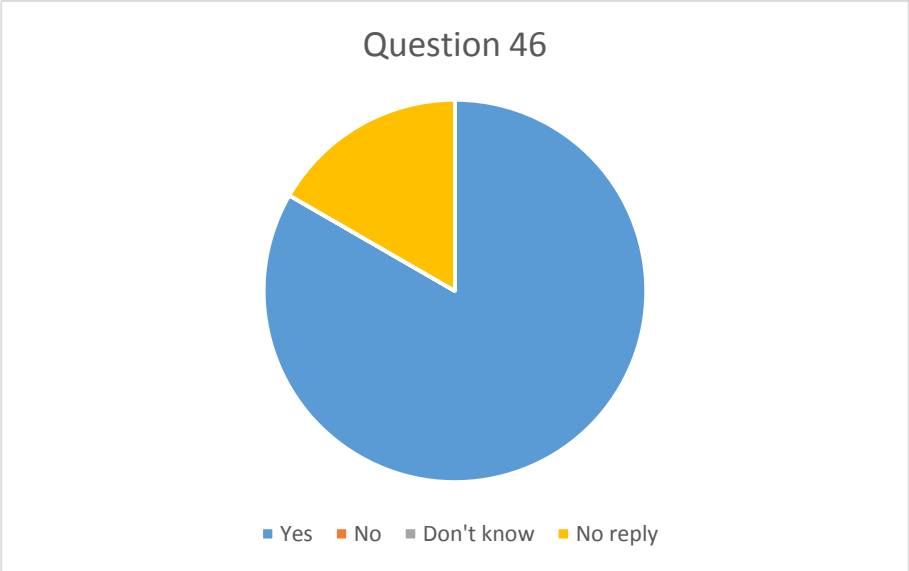


Figure 9. Responses to question 46 showing that all municipalities have concrete nutrient targets (except Slupsk) (Question 46. Do you have concrete nutrient reduction targets that you are working with in your city?).

Conclusions "Impact of monitoring and reporting"

The results show that:

- The municipalities are all involved in development of measures suggested for water bodies in their region.
- All the municipalities have concrete nutrients targets – a result which may be biased given all the municipalities all involved in the Baltic Sea City Accelerator program.
- Panevezys and Mariehamn are the only municipalities that consider that the complete monitor data is collected.
- The consequences from lack of complete monitoring data are;
    - difficult to comply with requirement of prediction of environmental effects from spatial planning according to the "Weser judgement",
    - uncertainty in status,
    - uncertainty in assessment of the most successful measures.

Publishing of Data

Questions

The questions that were included related to the publishing of data were the following:

Questions
48. Do you publish data officially? How and how often?
49. Is any of the data above open data (publicly available)?
50. Do you have/have you had a "citizen science project"?

51 a) Do you have any real-time sensor data in your municipality today on air quality?
51 b) Do you have any real-time sensor data in your municipality today on storm water?
51 c) Do you have any real-time sensor data in your municipality today on waste water
52. Are you interested in joining a regional public database that shares your city's data?

Results

The municipalities publish their data annually either in reports or on the web, or it is provided upon request. Several municipalities have established real-time data on air quality and municipal wastewater quality (all but Mariehamn on air quality, and all but Kalmar on wastewater), but not to the same degree on storm water where only Panevezys has real-time data (**Error! Reference ource not found.**).

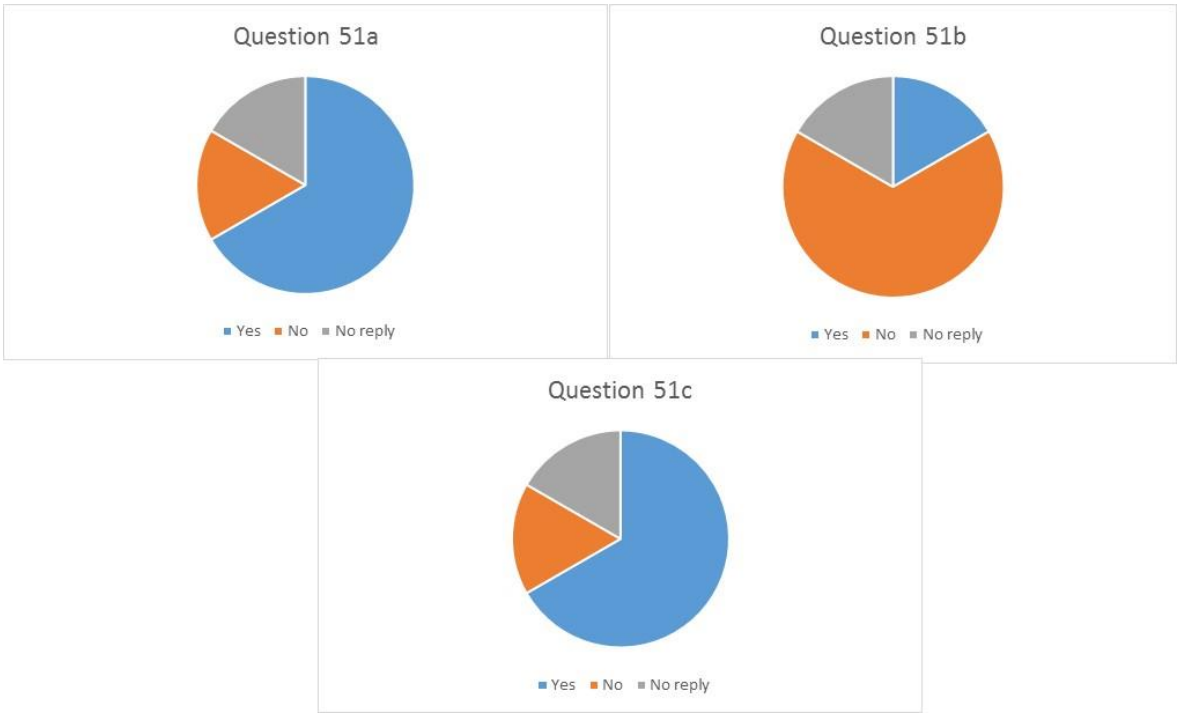


Figure 10 Responses on question 51 a, b and c showing the availability of real-time data on air and wastewater. Only Panevezys has real-time data on storm water (Question 51a. Do you have any real-time sensor data in your municipality today on Air; Question 51b. Do you have any real-time sensor data in your municipality today on storm water; Question 51c. Do you have any real-time sensor data in your municipality today on Wastewater?).

All the municipalities are interested in joining a regional public database that shares their data, but one municipality has commented that it should be a simple routine. One commented that this should be discussed with leading civil servants and politicians and one municipality commented that it should be run by a national body, like a county or water basin authority.

Conclusions ”Publishing of Data”

The results show that:

- The municipalities publish their data annually, but not all is publicly available on the internet.
- Several municipalities have real-time data on air quality and municipal wastewater quality, but only Panevezys has real-time data on storm water quality.
- All the municipalities are interested in joining a regional public database that shares their data.

5 Discussion

5.1 Correlation between HELCOM and WFD monitoring and reporting needs and municipalities monitoring and reporting

Information and Knowledge about Expectations and Needs

When interpreting to what extent HELCOM and WFD monitoring and reporting needs are met by the municipalities from the responses in the questionnaire, one needs to start by recognizing the municipalities' knowledge of the needs and responsibilities in the chain of monitoring and reporting. In general, it can be concluded from the questionnaire responses that it has not been fully communicated with the municipalities what data is needed from the municipalities for reporting for HELCOM and WFD. None of the municipalities knew what data is reported to HELCOM or WFD and only some of the municipalities knew which organisation is responsible for reporting to HELCOM. However, the knowledge of which organization is responsible for WFD is widely known.

There are many organizations involved in producing data for HELCOM reporting and the role and responsibility of the municipalities could be clarified, which may give more focus in the monitoring and reporting. The question to what extent the monitoring and reporting needs for HELCOM and WFD are met by municipalities, is not possible to answer without clarifying the expectations and the needs.

A review and comparison of the results from the questionnaire conducted by HELCOM on PLC data availability and the responses from this study may help to identify possible gaps in monitoring and reporting.

Monitoring Wastewater Treatment Plants

One specific responsibility of the municipalities regards the monitoring and reporting of effluent concentration, water flow and load from municipal wastewater treatment plants (WWTP).

HELCOM PLC guidelines are in line with the monitoring requirements according to the Urban wastewater treatment directive (UWWTD) and the monitoring of the wastewater treatment plants needs to comply with the UWWTD. According to the HELCOM PLC survey on data availability, the monitoring of wastewater treatment plants is incomplete in the coverage in sampling frequency in Estonia, Latvia and Poland. However, according to the responses from municipalities included in the questionnaire in this study, the monitoring is performed using standardized methods in accredited laboratories and, in some cases, is sampled by certified personnel. This provides data of good quality and is in accordance with the HELCOM PLC guidelines, but it does not guarantee the frequency in sampling. According to the responses in the questionnaire, the municipal wastewater treatment companies have the responsibilities of the monitoring and reporting of the WWTP and some of the municipalities seems to regard these companies as a separate organization. Could this be a factor that limits the municipality's influence on the frequency of sampling, monitoring, reporting and possibly on measures to reduce effluent discharges?

Monitoring Industrial Plants

The municipalities often have responsibilities for the inspection of industrial plants. However, there are gaps in the data that should be reported to HELCOM and WFD because the industrial plants are not regulated in any common directive that controls which monitoring should be performed according to Danish and Swedish responses in the HELCOM questionnaire. The monitoring of industrial plants is performed as part of the requirements in the facilities' permits. Thus, there are gaps between the requirements in the permits and the requirements of the HELCOM PLC reporting and the requirements of the WFD reporting.

Source Apportionment

Storm water

For the reporting of the source apportionment to HELCOM, there are no comprehensive requirements in the HELCOM PLC guideline, which is also reflected in the lack of data to report. For example, according to the results in the questionnaire in this study, there is little monitoring performed on storm water load and no information on reduction effect in storm water treatment facilities. However, all municipalities responded that they know how large a percentage of storm water producing area that was connected to municipal wastewater treatment plants. Thus, there is information available to indirectly calculate load for HELCOM reporting, but to calculate the effects these measures have requires relying on modelling results.

Diffuse Sources – Agriculture / Small onsite wastewater treatment systems

Agriculture – which is among the largest sources of pollution – is a diffuse source and hard to monitor, which may be the reason for the sparse monitoring. Only Västervik monitors load from agriculture and Mariehamn does not have the responsibility for monitoring agriculture. There are differences in the responsibilities of different sources of pollution which also complicates the data flow and reporting.

Another diffuse source which is required to be reported to HELCOM is scattered dwellings, i.e. wastewater load from households not connected to municipal wastewater treatment systems. The most common small onsite wastewater treatment system is an infiltration system – a diffuse load to groundwater and recipients which is hard to monitor. Regulations on control of onsite wastewater treatment systems do not include continuous effluents load monitoring in infiltration systems in

either Sweden or Poland, thus the monitoring is not performed[4]. However, there is increased focus, especially in Sweden, on small wastewater treatment facilities as a significant source of pollutants, and inventorying and inspection efforts have improved the facilities and boosted knowledge of the source which also is used as data for reporting. The increased focus in Sweden is reflected in the questionnaire in this study where all municipalities have knowledge on the percentage of population that is not connected to municipal wastewater treatment, but only Swedish municipalities know which techniques they use. To be able to report load properly, knowledge is needed both of the size of population living in scattered dwellings and the techniques they use.

5.2 Authorization and financing of the city monitoring

The municipalities were asked to describe their role and organization in monitoring and reporting and they have all answered who they are reporting to, and which is the authority at the regional or national level. However, the authority that requires the monitoring to be carried out has not been completely clarified in this study. The reason for gaps in monitoring stations to cover for WFD compliance according to the municipalities is lack of financing, lack of political will or unclear responsibilities. Thus, it indicates that the authorization is often set by the political leaders in the municipalities. In Västervik, the financing of some monitoring programmes has been done in projects, which means that there is a finite time frame for the monitoring and it is not a sustainable solution. The view from the Swedish Agency for Marine and Water Management is that the monitoring is financed by public funds (national and regional environmental monitoring) or by point source operators' recipient monitoring, but the system of reporting relies on voluntary actions from municipalities and other actors. This may give rise to uncertainties in the reporting obligations, which has been recognized by the authority and, as a result, investigations of the monitoring and reporting needs are ongoing. The Swedish Agency for Marine and Water Management has further proposed to the Swedish Ministry an investigation of a Water Control system for the financing of monitoring the environmental quality standards.

5.3 Variations in monitoring and reporting

There are significant differences and similarities among the municipalities regarding the monitoring of sources. The largest differences of the monitoring and reporting between the municipalities today are if and how monitoring is performed and if the municipality is responsible for monitoring the most important sources of pollution. All the municipalities included in the questionnaire in this study knew which the most important sources of pollution were. However, the monitoring operation is commonly carried out by the municipality companies on the municipal wastewater treatment plants. The other sources such as storm water, agriculture and small onsite wastewater treatment systems are not covered by monitoring, but in most cases only indirectly by status in recipients. Agriculture is often one of the largest sources, which is diffuse in the way it is spread on a large land area, and thus hard to monitor. Only Västervik monitors the agriculture source and effects of measures. Other municipalities use national available model data for assessment of agriculture or are not responsible for the monitoring of agriculture (Mariehamn).

[4] authors information from the BONUS OPTITREAT project, optitreat.ivl.se

6 Conclusions

HELCOM recognized the importance of the involvement of municipalities in the implementation of the BSAP and HELCOM agreements. The national authorities expect and need support from the regional and local authorities to contribute to the data of status and implementation and follow-up on measures needed to fulfil assessment of the development towards the targets in BSAP and to comply with requirements in the WFD.

While the municipalities are involved in the development of plans of measures today, they could be more involved in the monitoring, reporting and implementation of measures to reach BSAP targets.

Coordination and communication of the important role municipalities play, as well as feedback to municipalities on how their reported data is used, can lead to a higher prioritization of environmental work at the municipality level. Further, using harmonized and cost-efficient measures can build up the foundation required to reach WFD and BSAP targets.

Additionally, using harmonized and cost-efficient measures increases the ability for comparison of the results on the municipality level – which could be helpful for regional planning and determining best practices on the local level.

IVL Swedish Environmental Research Institute Ltd.
P.O. Box 210 60 // S-100 31 Stockholm // Sweden
Phone +46-(0)10-7886500 // Fax +46-(0)10-7886590 // www.ivl.se

Annex - Questionnaire

Summary of "Questionnaire - municipal nutrient monitoring and reporting"

1. The following summary is compiled of data gathered from questionnaires received from seven municipalities taking part in this study. The questionnaire sent to HaV is also summarized but only displayed in the Summary section of each topic.

2. Each topic of the questionnaire has been treated separately including:

- Organisation of monitoring and reporting
- Monitoring methods, analysis and stations
- Sources of pollution
- Impact of monitoring and reporting
- Publishing of Data

3. Each topic has been further split up between Categorical and Text replies. In other words, each subsection has three, color coded worksheets that summarize the replies.

4. In order to make analysis of replies easier, categorical replies has been coded, i.e. Yes = 0, No = 1, etc. Each subscetion has a specific Codebook available on the Summary page.

5. The summarizing table in Summary lists the questions by their number, i.e. Q1, Q2, Q3 etc.

6. The Summary page includes a list of Comments, if made, listed by questions number and municipality. Questions with Comments are highlighted in red in the summarizing table.

7. The Categorical data are compiled according to frequency of reply type, i.e. Yes, No, No reply etc., with no direct link to its respondents.

8. The Text replies are summarized according to municipality. Each question also have a response frequency percentage linked to it.

Organisation of monitoring and reporting

ID#	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Mariehamn	0	Ålands landskapregering. Local goverment on Aland islands. www.regeringen.ax	0	Ålands landskapsregering. Local goverment on Aland islands.	We collect data from our WWTP acordning current terms in permit document and send it to our local water authority by the end of february each year.	Ålands landskapsregering. Local goverment on Aland islands.	3	3	Ålands miljö- och hälsoskyddsmyndighet ÅMHM www.amhm.ax	3	Ålands landskapsregering www.regeringen.ax social- och miljöavdelningen, miljöbyrån byråchef Helena Blomqvist helena.blomqvist@regeringen.ax
Panevezys	1	Environmental Protection Agency	1	Ministry of the Environment	Joint Stock company "Aukštaitijos vandenys" monitoring data from large municipal wastewater treatment plants (MWWTP) (>100000 pe) and industries submitted to the Environmental Protection Agency. Joint Stock company "Panevėžio gatvės" conducted surface water monitoring, determined nutrients, suspended oil concentration of 13 outlets in the river Nevezis and report submittedto the Environmental Protection Agency every year	Ministry of Environment	2	2	Ministry of Environment	2	Panevėžys City Municipality, Laisvės sq.20, Panevėžys Tel. 370~45 501350, Fax 370~45 501352 E-mail: savivaldybe@panevezys.lt
Slupsk	4		4				4	4		4	
Vaxholm	3		0	Vattenmyndigheten Norra Östersjön/Länsstyrelserna	Every year Vaxholm reports to Vattenmyndigheten how the municipality is doing regarding water quality through "Kommunernas rapportering av genomförande av vattenmyndigheternas åtgärdsprogram".	The reporting is coordinated between the city planning office, the health and environment department and the municipal sewage company.	3	3	Länsstyrelserna (County Boards)/Vattenmyndigheten Norra Östersjön. Vaxholm does not report directly here, the reporting is done by Svealands Kustvattenvårdsförbund.	3	Vaxholm are members of Svealands kustvattenvårdsförbund (SKVVF), which conducts monitoring through the institution of Ecology, Environment and Botany (EMB) at Stockholm universitet. Contact Jakob Walve 08-161730, jakob.walve@su.se.
Västervik	0	Havs och vattenmyndigheten	0	Havs och vattenmyndigheten	Västervik reports to Länsstyrelsen i	Vattenmyndigheten för Södra	3	3	Länsstyrelsen i Kalmar län	1	Kalmar läns Kustvattenkomitte
Kalmar	3		0	The Swedish Agency for Marine and Water Management	Kalmar Municipality report the output of the national actionplan to Vattenmyndigheten for the WFD. As far as we know, no our outputs are not reported to HELCOM.	Classification and plan is made by Vattenmyndigheten.	3	1	Kalmar Vatten AB, part municipality owned coporation, report monitored data to the county administrative board (Länsstyrelsen).	1	Kalmar Vatten AB, Kalmar Municipality (the catchment area of Ljungby river)
Värmdö	4		4				4	4		4	
HaV	0	Havs- och vattenmyndigheten	0	Havs- och vattenmyndigheten	WFD - Vattenmyndigheterna ska se till	Vattendelegationerna	0	0		4	

Questions

1. Do you know who is responsible for your countries' reporting to HELCOM?
2. Name of responsible organisation/institution for HELCOM reporting:
3. Do you know who is responsible for reporting to EU Water Framework Directive (WFD)?
4. Name of responsible organisations/institution for WFD reporting
5. How is monitoring and reporting organized to HELCOM and WFD and which role does your city have?
6. Who determines the status classification and plan of measures of waterbodies in you city/municipality that is reported to WFD?
7. Do you know which data is needed for reporting to HELCOM?
8. Do you know which data is needed for reporting to WFD?
9. Name of the organisation/institution you report monitoring data to
10. Do you know what your monitoring data is used for in the reporting to HELCOM and WFD?
11. Name and contact information to responsible organisation for monitoring in your municipality:

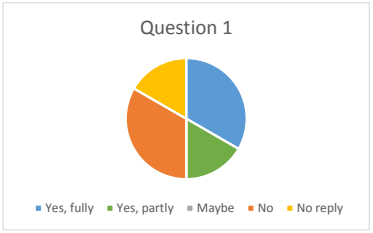
Codebook	
Yes, fully	0
Yes, partly	1
Maybe	2
No	3
Unanswered	4

Organisation of monitoring and reporting

Categorical

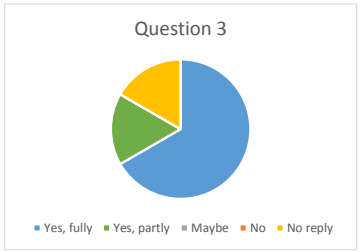
1. Do you know who is responsible for your countries' reporting to HELCOM?

Code	Response item	Frequency	Percent	Municipalities			
0	Yes, fully	2	33%	Mariehamn	Västervik		
1	Yes, partly	1	17%	Panevezys			
2	Maybe	0	0%				
3	No	2	33%	Vaxholm	Kalmar		
4	No reply	1	17%		Slupsk		
	Total	6	100%				



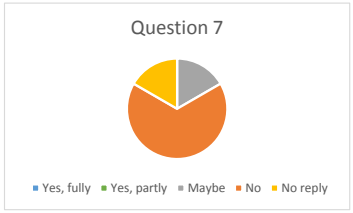
3. Do you know who is responsible for reporting to EU Water Framework Directive (WFD)?

Code	Response item	Frequency	Percent	Municipalities			
0	Yes, fully	4	67%	Mariehamn	Vaxholm	Västervik	Kalmar
1	Yes, partly	1	17%	Panevezys			
2	Maybe	0	0%				
3	No	0	0%				
4	No reply	1	17%		Slupsk		
	Total	6	100%				



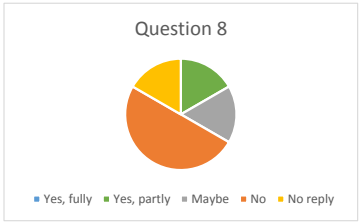
7. Do you know which data is needed for reporting to HELCOM?

Code	Response item	Frequency	Percent	Municipalities			
0	Yes, fully	0	0%				
1	Yes, partly	0	0%				
2	Maybe	1	17%	Panevezys			
3	No	4	67%	Mariehamn	Vaxholm	Västervik	Kalmar
4	No reply	1	17%		Slupsk		
	Total	6	100%				



8. Do you know which data is needed for reporting to WFD?

Code	Response item	Frequency	Percent	Municipalities			
0	Yes, fully	0	0%				
1	Yes, partly	1	17%	Kalmar			
2	Maybe	1	17%	Panevezys			
3	No	3	50%	Mariehamn	Vaxholm	Västervik	
4	No reply	1	17%		Slupsk		
	Total	6	100%				



10. Do you know what your monitoring data is used for in the reporting to HELCOM and WFD?

Code	Response item	Frequency	Percent	Municipalities			
0	Yes, fully	0	0%				
1	Yes, partly	2	33%	Västervik	Kalmar		
2	Maybe	1	17%	Panevezys			
3	No	2	33%	Mariehamn	Vaxholm		
4	No reply	1	17%		Slupsk		
	Total	6	100%				

Organisation of monitoring and reporting

Text

2. Name of responsible organisation/institution for HELCOM reporting:

Municipality	Response
Mariehamn	Local government on Åland Islands
Panevezys	Environmental Protection Agency
Slupsk	No reply
Vaxholm	No reply
Västervik	The Swedish Agency for Marine and Water Management
Kalmar	No reply
Response freq.	67%

4. Name of responsible organisations/institution for WFD reporting

Municipality	Response
Mariehamn	Local government on Åland Islands
Panevezys	Ministry of the Environment
Slupsk	No reply
Vaxholm	Vattenmyndigheten Norra Östersjön/Länsstyrelserna
Västervik	The Swedish Agency for Marine and Water Management
Kalmar	The Swedish Agency for Marine and Water Management
Response freq.	83%

5. How is monitoring and reporting organized to HELCOM and WFD and which role does your city have?

Municipality	Response
Mariehamn	We collect data from our WWTP acordning current terms in permit document and send it to our local water authority by the end of february each year.
Panevezys	Joint Stock company "Aukštaitijos vandenys" monitoring data from large municipal wastewater treatment plants (MWWTP) (>100000 pe) and industries submitted to the Environmental Protection Agency. Joint Stock company "Panevėžio gatvės" conducted surface water monitoring, determined nutrients, suspended oil concentration of 13 outlets in the river Nevezis and report submittedto the Environmental Protection Agency every year
Slupsk	No reply
Vaxholm	Every year Vaxholm reports to Vattenmyndigheten how the municipality is doing regarding water quality through "Kommunernas rapportering av genomförande av vattenmyndigheternas åtgärdsprogram".
Västervik	Västervik reports to Länsstyrelsen i Kalmar län och Vattenmyndigheten för Södra Östersjön
Kalmar	Kalmar Municipality report the output of the national actionplan to Vattenmyndigheten for the WFD. As far as we know, no our outputs are not reported to HELCOM.
Response freq.	83%

6. Who determines the status classification and plan of measures of waterbodies in you city/municipality that is reported to WFD?

Municipality	Response
Mariehamn	Ålands landskapsregering. Local goverment on Aland islands.
Panevezys	Ministry of Environment
Slupsk	No reply
Vaxholm	The reporting is coordinated between the city planning office, the health and environment department and the municipal sewage company.
Västervik	Vattenmyndigheten för Södra Östersjön
Kalmar	Classification and plan is made by Vattenmyndigheten.
Värmdö	No reply
Response freq.	71%

9. Name of the organisation/institution you report monitoring data to

Municipality	Response
Mariehamn	Ålands miljö- och hälsoskyddsmyndighet ÅMHM www.amhm.ax
Panevezys	Ministry of Environment
Slupsk	No reply
Vaxholm	Länsstyrelserna (County Boards)/Vattenmyndigheten Norra Östersjön. Vaxholm does not report directly here, the reporting is done by Svealands Kustvattenvårdsförbund.
Västervik	Länsstyrelsen i Kalmar län och Vattenmyndigheten för Södra Östersjön and Kalmar läns Kustvattenkomitte see www.kalmarlanskustvatten.org
Kalmar	Kalmar Vatten AB, part municipality owned coporation, report monitored data to the county administrative board (Länsstyrelsen).
Response freq.	83%

11. Name and contact information to responsible organisation for monitoring in your municipality:

Municipality	Response
Mariehamn	Ålands landskapsregering www.regeringen.ax social- och miljöavdelningen, miljöbyrån byråchef Helena Blomqvist helena.blomqvist@regeringen.ax
Panevezys	Panevėžys City Municipality, Laisvės sq.20, Panevėžys Tel. 370~45 501350, Fax 370~45 501352 E-mail: savivaldybe@panevezys.lt
Slupsk	No reply
Vaxholm	Vaxholm are members of Svealands kustvattenvårdsförbund (SKVVF), which conducts monitoring through the institution of Ecology, Environment and Botany (EMB) at Stockholm universitet. Contact Jakob Walve 08-161730, jakob.walve@su.se.
Västervik	Kalmar läns Kustvattenkomitte (http://www.kalmarlanskustvatten.org/). Local monotoring of swage treatment plants and recipient water by Västervik Miljö&Energi AB (kerstin.karlsson@vastervik.se) and in different waterprojects Västerviks kommun (dennis.wistrom@vastervik.se)
Kalmar	Kalmar Vatten AB, Kalmar Municipality (the catchment area of Ljungby river)
Response freq.	83%

Röd text = Comments

Monitoring methods, analysis and stations

ID#	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25
Mariehamn	0	0	1	catalytic oxidation	0	0	In separate files, specify who is responsible	1	50%	0	0		1	50
Panevezys	0	0	0	Oxidative digestion with peroxodisulfate method (ISO 11905-1)	2	1	In separate files, specify who is responsible	1	90%	1	1	Funding & Political will	1	100
Slupsk	0	0	0	Kjeldahl N+ nitrate+ nitrite	0	0		3		3	3		3	
Vaxholm	2	2	2	Don't know	2	2	Online on internet, specify webaddress: http://www.kustdata.su.se/skvvf/datauttag.html	0	0%	2	2	Funding	1	100
Västervik	0	0	0	Kjeldahl N+ nitrate+ nitrite	0	0	Online on internet, specify webaddress: www.kalmarlanskustvatten.org samt	1	Don't know	1	1	Funding	1	<30%
Kalmar	0	0	0	SS-EN ISO 11905 and ISO 29441:2010	0	1	Online on internet, specify webaddress: www.eurofins.se for some monitoring of recipient & In separate files, specify who is responsible: For waste water monitoring and some recipient moneroring	1	Don't know	1	1	Unsertainty regarding responsability	1	No
HaV										2	2	Knowledge, Funding & Political will	0	Framgår av vattenmyndigheternas förvaltningsplan.

Q14 Comments

Vaxholm	As SKVVF does the monitoring in Vaxholms waters, I don't have detailed information about how the monitoring is conducted.
Kalmar	Yeas for monitoring waste water. No for monitoring recipients

Q16 Comments

Slupsk	We use sensor techniques for monitoring nitrogen in the biological reactor in the side treatment for leachates
Vaxholm	As SKVVF does the monitoring in Vaxholms waters, I don't have detailed information about how the monitoring is conducted.
Västervik	Spectronic detection and UV-digestion

Q17 Comments

Slupsk	Only in the biological reactor for leachates
Vaxholm	As SKVVF does the monitoring in Vaxholms waters, I don't have detailed information about how the monitoring is conducted.

Q19 Comments

Västervik	Basic Monitoring-Yes - but the local monitoring linked to projects ends when project ends....

Q21 Comments

Vaxholm	As of now, there is one station in each water body. I think there should be more, but it's difficult to say, I don't have enough knowledge about the monitioring.
Västervik	Local monitoring linked to projects ends when project ends

Q22 Comments

Vaxholm	As of now, there is one station in each water body. I think there should be more, but it's difficult to say, I don't have enough knowledge about the monitioring.
Västervik	Local monitoring linked to projects ends when project ends

Q23 Comments

Vaxholm	But think the reason is funding as SKVVF is financed by it's member municiplaities and organizations.

Q24 Comments

HaV	Arbete pågår utifrån handlingsplan "Full koll på våra vatten" att identifiera behovet av kontrollerande övervakningsstationer. Detta ska ligga till grund för revidering av existerande övervakningsprogram. (https://www.havochvatten.se/hav/samordning--fakta/miljoovervakning/full-koll-pa-vara-vatten.html)

Q25 Comments

Västervik	Även ikryssat "Don't know" + 100 % of Coast Water is classified moderate or worse, 20 % of lakes and 75 % of rivers in the Municipality

Q27 Comments

Vaxholm	Preferably there should be more, there is data missing for biological and chemical quality factors used to determine the status of the water bodies. Also -the water bodies are large - more monitoring stations are needed.

Questions

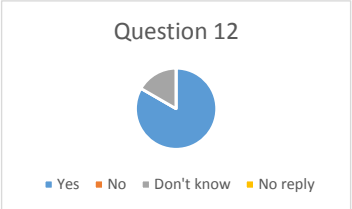
12. Do you use standardized methods for laboratory analysis of nitrogen and phosphorous concentrations?
13. Do you require laboratories doing the analysis to be ackredited/certified?
14. Do you require personell doing the monitoring sampling to be certified?
15. What method do you use to determine total nitrogen?
16. Do you use sensor techniques for monitoring nitrogen and/or phosphorous?
17. Do you have real-time data for monitoring nitrogen and/or phosphorous?
18. How is data available today?
19. Does your monitoring stations network cover all waterbodies needed for surveillance monitoring?
20. If not - how large percentage of the number of waterbodies are not covered by needed surveillance monitoring?
21. Do you have enough stations for operational monitoring in all necessary water bodies? (It is required for water bodies identified as being at risk of failing to meet their environmental objectives and in water bodies to monitor status as an effect of measures)
22. Do you have enough stations for investigative monitoring in all necessary water bodies? (It is required for water bodies where the reason for any exceedances is unknown and operational monitoring is not yet established)
23. What is the reason for not having enough stations?
24. Do you have plans to increase the coverage for surveillance monitoring?, how?
25. How large percentage of the number of waterbodies with status "moderate or worse" are covered by operational monitoring?
26. What methods do you use to determine flow and runoff?
27. Do you consider your time-series and annual variations data good enough to determine status in all water bodies?
28. How long time-series are available of nitrogen and phosphorous concentrations?

Codebook	
Yes	0
No	1
Don't know	2
No reply	3

Monitoring methods, analysis and stations

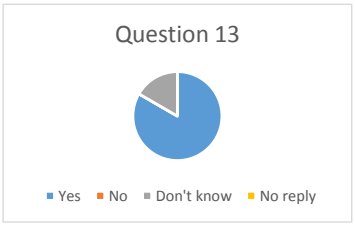
12. Do you use standardized methods for laboratory analysis of nitrogen and phosphorous concentrations?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	5	83%	Mariehamn Panevezys Slupsk Västervik Kalmar
1	No	0	0%	
2	Don't know	1	17%	Vaxholm
3	No reply	0	0%	
	Total	6	100%	



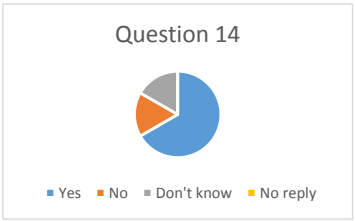
13. Do you require laboratories doing the analysis to be ackredited/certified?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	5	83%	Mariehamn Panevezys Slupsk Västervik Kalmar
1	No	0	0%	
2	Don't know	1	17%	Vaxholm
3	No reply	0	0%	
	Total	6	100%	



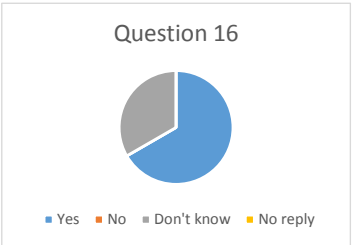
14. Do you require personell doing the monitoring sampling to be certified?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	4	67%	Panevezys Västervik Slupsk Kalmar
1	No	1	17%	Mariehamn
2	Don't know	1	17%	Vaxholm
3	No reply	0	0%	
	Total	6	100%	



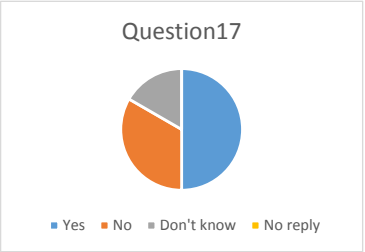
16. Do you use sensor techniques for monitoring nitrogen and/or phosphorous?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	4	67%	Mariehamn Västervik Slupsk Kalmar
1	No	0	0%	
2	Don't know	2	33%	Panevezys Vaxholm
3	No reply	0	0%	
	Total	6	100%	



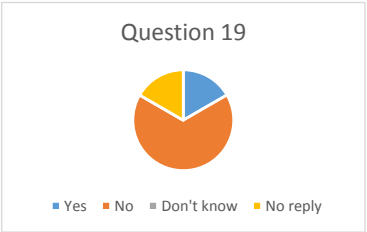
17. Do you have real-time data for monitoring nitrogen and/or phosphorous?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	3	50%	Mariehamn Västervik Slupsk
1	No	2	33%	Panevezys Kalmar
2	Don't know	1	17%	Vaxholm
3	No reply	0	0%	
	Total	6	100%	



19. Does your monitoring stations network cover all waterbodies needed for surveillance monitoring?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	1	17%	Vaxholm
1	No	4	67%	Mariehamn Panevezys Västervik Kalmar
2	Don't know	0	0%	
3	No reply	1	17%	Slupsk
	Total	6	100%	

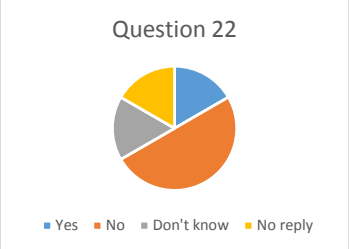


21. Do you have enough stations for operational monitoring in all necessary water bodies? (It is required for water bodies identified as being at risk of failing to meet their environmental objectives and in water bodies to monitor status as an effect

Code	Response item	Frequency	Percent	Municipalities
0	Yes	1	17%	Mariehamn
1	No	3	50%	Panevezys Västervik Kalmar
2	Don't know	1	17%	Vaxholm
3	No reply	1	17%	Slupsk
	Total	6	100%	

22. Do you have enough stations for investigative monitoring in all necessary water bodies? (It is required for water bodies where the reason for any exceedances is unknown and operational monitoring is not yet established)

Code	Response item	Frequency	Percent	Municipalities
0	Yes	1	17%	Mariehamn
1	No	3	50%	Panevezys Västervik Kalmar
2	Don't know	1	17%	Vaxholm
3	No reply	1	17%	Slupsk
	Total	6	100%	

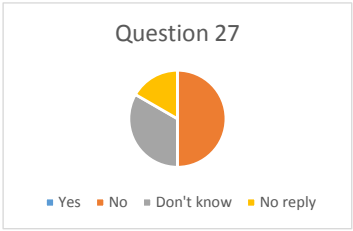


24. Do you have plans to increase the coverage for surveillance monitoring?, how?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	0	0%	
1	No	5	83%	Mariehamn Panevezys Vaxholm Västervik Kalmar
3	No reply	1	17%	Slupsk
	Total	6	100%	

27. Do you consider your time-series and annual variations data good enough to determine status in all water bodies?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	0	0%	
1	No	3	50%	Vaxholm Västervik Kalmar
2	Don't know	2	33%	Mariehamn Panevezys
3	No reply	1	17%	Slupsk
	Total	6	100%	



Monitoring methods, analysis and stations

15. What method do you use to determine total nitrogen?

Municipality	Response
Mariehamn	catalytic oxidation
Panevezys	Oxidative digestion with peroxodisulfate method (ISO 11905-1)
Slupsk	Kjeldahl N+ nitrate+ nitrite
Vaxholm	Don't know
Västervik	Kjeldahl N+ nitrate+ nitrite
Kalmar	SS-EN ISO 11905 and ISO 29441:2010
Response freq.	100%

18. How is data available today?

Municipality	Response
Mariehamn	In separate files, specify who is responsible
Panevezys	In separate files, specify who is responsible
Slupsk	No reply
Vaxholm	Online on internet, specify webaddress: http://www.kustdata.su.se/skvvf/datauttag.html
Västervik	Online on internet, specify webaddress: www.kalmarlanskustvatten.org samt Vattenmyndigheten VISS viss.lansstyrelsen.se & In separate files, specify who is responsible: dennis.wistrom@vastervik.se
Kalmar	Online on internet, specify webaddress: www.eurofins.se for some monitoring of recipient & In separate files, specify who is responsible: For waste water monitoring and some recipient moneroring
Response freq.	83%

20. If not - how large percentage of the number of waterbodies are not covered by needed surveillance monitoring?

Municipality	Response
Mariehamn	50%
Panevezys	90%
Slupsk	No reply
Vaxholm	0%
Västervik	Don't know
Kalmar	Don't know
Response freq.	83%

23. What is the reason for not having enough stations?

Municipality	Response
Mariehamn	No reply
Panevezys	Funding & Political will
Slupsk	No reply
Vaxholm	Funding
Västervik	Funding
Kalmar	Unsertainty regarding responsability
Värmdö	No reply
Response freq.	57%

25. How large percentage of the number of waterbodies with status "moderate or worse" are covered by operational monitoring?

Municipality	Response
Mariehamn	50
Panevezys	100
Slupsk	No reply
Vaxholm	100
Västervik	<30%
Kalmar	No
Response freq.	83%

26. What methods do you use to determine flow and runoff?

Municipality	Response
Mariehamn	No reply
Panevezys	Model supported by monitoring
Slupsk	No reply
Vaxholm	Vaxholm uses consultants to determine flow and runoff in spatial planning, they often use StormTac for modelling.
Västervik	Monitoring, specify methods: SMHI Stations
Kalmar	SMHI modelling
Response freq.	67%

28. How long time-series are available of nitrogen and phosphorous concentrations?

Municipality	Response
Mariehamn	# years: 10; # per year: 4 to 8
Panevezys	# per year: 4
Slupsk	No reply
Vaxholm	# years: 13; # per year: 2
Västervik	20 år i Gammelbyviken
Kalmar	# years: 40; # per year: 4
Response freq.	83%

Röd text = Comments

Sources of pollution

ID#	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41
Mariehamn	WWTP, acrigulture	Analysis of water samples from WWTP and recipient water body.	2	1	1	0	1	0	Marieham 30000 pe	Please contact Ålands landskapregering. Local goverment on Aland islands. www.regeringen.ax	2	2	
Panevezys	Don't know		1	1	0	0	1	1	Monitoring data submitted to Environmental Protection Agency	Panevėžys City Municipality do not monitor ntrogen and phosphorous load from farming and agriculture, becouse is City Municipality	1	1	
Slupsk			3	3	3	3	3	3			3	3	
Vaxholm	Direct output point source 67 % nitrogen, 48% phosphorous.	The sewage plants monitor input and output. I don't know how the other sources are monitored.	2	0	0	0	0	0	> 2000 - Available for 2015, for 2016 not finished yet. Reported to environmental and health protection agency and https://smp.lansstyrelsen.se/.	We don't. We have made calculations according to template.	1	1	Incoming water to sewage plants is measured regarding content of N and P.
Västervik	Agriculture 50% - Gamlebyviken	In Gamlebyviken area; Water samples once a month in the four rivers. Water flow from SMHI water web. In costwater se link to Kalmar läns kustvattenkomitte http://www.kalmarlanskustvatten.org/index.php?option=com_content&vie	0	1	0	0	0	1	> 100000	Water samples once a month, water flow from SMHI water web - in projects	0	1	No
Kalmar	Fosfor: Agriculture 29%, Forest 17%, Stormwater 17%. Nitrogen: Agriculture 57%	Using PLC modeling	0	0	0	0	0	0	> 100000, 10000, 2000 - Environmental report Kalmar ARV	PLC modelling. Some monetoring in Ljunby river.	0	1	
HaV		Krav ställs på vissa verksamheter att rapportera in belastninsdata. Detta rapporteras till SMP.	0										

Q29 Comments
Mariehamn I have no current data available at the moment
Västervik See anneex document

Q31 Comments
Västervik SMED PLC5
Kalmar PLC moddeling
HaV PLC

Q32 Comments
Vaxholm In Vaxholm there is currently no treatment of storm water other than natural wetlands.
Kalmar 50%

Q33 Comments
Mariehamn 11% of wastewater pipes
Panevezys 22.22
Vaxholm 0 %. As SKVVF does the monitoring in Vaxholms waters, I don't have detailed information about how the monitoring is conducted.
Västervik See anexed document
Kalmar 17%

Q34 Comments
Mariehamn <1%. Mariehamn
Panevezys 1,04%
Vaxholm 69% connected to municipal sewage (7900 person equivalents).
Västervik 15%. 8000 housholds has small sewage systems -(30 % of those are not OK)
Kalmar <10%

Q35 Comments
Vaxholm Kullö: Avloppsvattnet behandlas i ett första steg av ett galler och går sedan vidare till en buffertbassäng, därefter pumpas vattnet vidare till en SBR-reaktor för satsvis biologisk och kemisk rening.
Den biologiska reningen sker med aktiv slam och den kemiska genom simultanfällning med fällningskemikalie polyaluminiumklorid (PAX-XL260). Karlsudd: Avloppsvattnet leds in via ett sandfång och en försedimentering, vidare till en buffertbassäng. Från buffertbassängen pumpas vattnet till en SBR-reaktor för satsvis biologisk och kemisk rening. Den biologiska reningen sker med aktiv slam och den kemiska reningen genom simultanfällning med fällningskemikalie järnklorid (PIX-111). Bräddning kan ske från verkets buffertbassäng. Byviken: Spillvatten leds via en slamavskiljare till en kombinerad buffert- och pumpbassäng för att vidarepumpas till SBR-reaktor för satsvis biologisk och kemisk rening. Den biologiska behandlingen sker med aktiv slam och den kemiska genom simultanfällning med fällningskemikalie järnklorid (varunamn PIX-111). Bräddning kan ske från slamavskiljare. Utsläppspunkten för bräddat vatten är samma som för behandlat vatten.
Västervik Bräddning kan ske från verkets buffertbassäng. Under sommarhalvåret släpps vatten via UV-aggregat till en polerdamm och bäck.
8000 housholds has small sewage systems -(30 % of those are not OK) 90 % infiltration
Kalmar Infiltration systems are most common.

Q36 Comments
Mariehamn >10 000 pe. WWTP Mariahamn 30 000 pe
Panevezys Joint Stock company "Aukštaitijos vandenys"
Vaxholm Roslagsvatten the municipal sewage company is responsible.
Västervik Miljö&Energi AB (kerstin.karlsson@vastervik.se). Environmental Reports sends to the municipality (Miljö och byggnadskontoret) once a year

Q37 Comments
Västervik See above

Q39 Comments
Mariehamn Not our responsibility
Västervik County government of Kalmar/VISS
Kalmar Sporadicly when involved in projects. Continuity is lacking

Q40 Comments
Vaxholm Could be calculated from total P and N discharge to water bodies divided by number of citizens:

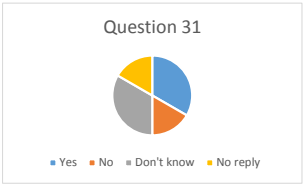
Questions
29. Which are the most important sources of nitrogen and phosphorous load in you city/municipality? Specify percentage of total load
30. How do you monitor load of nutrients from the most important sources of nitrogen and phosphorous?
31. Do you use models for source load descriptions? (Needed for WFD pressure analysis and HELCOM PLC periodical)
32. Do you have information on what percentage of the stormwater producing area is covered by treatment methods? Do you monitor load and reduction effects?
33. Do you have information on what percentage of stormwater producing area is connected to municipal wastewater treatment plants through coupled sewer systems?
34. Do you have information on the percentage of population not connected to municipal wastewater treatment plants ? (Definition of scattered dwellings according to HELCOM Pollution Load Compilations)
35. Do you have information on what different techniques are used in small onsite waterwater treatment plants, and to what extend they are used (please specify the relative use of each technique in percent)
36. Are you responsible for monitoring of effluent water from large municipal wastewater treatment plants (MWWTP) (>100000 pe, >10000 pe, >2000 pe) and industries?
37. Are there monitoring data of nitrogen, phosphorous and flow available on large MWWTP?
38. How do you monitor nitrogen and phosphorous load from farming and agriculture?
39. Do you register, monitor and report effects of measures to reduce loss of nutrients on farming and agriculture? How and to whom?
40. Do you monitor nutrient footprint per citizen?
41. Do you collect data regarding water and pollution from citizens? If so please provide more info:

Codebook	
Yes	0
No	1
Don't know	2
No reply	3

Sources of pollution

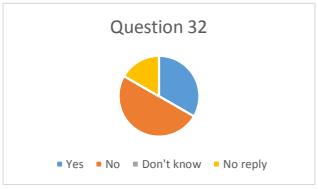
31. Do you use models for source load descriptions? (Needed for WFD pressure analysis and HELCOM PLC periodical)

Code	Response item	Frequency	Percent	Municipalities
0	Yes	2	33%	Västervik Kalmar
1	No	1	17%	Panevezys
2	Don't know	2	33%	Mariehamn Vaxholm
3	No reply	1	17%	Slupsk
	Total:	6	100%	



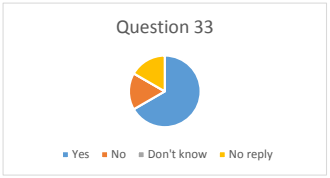
32. Do you have information on what percentage of the stormwater producing area is covered by treatment methods? Do you monitor load and reduction effects?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	2	33%	Vaxholm Kalmar
1	No	3	50%	Mariehamn Panevezys Västervik
2	Don't know	0	0%	
3	No reply	1	17%	Slupsk
	Total:	6	100%	



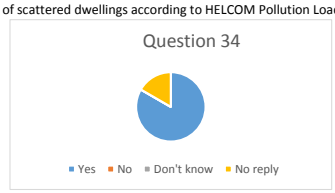
33. Do you have information on what percentage of stormwater producing area is connected to municipal wastewater treatment plants through coupled sewer systems?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	4	67%	Panevezys Vaxholm Västervik Kalmar
1	No	1	17%	Mariehamn
2	Don't know	0	0%	
3	No reply	1	17%	Slupsk
	Total:	6	100%	



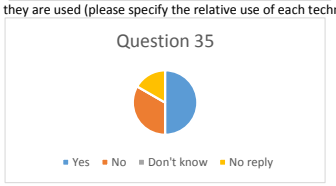
34. Do you have information on the percentage of population not connected to municipal wastewater treatment plants ? (Definition of scattered dwellings according to HELCOM Pollution Load Compilations)

Code	Response item	Frequency	Percent	Municipalities
0	Yes	5	83%	Mariehamn Panevezys Vaxholm Västervik Kalmar
1	No	0	0%	
2	Don't know	0	0%	
3	No reply	1	17%	Slupsk
	Total:	6	100%	



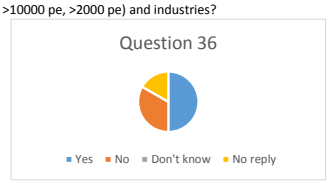
35. Do you have information on what different techniques are used in small onsite waterwater treatment plants, and to what extend they are used (please specify the relative use of each technique in percent)

Code	Response item	Frequency	Percent	Municipalities
0	Yes	3	50%	Vaxholm Västervik Kalmar
1	No	2	33%	Mariehamn Panevezys
2	Don't know	0	0%	
3	No reply	1	17%	Slupsk
	Total:	6	100%	



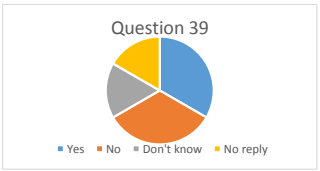
36. Are you responsible for monitoring of effluent water from large municipal wastewater treatment plants (MWWTP) (>100000 pe, >10000 pe, >2000 pe) and industries?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	3	50%	Mariehamn Vaxholm Kalmar
1	No	2	33%	Panevezys Västervik
2	Don't know	0	0%	
3	No reply	1	17%	Slupsk
	Total:	6	100%	



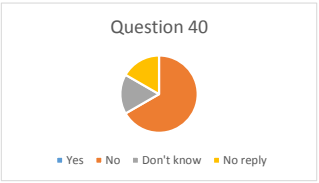
39. Do you register, monitor and report effects of measures to reduce loss of nutrients on farming and agriculture? How and to whom?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	2	33%	Västervik Kalmar
1	No	2	33%	Panevezys Vaxholm
2	Don't know	1	17%	Mariehamn
3	No reply	1	17%	Slupsk
	Total:	6	100%	



40. Do you monitor nutrient footprint per citizen?

Code	Response item	Frequency	Percent	
0	Yes	0	0%	
1	No	4	67%	Panevezys Vaxholm Västervik Värmdö
2	Don't know	1	17%	Mariehamn
3	No reply	1	17%	Slupsk
	Total:	6	100%	



Sources of pollution

29. Which are the most important sources of nitrogen and phosphorous load in you city/municipality? Specify percentage of total load

Municipality	Response
Mariehamn	WWTP, acrigulture
Panevezys	Don't know
Slupsk	
Vaxholm	Direct output point source 67 % nitrogen, 48% phosphorous.
Västervik	Agriculture 50% - Gamlebyviken
Kalmar	Fosfor: Agriculture 29%, Forest 17%, Stormwater 17%. Nitrogen: Agriculture 57%
Response freq.	83%

30. How do you monitor load of nutrients from the most important sources of nitrogen and phosphorous?

Municipality	Response
Mariehamn	Analysis of water samples from WWTP and recipient water body.
Panevezys	
Slupsk	
Vaxholm	The sewage plants monitor input and output. I don't know how the other sources are monitored.
Västervik	In Gamlebyviken area; Water samples once a month in the four rivers. Water flow from SMHI water web. In costwater se link to Kalmar läns kustvattenkomitte http://www.kalmarlanskustvatten.org/index.php?option=com_content&view=article&id=2&Itemid=4
Kalmar	Using PLC modeling
Response freq.	67%

37. Are there monitoring data of nitrogen, phosphorous and flow available on large MWWTP?

Municipality	Response
Mariehamn	Marieham 30000 pe
Panevezys	Monitoring data submitted to Environmental Protection Agency
Slupsk	
Vaxholm	> 2000 - Available for 2015, for 2016 not finished yet. Reported to environmental and health protection agency and https://smp.lansstyrelsen.se/.
Västervik	> 100000
Kalmar	> 100000, 10000, 2000 - Environmental report Kalmar ARV
Response freq.	83%

38. How do you monitor nitrogen and phosphorous load from farming and agriculture?

Municipality	Response
Mariehamn	Please contact Ålands landskapregering. Local goverment on Aland islands. www.regeringen.ax
Panevezys	Panevėžys City Municipality do not monitor ntrogen and phosphorous load from farming and agriculture, becouse is City Municipality
Slupsk	
Vaxholm	We don't. We have made calculations according to template.
Västervik	Water samples once a month, water flow from SMHI water web - in projects
Kalmar	PLC modelling. Some monetoring in Ljunby river.
Response freq.	83%

41. Do you collect data regarding water and pollution from citizens? If so please provide more info:

Municipality	Response
Mariehamn	
Panevezys	
Slupsk	
Vaxholm	Incoming water to sewage plants is measured regarding content of N and P.
Västervik	No
Kalmar	
Response freq.	33%

Röd text = Comments

Impact of monitoring and reporting

ID#	Q42	Q43	Q44	Q45	Q46	Q47
Mariehamn	Yes the city is involved in the development of plan of measures	Yes to the public: http://www.mariehamn.ax/organisation-arbete/stadens-miljoarbete/	0		0	
Panevezys	Yes the city gives feedback on possible measures after the plan has been adopted	Yes to the public: through media	0		0	
Slupsk			3		3	
Vaxholm	Yes the city is involved in the development of plan of measures	Yes to the WFD reporting: Every year Vaxholm reports to Vattenmyndigheten how the municipality is doing regarding water quality through "Kommunernas rapportering av genomförande av vattenmyndigheternas åtgärdsprogram". The answers are coordinated between the municipality management, the environment and health protection agency and the municipal sewage company.	1	It is harder for smaller municipalities like Vaxholm to describe how areas planned will affect the water quality. There are higher demands on this since the "Weser judgement". The county board can deny spatial plans to be adopted if the municipality	0	
Västervik	Yes the city is involved in the development of plan of measures	Yes to the public	1	We dont know for reeal....	0	
Kalmar	Yes the city is involved in the development of plan of measures	Yes to the WFD reporting	1	Uncertanty, lack of knowledge on annual status ans lack of knowledge regarding most sucessful action.	0	
HaV						

Q42 Comments

Vaxholm	Which measures do you mean here and who suggests the measures? Vattenmyndigheten? Then we have been given oppurtunity to comment on suggested plan. The municipality itself also develops plan for measures.

Q44 Comments

Vaxholm	Preferably there should be more, there is data missing for certain biological and chemical quality factors used to determine the status of the water bodies. Why: I would guess it is for financial reasons.
Västervik	Stormwater/agriculture (some areas). Why: Financial
Kalmar	Lacking continuity. Clarification on responsibility. Lack of funds. Should be a national responsability.

Q46 Comments

Västervik	Action Plan will be developed 2017

Questions

42. Do you give and get feedback on measures suggested for water bodies in your city/municipality?
43. Do you report progress of implementation of measures?
44. Do you think that the complete monitoring data needed is collected?
45. What are the consequences, regarding that the monitoring isn´t complete?
46. Do you have concrete nutrient reduction targets that you are working with in your city?
47. If not, is this something that you think your city should adapt?

Codebook	
Yes	0
No	1
Don't know	2
No reply	3

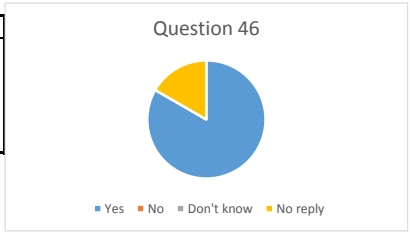
Impact of monitoring and reporting

44. Do you think that the complete monitoring data needed is collected?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	2	33%	Mariehamn Panevezys
1	No	3	50%	Vaxholm Västervik Kalmar
2	Don't know	0	0%	
3	No reply	1	17%	Slupsk
	Total:	6	100%	

46. Do you have concrete nutrient reduction targets that you are working with in your city?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	5	83%	Mariehamn Panevezys Vaxholm Västervik Kalmar
1	No	0	0%	
2	Don't know	0	0%	
3	No reply	1	17%	Slupsk
	Total:	6	100%	



Impact of monitoring and reporting

42. Do you give and get feedback on measures suggested for water bodies in your city/municipality?

Municipality	Response
Mariehamn	Yes the city is involved in the development of plan of measures
Panevezys	Yes the city gives feedback on possible measures after the plan has been adopted
Slupsk	
Vaxholm	Yes the city is involved in the development of plan of measures
Västervik	Yes the city is involved in the development of plan of measures
Kalmar	Yes the city is involved in the development of plan of measures
Response freq.	83%

43. Do you report progress of implementation of measures?

Municipality	Response
Mariehamn	Yes to the public: http://www.mariehamn.ax/organisation-arbete/stadens-miljoarbete/
Panevezys	Yes to the public: through media
Slupsk	
Vaxholm	Yes to the WFD reporting: Every year Vaxholm reports to Vattenmyndigheten how the municipality is doing regarding water quality through "Kommunernas rapportering av genomförande av vattenmyndigheternas åtgärdsprogram". The answers are coordinated between the municipality management, the environment and health protection agency and the municipal sewage company.
Västervik	Yes to the public
Kalmar	Yes to the WFD reporting
Response freq.	83%

45. What are the consequences, regarding that the monitoring isn´t complete?

Municipality	Response
Mariehamn	
Panevezys	
Slupsk	
Vaxholm	It is harder for smaller municipalities like Vaxholm to describe how areas planned will affect the water quality. There are higher demands on this since the "Weser judgement". The county board can deny spatial plans to be adopted if the municipality
Västervik	We dont know for reeal….
Kalmar	Uncertanty, lack of knowledge on annual status ans lack of knowledge regarding most sucessful action.
Response freq.	50%

47. If not, is this something that you think your city should adapt?

Municipality	Response
Mariehamn	
Panevezys	
Slupsk	
Vaxholm	
Västervik	
Kalmar	
Response freq.	0%

Röd text = Comments

Publishing of Data

ID#	Q48	Q49	Q50	Q51 a)	Q51 b)	Q51 c)	Q52
Mariehamn	Once a year on webb	See following site http://www.marieh	No	1	1	0	0
Panevezys	The annual report is published in the website: file:///C:/Users/Ruta1/Downloads/vandens%20mionitoringas.pdf		In 2008 Panevėžys City Municipality implemented the project "Public Environmental Education"	0	0	0	0
Slupsk				3	3	3	3
Vaxholm	Data is reported to Environmental and health protection agency once a year. Data from monitoring is available on SKVVF:s homepage http://www.kustdata.su.se/skvvf/index.html	The reports and data are official and can be sent out on request, but they are not published on homepage or similar.	Not sure what you mean by this.	0	1	0	0
Västervik	Reports from projects to County Administration and "Hållbarhetsbokslut" once a year	Hållbarhetsbokslut on the web and Kustvattenkommitten on web	Yes Havsmiljö Gamlebyviken	0	1	0	0
Kalmar	Yes, yearly in Environemntal report. Kalmar ARV	Yes	No	0	1	1	0

Q51 a) Comments

Panevezys	Dom har svarat med x endast. SÅ det kan även vara No.
Vaxholm	Monitoring is conducted by Östra Sveriges luftvårdsförbund, data is published on http://slb.nu/slbanalys/
Västervik	Winter daily. PM10 and bensen.

Q51 c) Comments

Vaxholm	Yes, the flow is measured online and can be seen online, but it is not available for the public.
Västervik	In the larger sewage plants

Q52 Comments

Mariehamn	Maybe. Routines should be simple
Vaxholm	From my point of view, yeas, but this has to be discussed with leading civil servants and politicians.
Kalmar	Yes, if run by national body, like Länsstyrelsen or Vattenmyndigheten

Questions

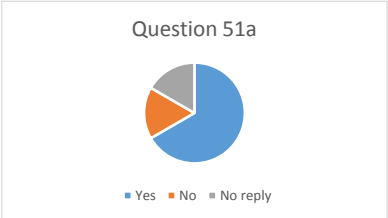
48. Do you publish data officially? How and how often?
49. Is any of the data above open data (publically available)?
50. Do you have/have you had a "citizen science project"?
51 a) Do you have any realtime sensor data in your municipality today on Air
51 b) Do you have any realtime sensor data in your municipality today on Stormwater
51 b) Do you have any realtime sensor data in your municipality today on Wastewater
52. Are you interested in joining a regional public database that shares your city's data?

Codebook	
Yes	0
No	1
No reply	3

Publishing of Data

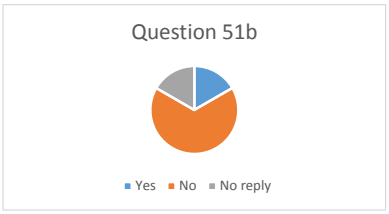
Q51 a) Do you have any realtime sensor data in your municipality today on Air

Code	Response item	Frequency	Percent	Municipalities
0	Yes	4	67%	Panevezys Vaxholm Västervik Kalmar
1	No	1	17%	Mariehamn
3	No reply	1	17%	Slupsk
	Total:	6	100%	



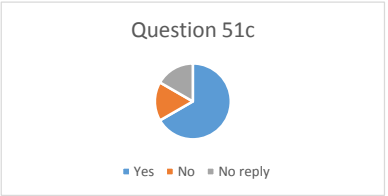
Q51 b) Do you have any realtime sensor data in your municipality today on Stormwater

Code	Response item	Frequency	Percent	Municipalities
0	Yes	1	17%	Panevezys
1	No	4	67%	Vaxholm Västervik Mariehamn Kalmar
3	No reply	1	17%	Slupsk
	Total:	6	100%	



Q51 c) Do you have any realtime sensor data in your municipality today on Wastewater

Code	Response item	Frequency	Percent	Municipalities
0	Yes	4	67%	Mariehamn Panevezys Vaxholm Västervik
1	No	1	17%	Kalmar
3	No reply	1	17%	Slupsk
	Total:	6	100%	



52. Are you interested in joining a regional public database that shares your city's data?

Code	Response item	Frequency	Percent	Municipalities
0	Yes	5	83%	Mariehamn Panevezys Vaxholm Västervik Kalmar
1	No	0	0%	
3	No reply	1	17%	Slupsk
	Total:	6	100%