Task 2.3.1 Regional database for beach litter and micro litter

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Contents

Introduction

The purpose of this document is to briefly describe three different databases or programmes which are used in the work with marine litter related issues as a prerequisite to identify the best option for setting up a regional database for beach litter. The three studied ones are OSPAR database, MARLIN database (a harmonised marine litter monitoring method based on the UNEP/IOC monitoring guidelines adapted for the Baltic Sea) and Marine Litter Watch (EEA).

HELCOM data on marine litter

Monitoring of beach litter in the Baltic Sea area is carried out in Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland and Sweden. In six countries monitoring started in 2012, in five of them data were collected in the period 2012-2016. In Denmark and Poland monitoring started in 2015 (see Table 1).

Country	Monitoring period	Number of monitoring sections	Length of monitored section	Beach types (number)	Frequency of monitoring per year	Seasons (total number of visits)	Marine litter items categorization
Denmark	2015 - 2016	3	100	reference (rural) (3)	3(4)	spring (6), summer (6), autumn (6), winter (1)	TG ML Master list
Estonia	2012 - 2016	10	300, 350, 400, 500, 600, 800, 2500, 3000	peri-urban (5), urban (1), rural (4)	3	spring (32), summer (42), autumn (32)	UNEP/ MARLIN
Finland	2012 - 2016	12	100, 110, 152, 320, 326	peri-urban (3), urban (5), rural (4)	3	spring (45), summer (42), autumn (42)	UNEP/ MARLIN
Germany	2012 - 2016	26	100	reference (11), urban (1), rural (14)	4	spring (96), summer (102), autumn (101), winter (79)	OSPAR Guideline for Monitoring Marine Litter on the Beaches, with slight adaptations
Latvia	2012 - 2016	42	100	urban (12), rural (18), peri-urban (5), periurban(rural) (4), rural/remote (3)	1	summer (175)	UNEP/ MARLIN
Lithuania	2012 - 2013	4	100	urban (1) rural (1) semi-urban (1) touristic (1)	4	spring (8), summer (8), autumn (8), winter (8)	
Poland	2015 - 2016	15	1000	urban (7), rural (8)	4	spring (30), summer (30), autumn (30), winter (30)	TG ML Master list
Sweden	2012 - 2016	10	100	peri-urban(6), rural (4)	3	spring (37), summer (37), autumn (39)	UNEP/ MARLIN

Table 1. Summary of available national beach litter monitoring data: spatial, temporal and categorization method used.

The number of monitored beaches (stations) varies by country. The smallest number of beaches is monitored in Denmark (3) and Lithuania (4), while the largest number of monitored beaches is in Latvia (42). The main types of monitored beaches are urban and rural ones, but in some countries reference beaches (where the

anthropogenic impact is minimal) as well as peri-urban beaches[1] are monitored. The length of the monitored beaches ranges from 100 to 3000m, being 100m the most common length used (in five countries). In four countries, monitoring is conducted three times a year (spring, summer and autumn). In the case of Denmark, only one survey was conducted in winter time. In Germany and Poland regular monitoring is conducted in the four seasons of the year. In Latvia, monitoring is carried out only in the summer season.

The monitored litter is assigned to eight main material categories: artificial polymer materials, rubber, cloth/textile, paper/cardboard, processed/worked wood, metal, glass/ceramics and unclassified. Some countries have identified two additional categories: food waste and chemicals such as e.g. paraffin, wax, oil or tar. The categorization of individual litter items is conducted according to different methodologies and protocols (UNEP 2009, OSPAR 2010, JRC 2013, MARLIN 2013) depending on the countries. Task Group Master List (TG ML) (JRC 2013) is used in Denmark and Poland, the UNEP/MARLIN classification methodology is used in four countries: Estonia, Finland, Latvia and Sweden, whereas Germany use the OSPAR methodology and protocol.

Data call on marine litter

A data call on marine litter was launched to HELCOM countries in May 2017. It was conducted in Excel-format via email. Instructions on filling the Excel-template were on the first sheet of the file (Table 2), and the actual data call template on the second sheet (Table 3).

Please read these short instructions before filling-in the table
Please indicate the **coding list used**: UNEP, OSPAR, TG ML. If none of this, please provide reference
Data on **number of items** is to be included below each green column
Please create **one column per item code reported**. Create as many columns as needed
When creating a column, please first indicate the 'Material' to be followed by 'a short description of the item' followed by the 'Item code'. The idea is to merge all this information in one field. For example: 'Plastic: Shoes [44]' if using the OSPAR coding list.
Please select from the list below when indicating the **'Material':** ARTPOLY -> Artificial polymer materials RUBBER-> Rubber TEXTILE -> Cloth/textile PAPER -> Paper/cardboard WOOD -> Processed/worked wood METAL -> Metal GLASS -> Glass/ceramics CHEM -> Chemicals FOOD -> Food waste UNDEF -> Undefined

Table 2. Data call, instructions sheet

[1] Understood as beaches with (many) visitors but which are not in or very close to a city.

COLUMN	FORMAT
Country	General
E-mail contact person	General
Monitoring protocol used	General
Type of beach (rural/urban/reference beach)	General
Monitoring area ID	General
Length (m)	General
Width (m)	General
Start geographical longitude	General
Start geographical latitude	General
End geographical longitude	General
End geographical latitude	General
HELCOM subbasin name (level 3 according to the HELCOM Monitoring and Assessment Strategy)	General
Monitoring date: dd/mm/yy	General
Coding list used	General
Material: description of the item [item code]	General
Material: description of the item [item code]	General
Material: description of the item [item code]	General

Table 3. Data call, data template

Marlin database

Marlin database was created as a product of the Central Baltic project Baltic Marine Litter (MARLIN), which ran in 2011-2013. Countries involved in the project were Estonia, Finland, Latvia and Sweden. Swedish partner was in charge of building, launching and maintaining the database. After the project ended the Swedish partner, Keep Sweden Tidy, has been maintaining the database. The database is now funded by The Swedish Agency for Marine and Water Management.

The purpose of the database was and still is to collect data from beach assessments into one database from where reports on the litter situation can easily be drawn.

Beaches are established to the database and from each beach assessment litter data is input. The database is not meant to be used by public as a citizen science tool, but rather the managers of beaches/assessment beaches, NGOs active in marine litter issues and officials.

Technical

Located at: http://hsr-beach.herokuapp.com/login

Operation and maintenance of the database is financed by: The Swedish Agency for Marine and Water Management

Technical support and access to the database is provided by: Keep Sweden Tidy, info@hsr.se

Map: Google maps

Database in action

Database is aimed at professionals in the field of marine litter. It is essential to know different beach litter monitoring methodologies and protocols. Itself the database is self-guiding when using it, and clearly defined.

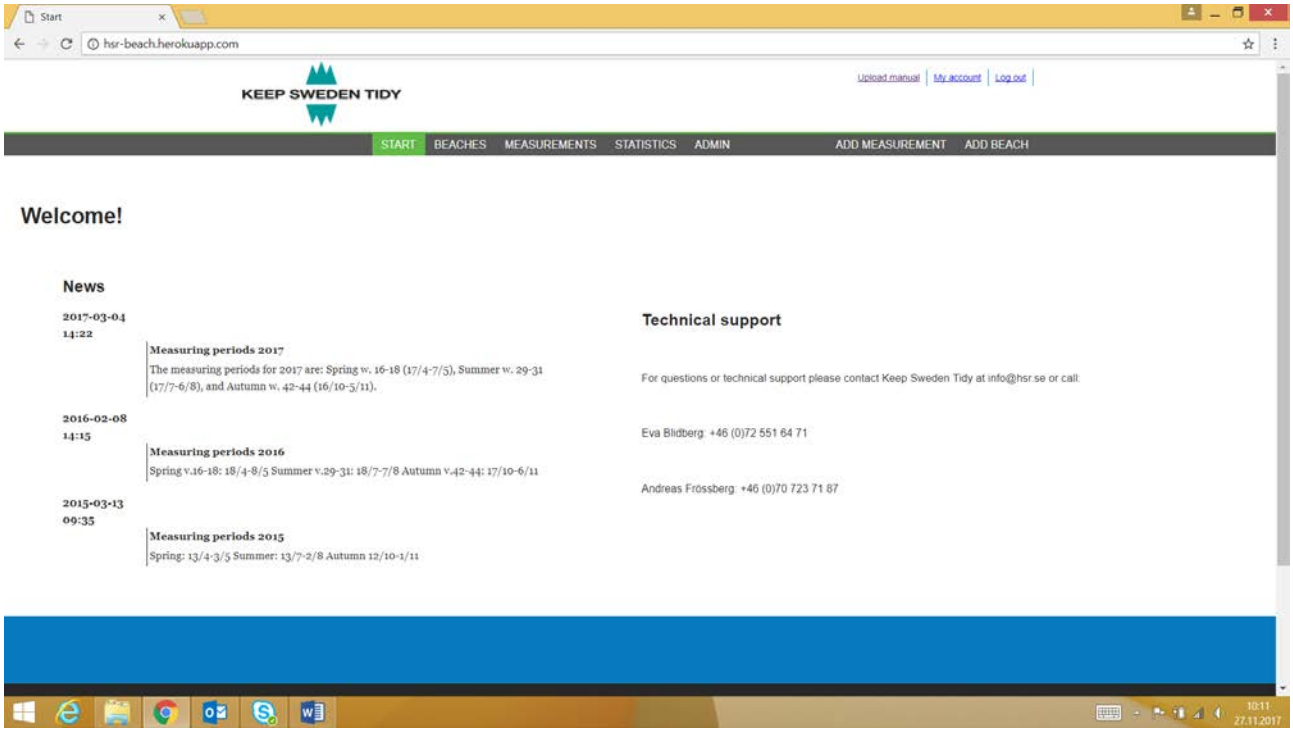


Figure 1. First page of the database web application

Beaches in the database are located in Estonia, Finland, Germany, Latvia, Lithuania and Poland. Most of the beaches are monitored with UNEP/Marlin method and UNEP/Marlin protocol for litter items. The database, also includes beaches monitored in the OSPAR area. A great advantage with the Marlin database is that more than one protocol can be added to the database, thus giving the chance of developing this database into a regional database where all protocols can be added.

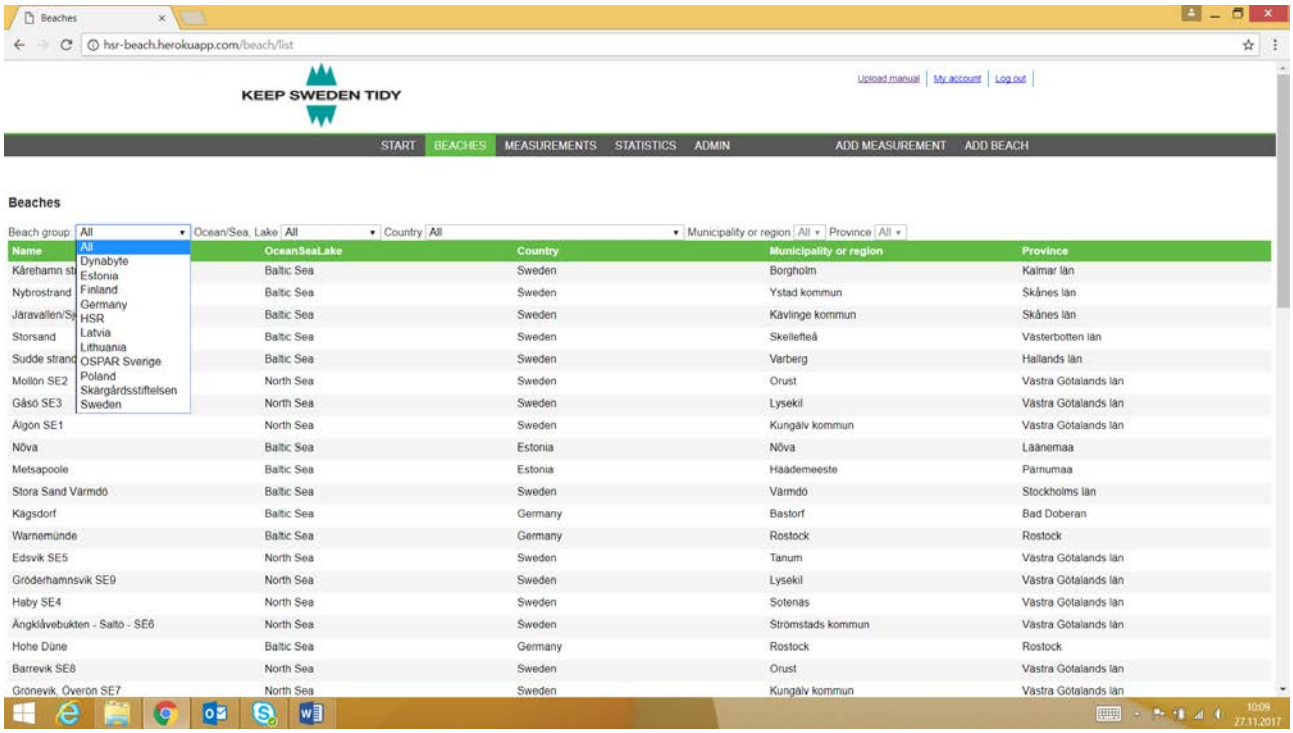


Figure 2. Beach list view in the database web application

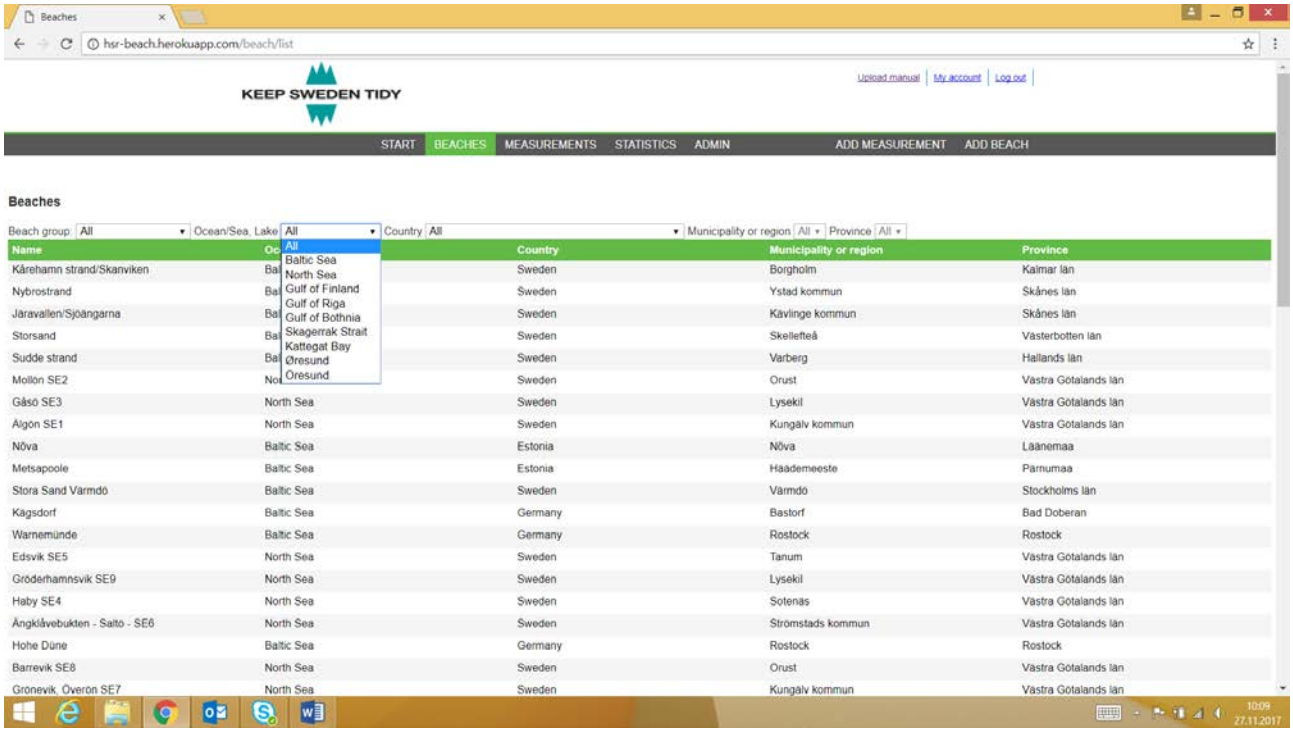


Figure 3. Beach list view in the database web application

User types

There are different types of users, each user type has different rights. A basic user can only see the data from his respective country, group administrator is so called beach manager and can input data for his monitoring

beach and super administrator can input data and see data from all beaches in the database. The user types are given by the Swedish NGO [Keep Sweden Tidy].

Adding a monitoring site

Beach managers and administrators can add a monitoring site to the database. As a first step a country/area is chosen and then a place from the map is pointed. The map tool uses Google maps and coordinates are given by the system, when pointing the place from the map (Figure 4 – Figure 5). Background information on the beach is filled out at this point (from physical characteristics to estimated visitors). Information can be edited at any point.

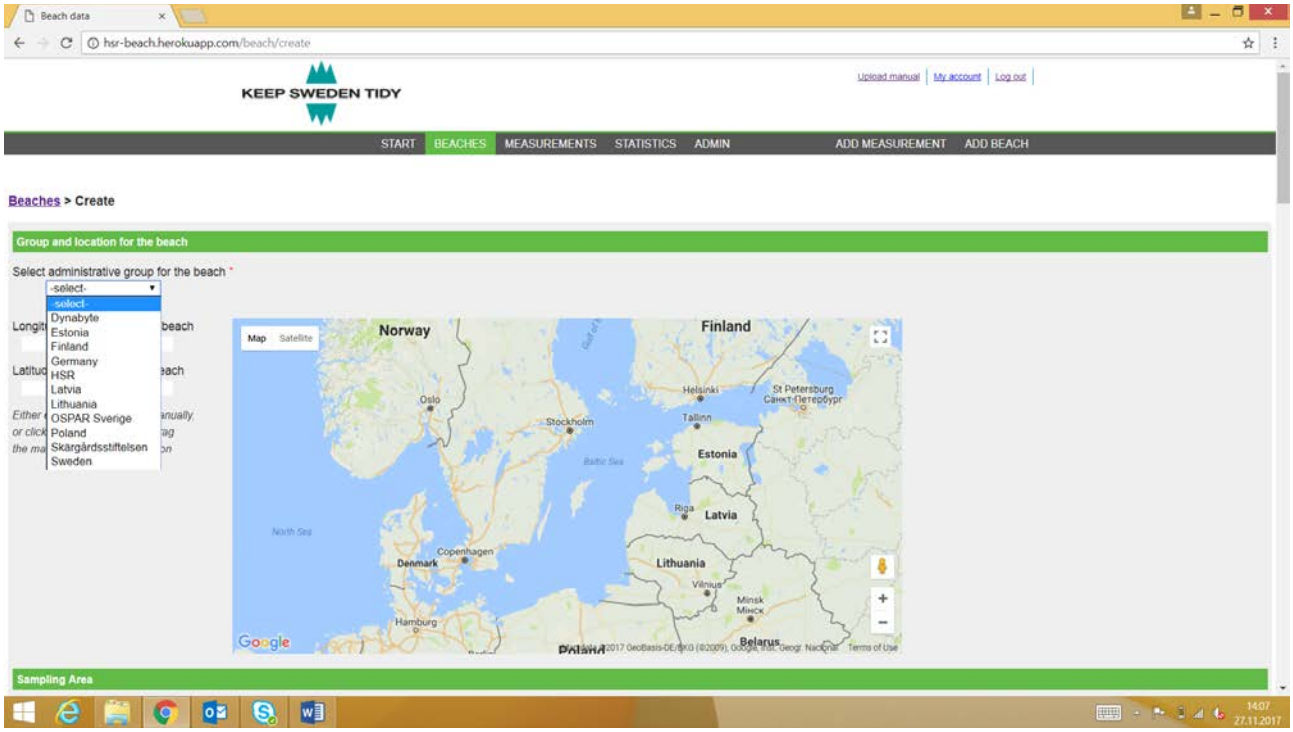


Figure 4. Creating a new beach/monitoring site

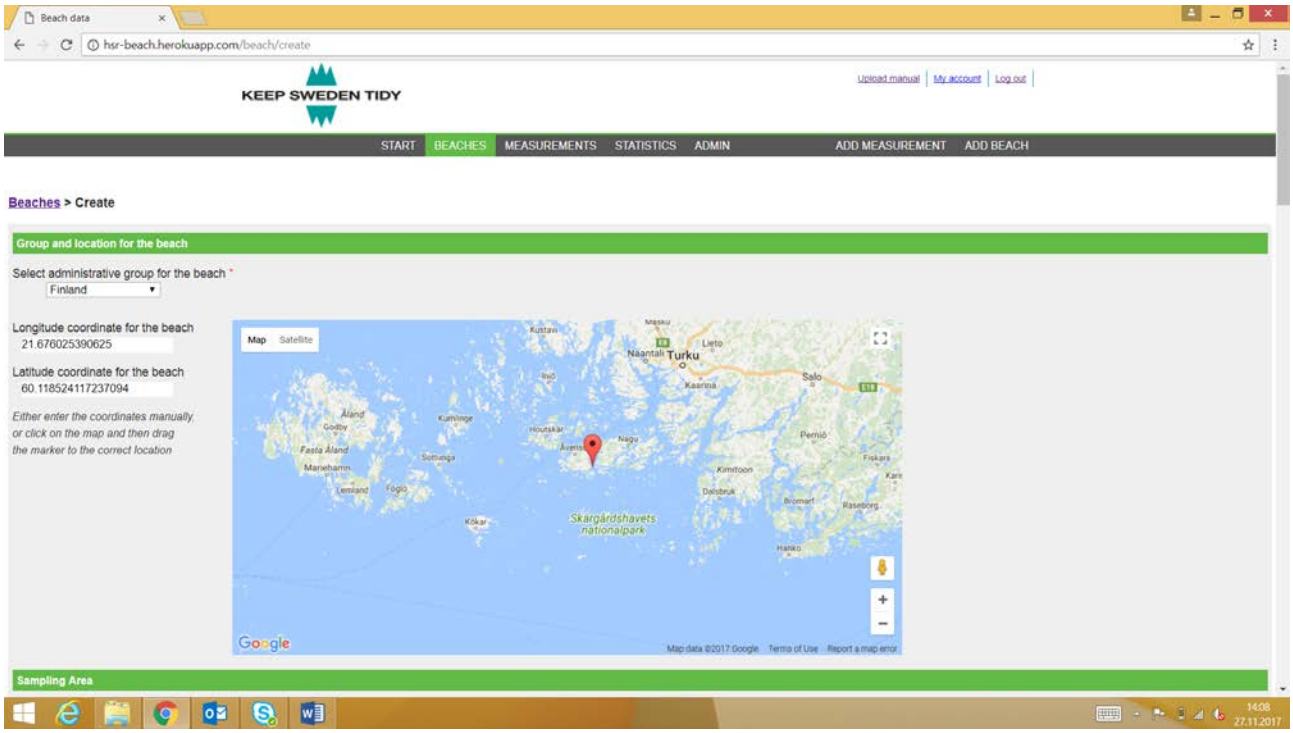


Figure 5. Creating a new beach/monitoring site

Collecting the monitoring data

Data from monitoring sites is collected through the website. Main user can send a link to the monitoring beach manager who can input the litter info, or the main user can input info on behalf of the beach manager. It is possible to set a separate manager for each beach (Figure 6).

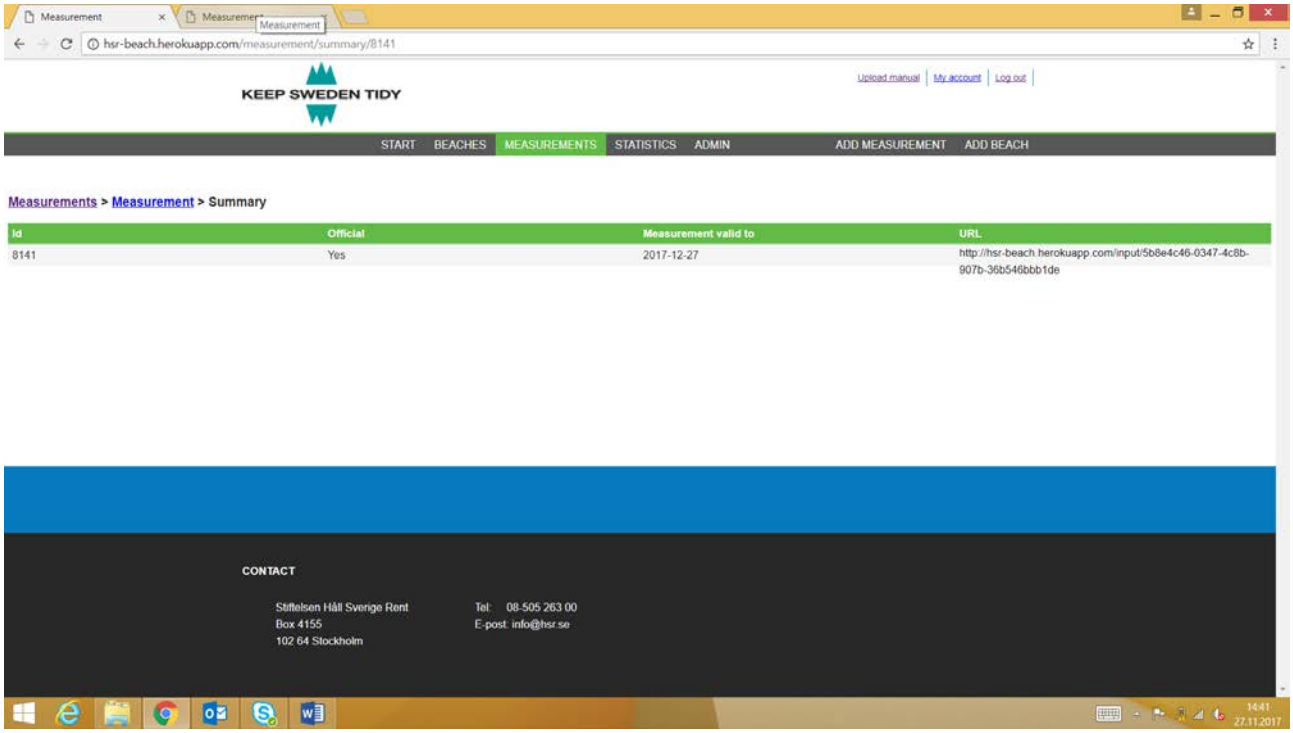


Figure 6. Collecting data

For each monitoring, litter data and monitoring data is “input”. Monitoring data refers to background information from a particular monitoring event e.g. unusual circumstances, such as storm activity. The actual litter data is input simply by inputting total numbers of litter items to each litter category (Figure 7 – Figure 8). At the moment this is the only possible way to upload data.

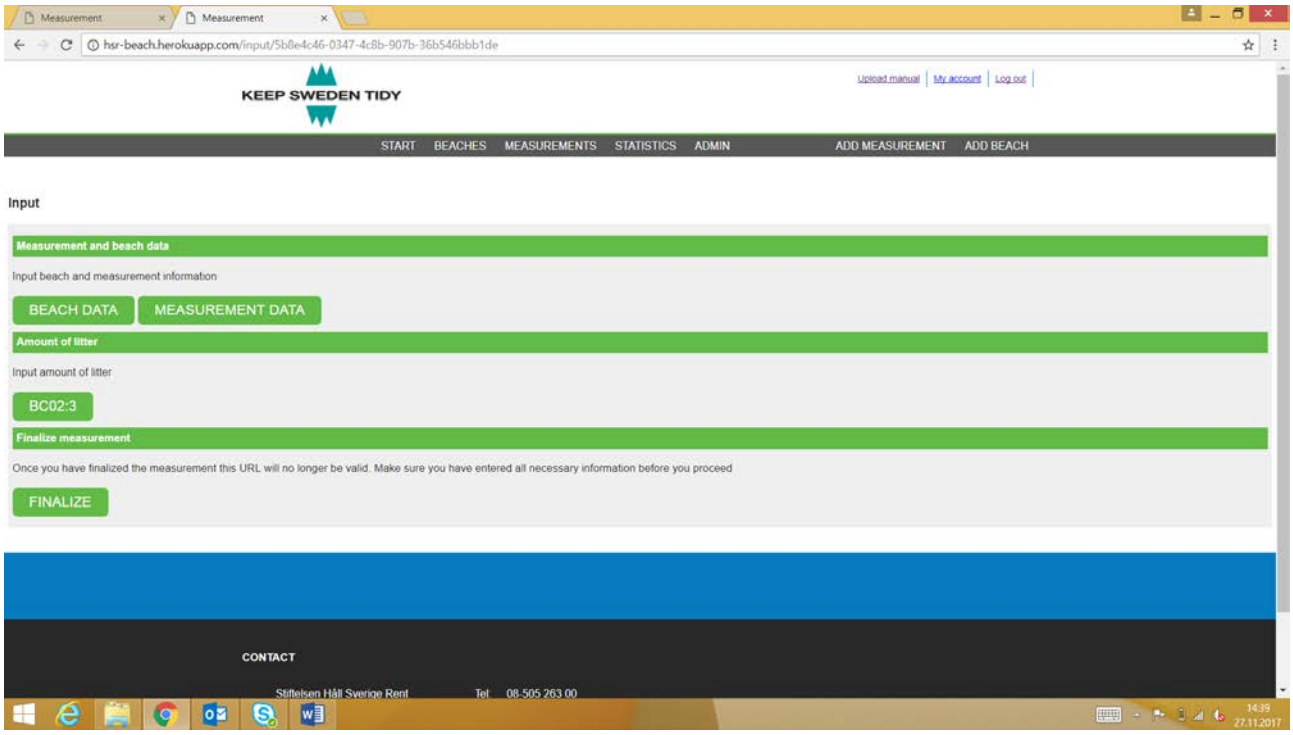


Figure 7. Collecting data

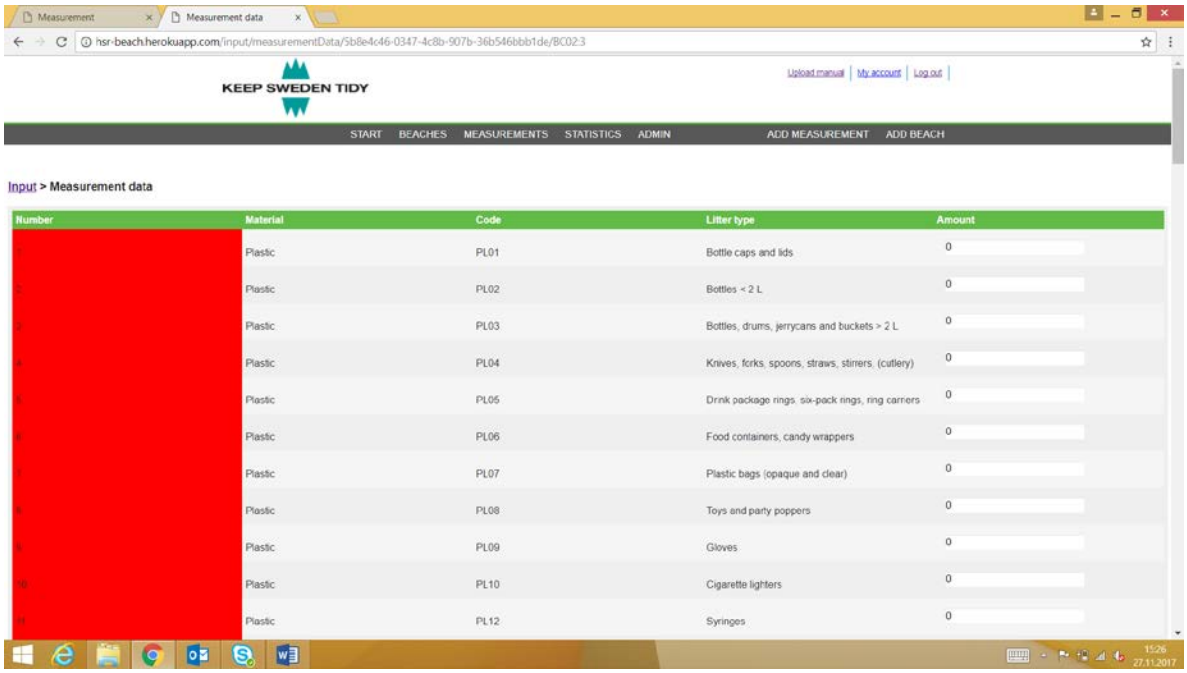


Figure 8. Collecting data, adding litter items

Measurements – beach assessments

Measurements can be filtered by groups (country related category), beaches, status and protocols. All different options from drop-down menus are presented below (Figure 9 –Figure 12).

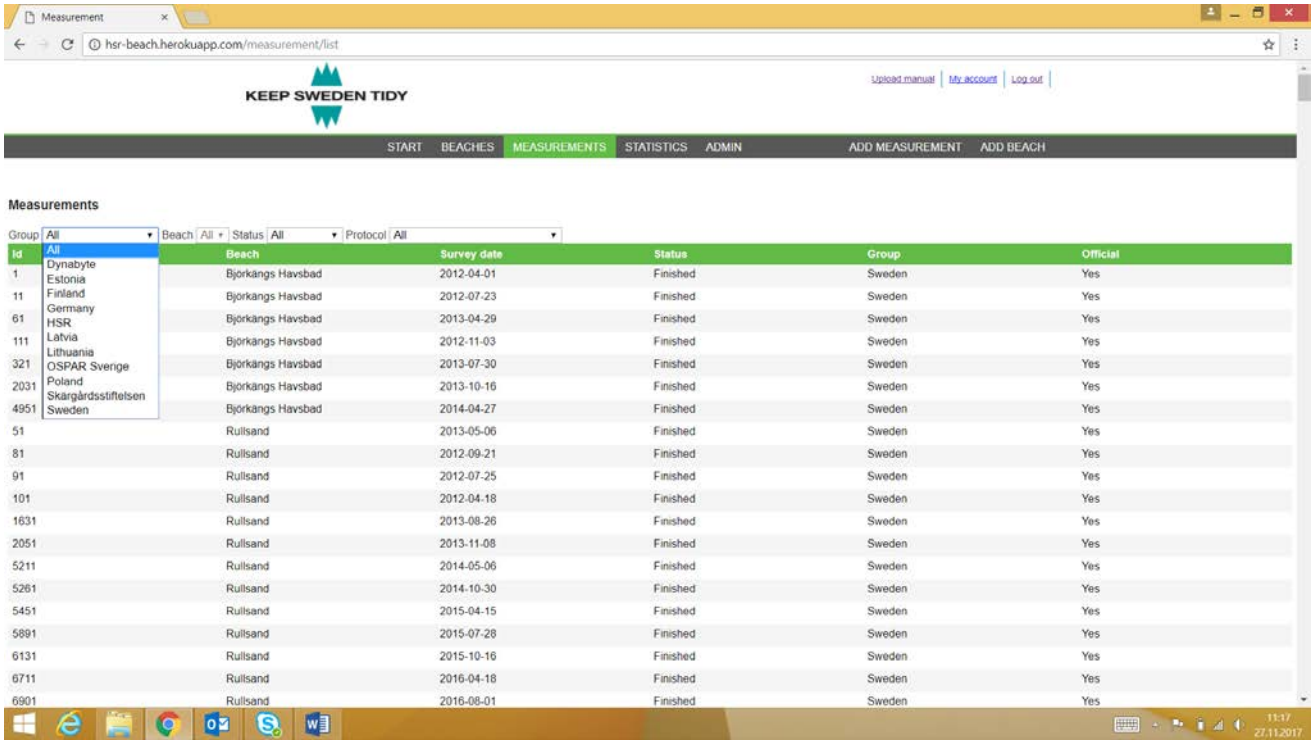


Figure 9. Studying litter data, different search filters

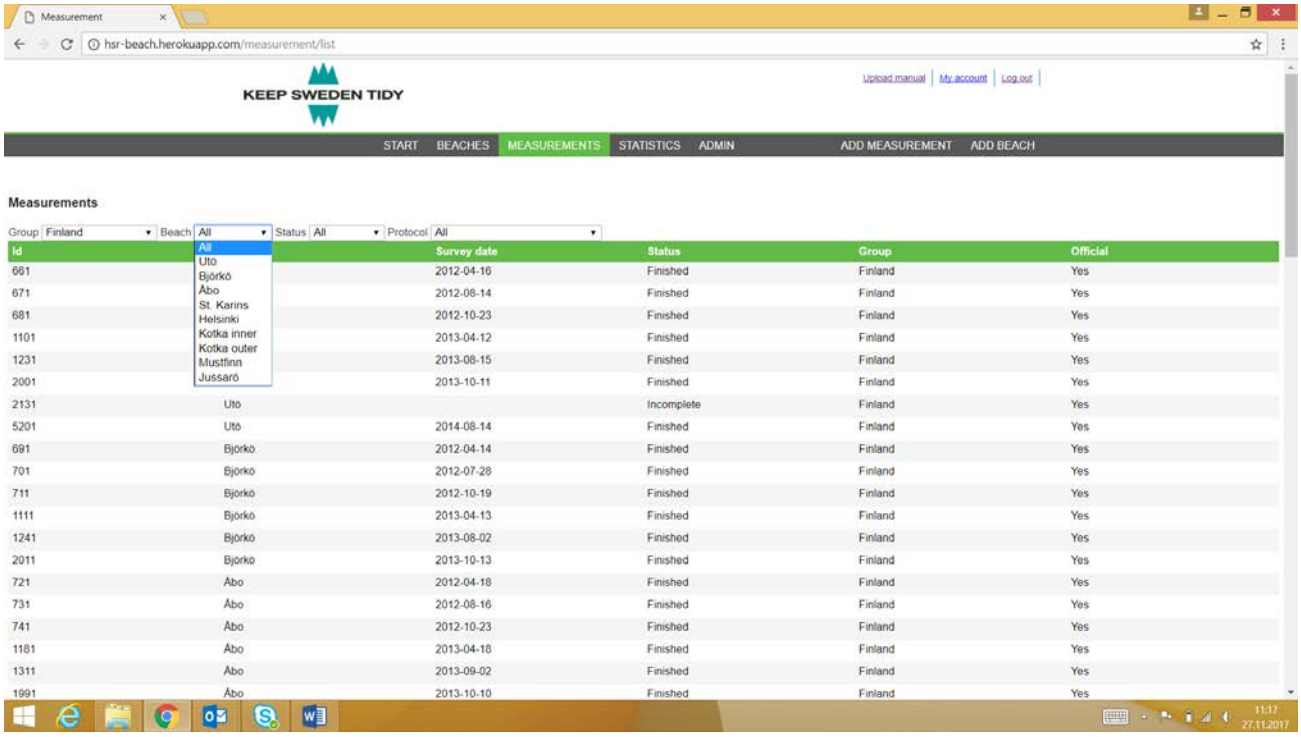


Figure 10. Studying litter data, different search filters

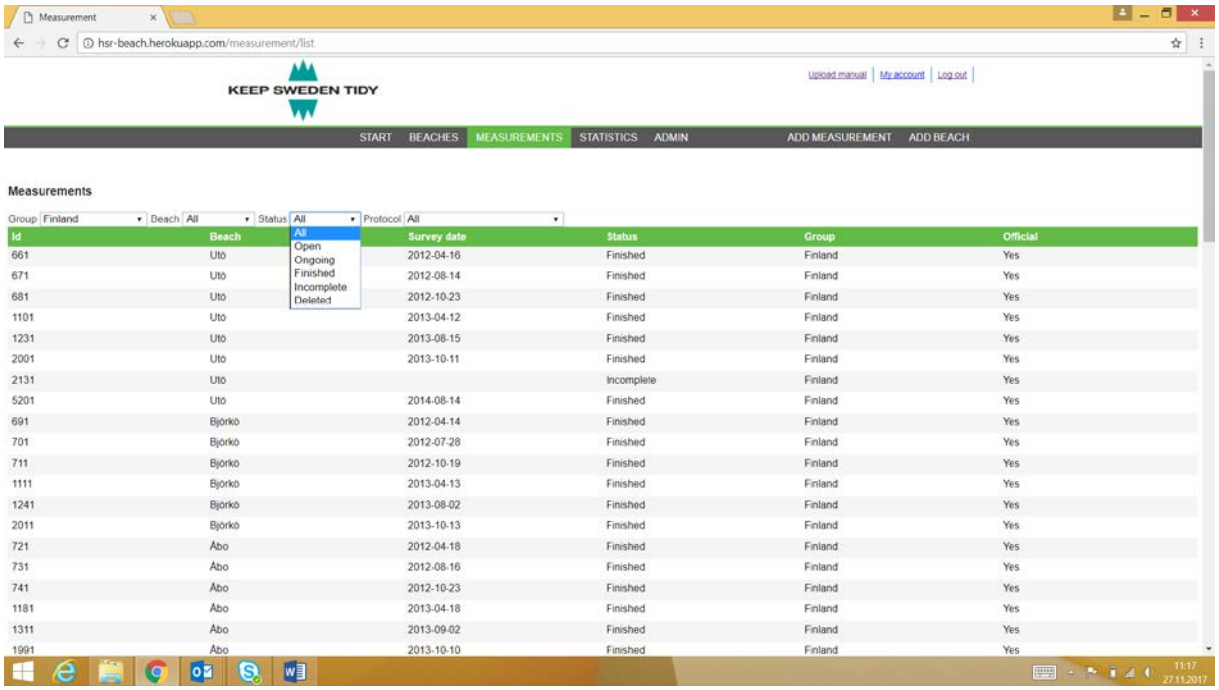


Figure 11. Studying litter data, different search filters

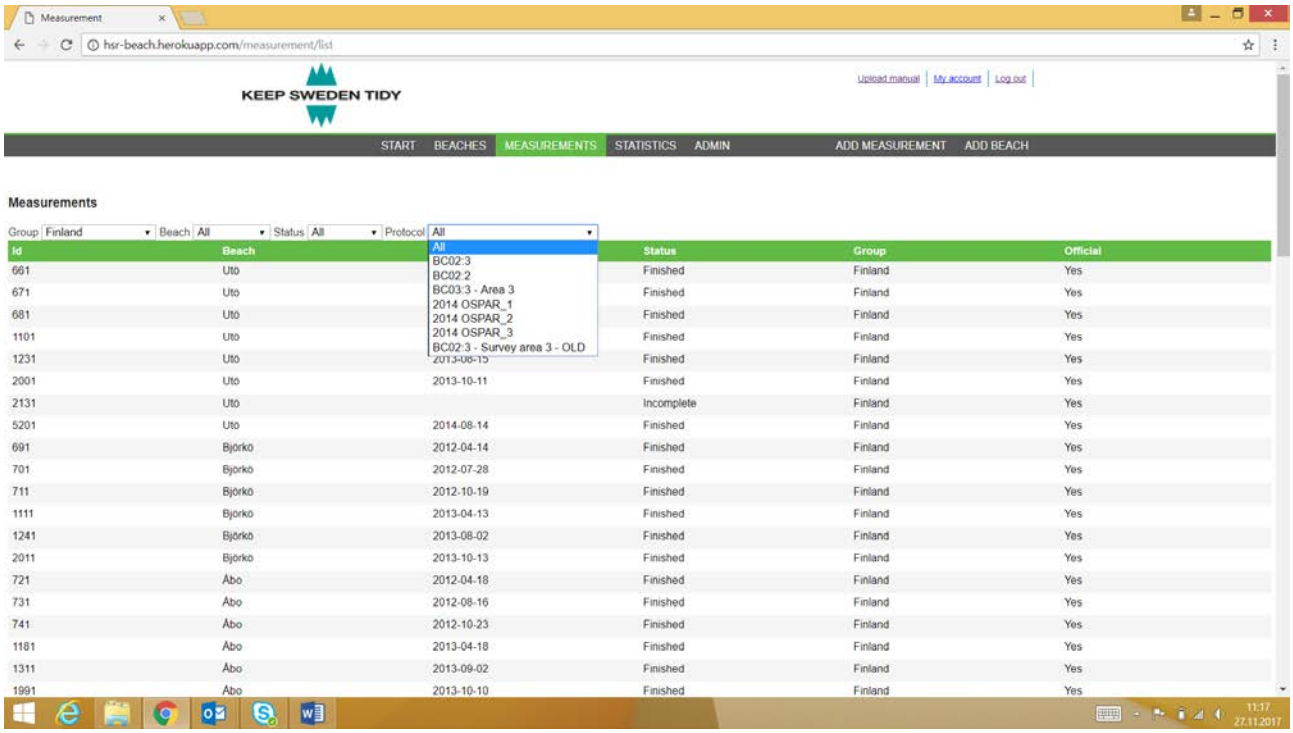


Figure 12. Studying litter data, different search filters

Single measurements to study

All measurements can be studied separately in the web interface or by downloading the results as an Excel or pdf file. It is possible to study:

- beach information, which consists of information on the beach and its characteristics, Figure 13
- measurement information, which consists of background information on the specific conditions when the measurement was conducted, Figure 14
- measurement data, consisting of litter data from the specific measurement, Figure 15.

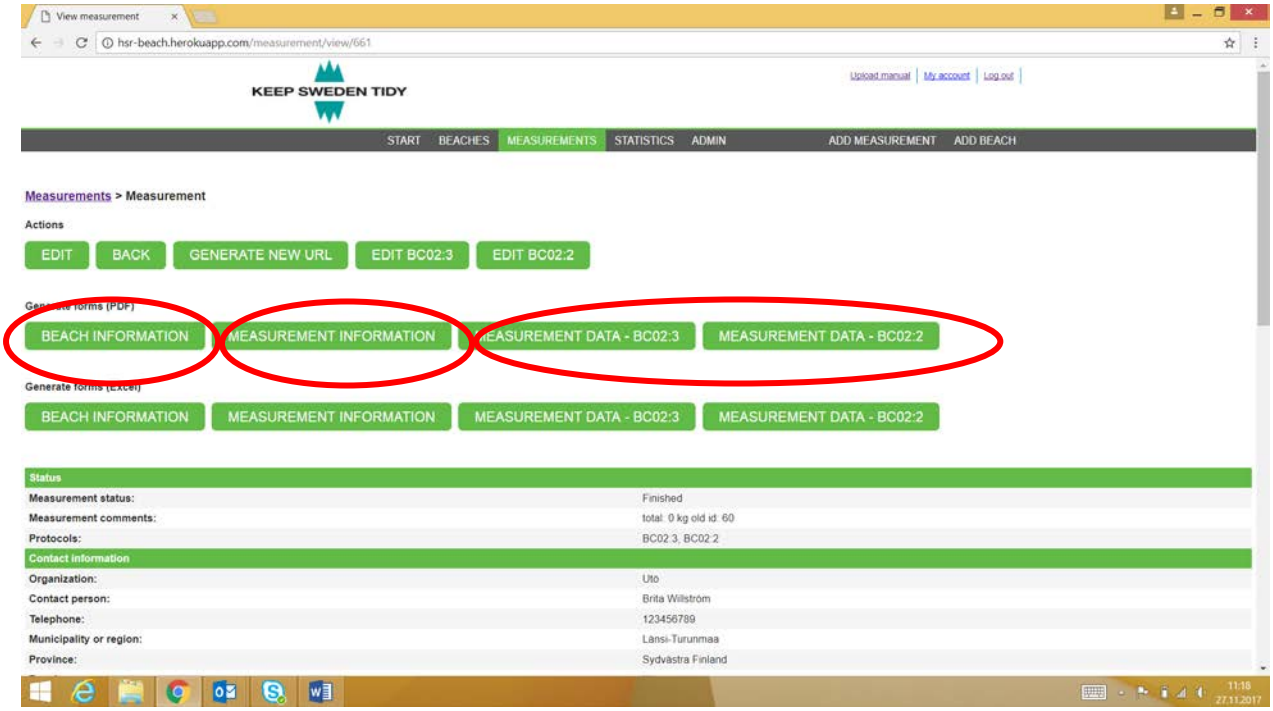


Figure 13. Studying litter data, different form selection and beach information

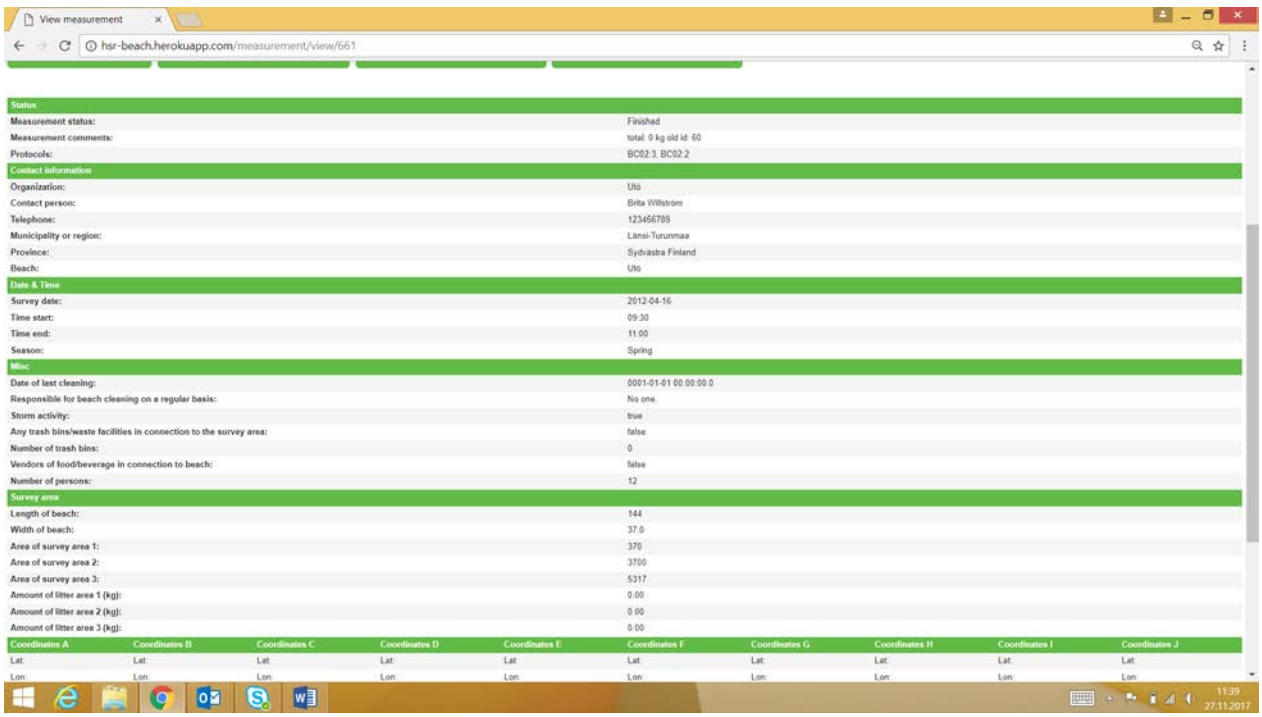


Figure 14. Studying litter data, measurement information

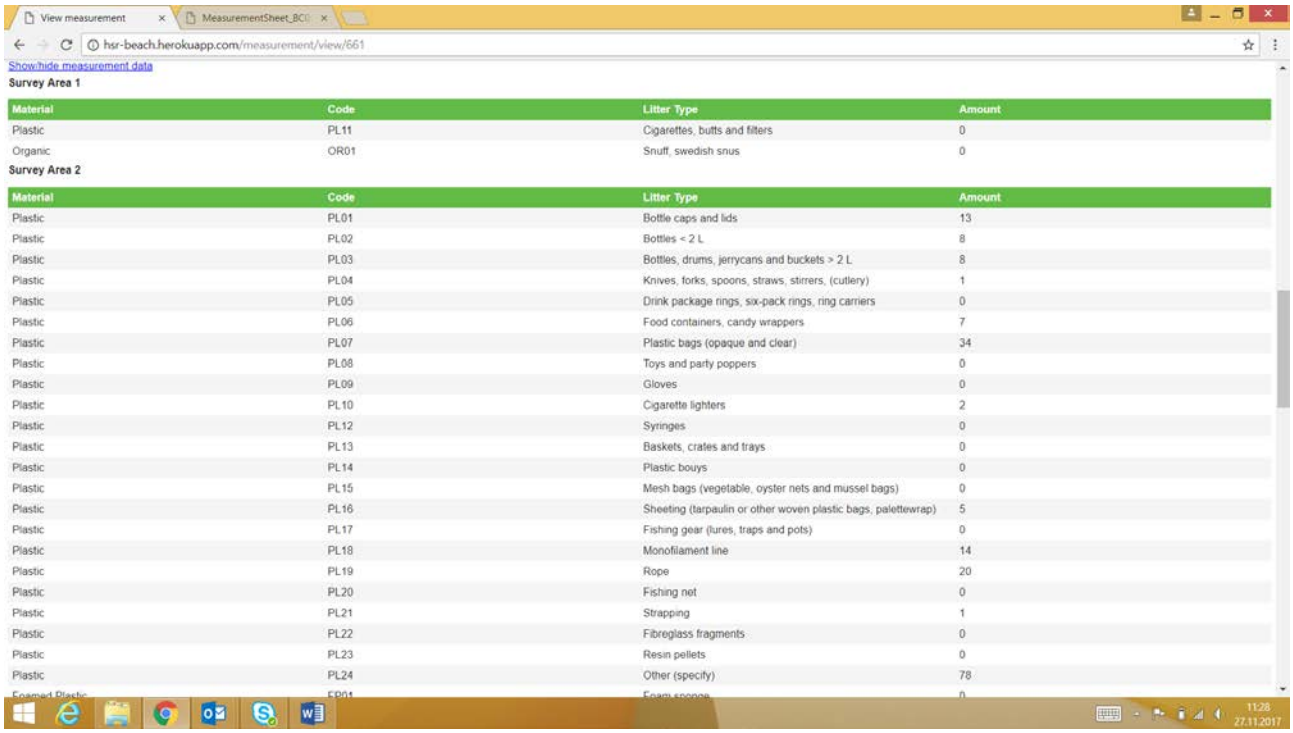


Figure 15. Studying litter data, measurement litter data

Statistics

The statistic tool enables to study the litter data in different ways: by measurement, beach and filter (Figure 16). All these possibilities are presented below.

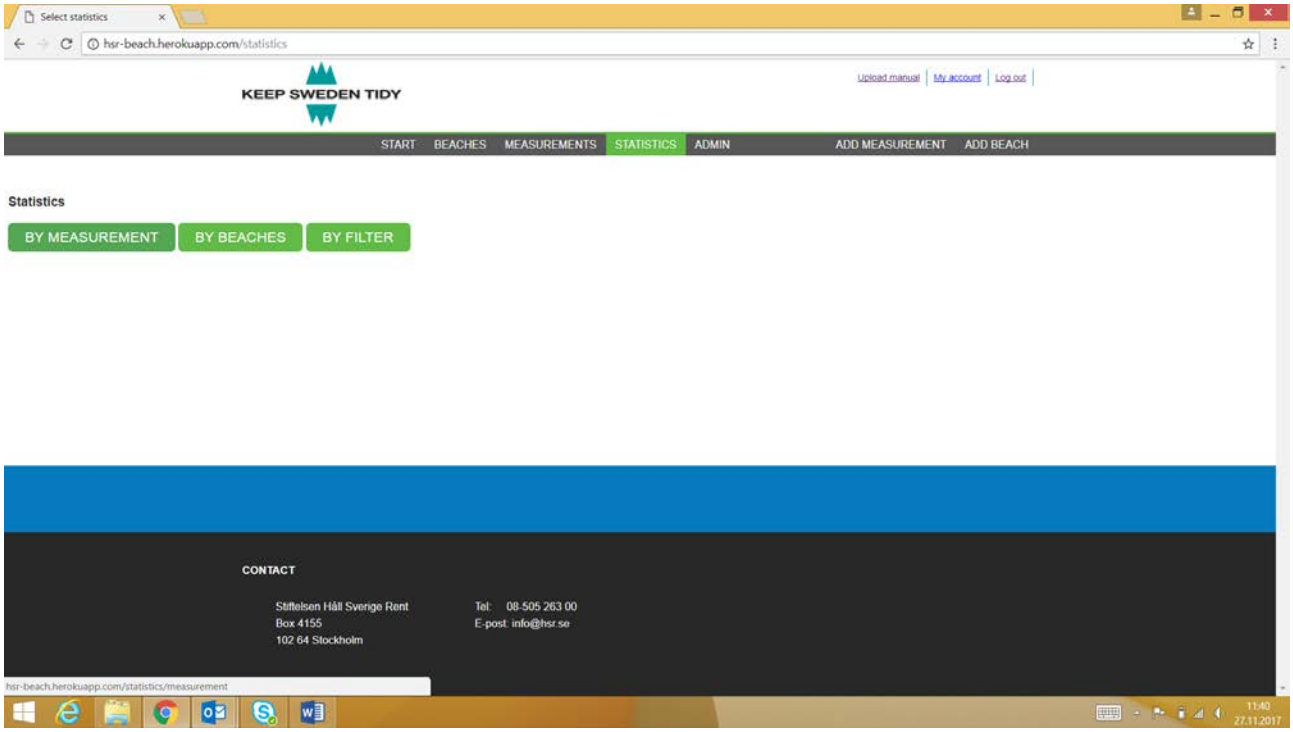


Figure 16. Studying litter data, statistics tool, choices

The results of each search are presented in the same format whether measurement, beach or filter tool is used. The results are presented in the web browser immediately. From the web browser view it is possible to study common litter items (Top 10), litter trend per main category (plastic, rubber, wood, etc.), material proportion percentages, key figures, included measurements and a map. Top litter items are calculated by the simple method, based on the total number of items found. These are presented in Figure 17 – Figure 22. Additionally to the web browser view, it is possible to download different reports in excel and pdf format. The basic excel file contains the same information as the web browser view. That same information can also be downloaded as a pdf file. In the excel format it is also possible to download the raw data, which includes only litter items recorded in numerical format, columns being beach name, measurement id, material type, trash code, trash code description, survey area and amount (litter items).

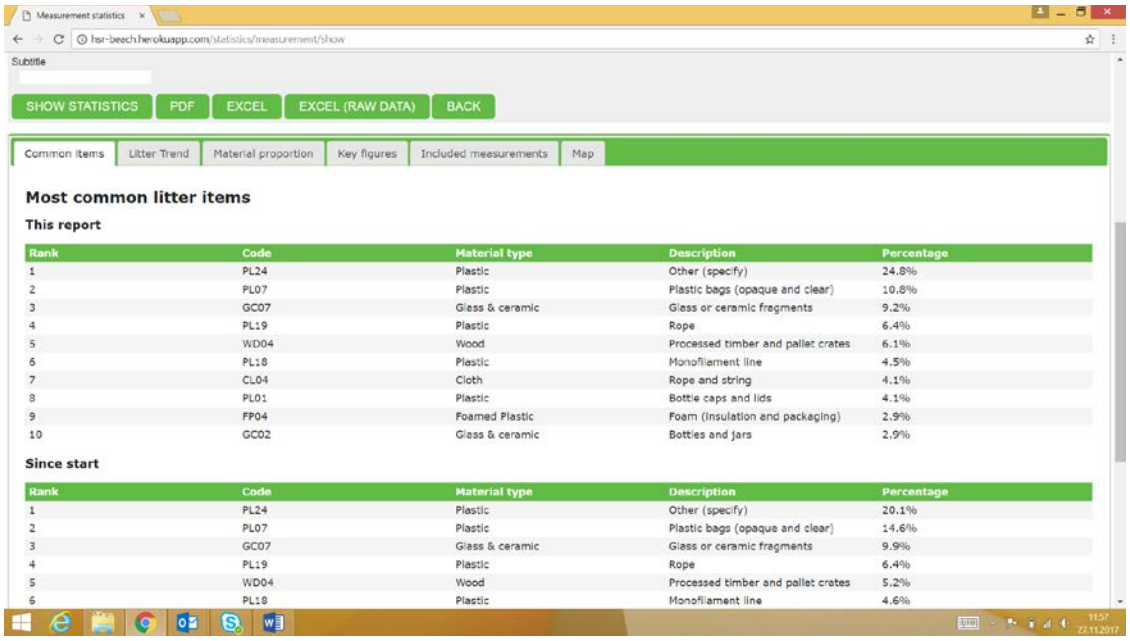


Figure 17. Statistics, litter data, web browser view of the report

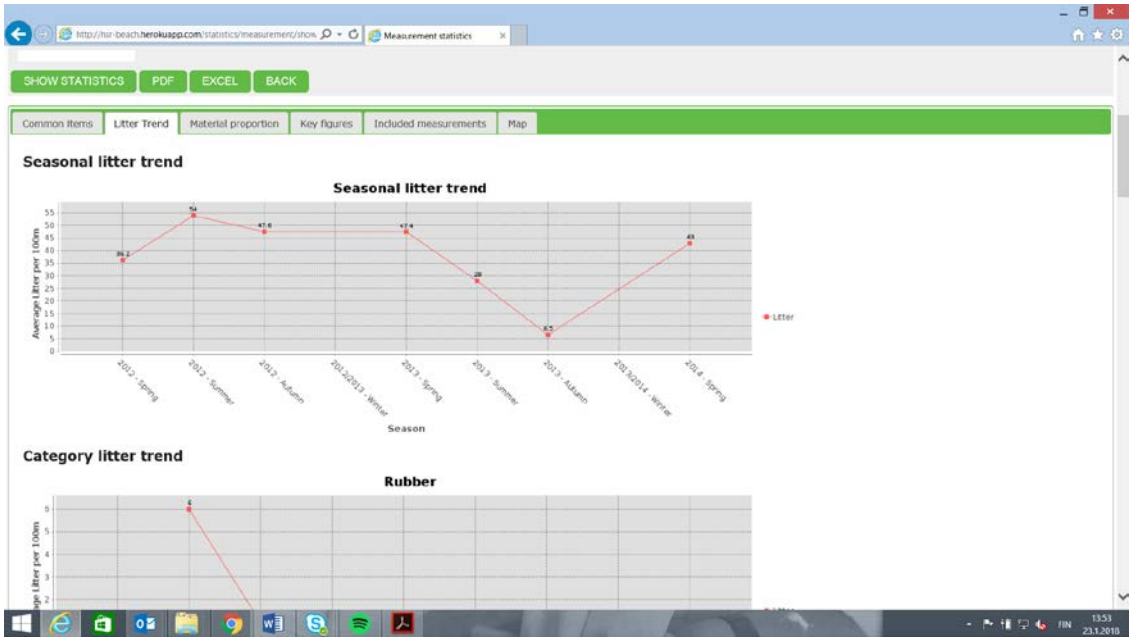


Figure 18. Statistics, litter data, web browser view of the report

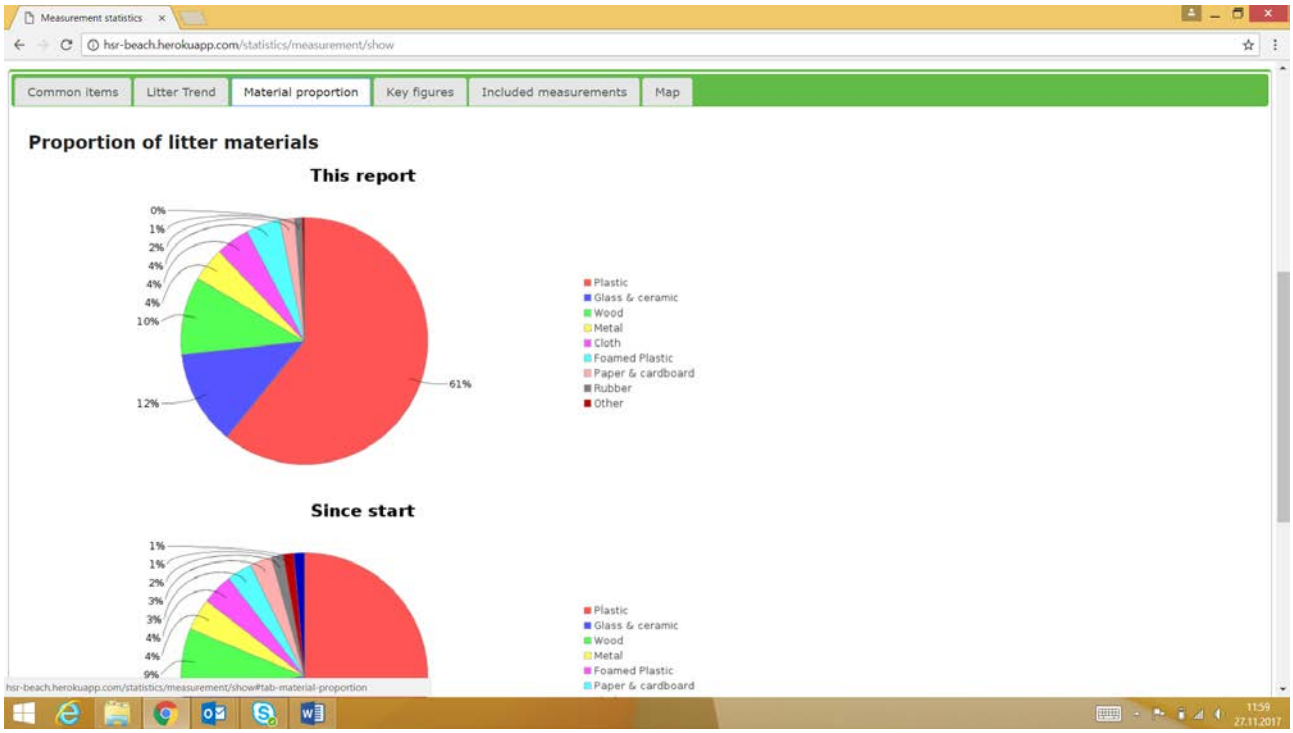


Figure 19. Statistics, litter data, web browser view of the report

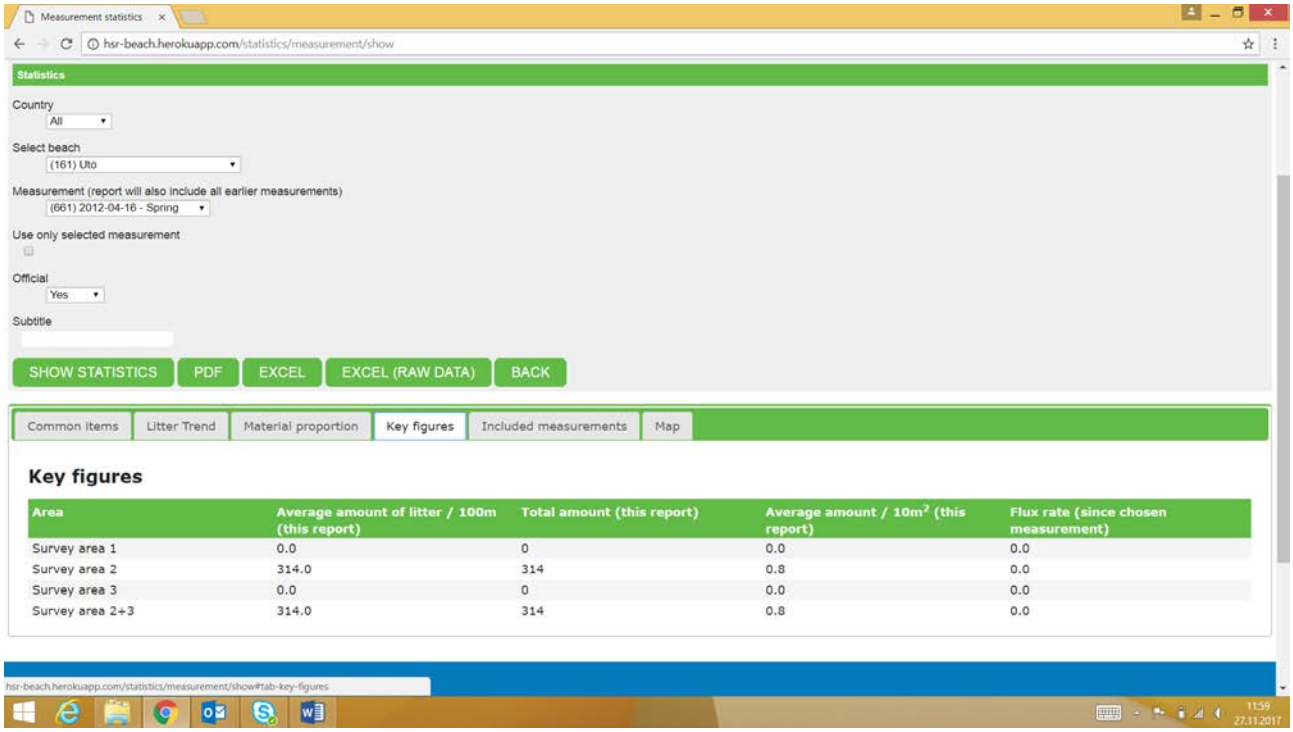


Figure 20. Statistics, litter data, web browser view of the report

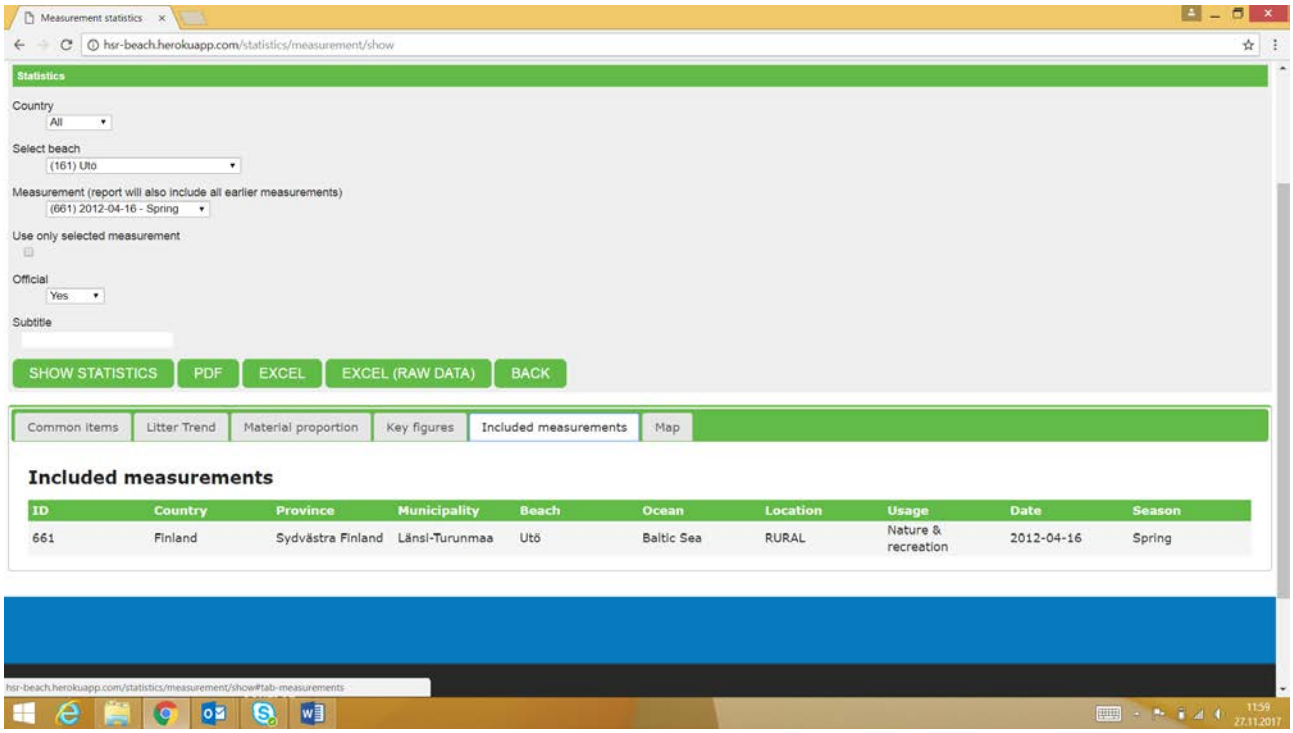


Figure 21. Statistics, litter data, web browser view of the report

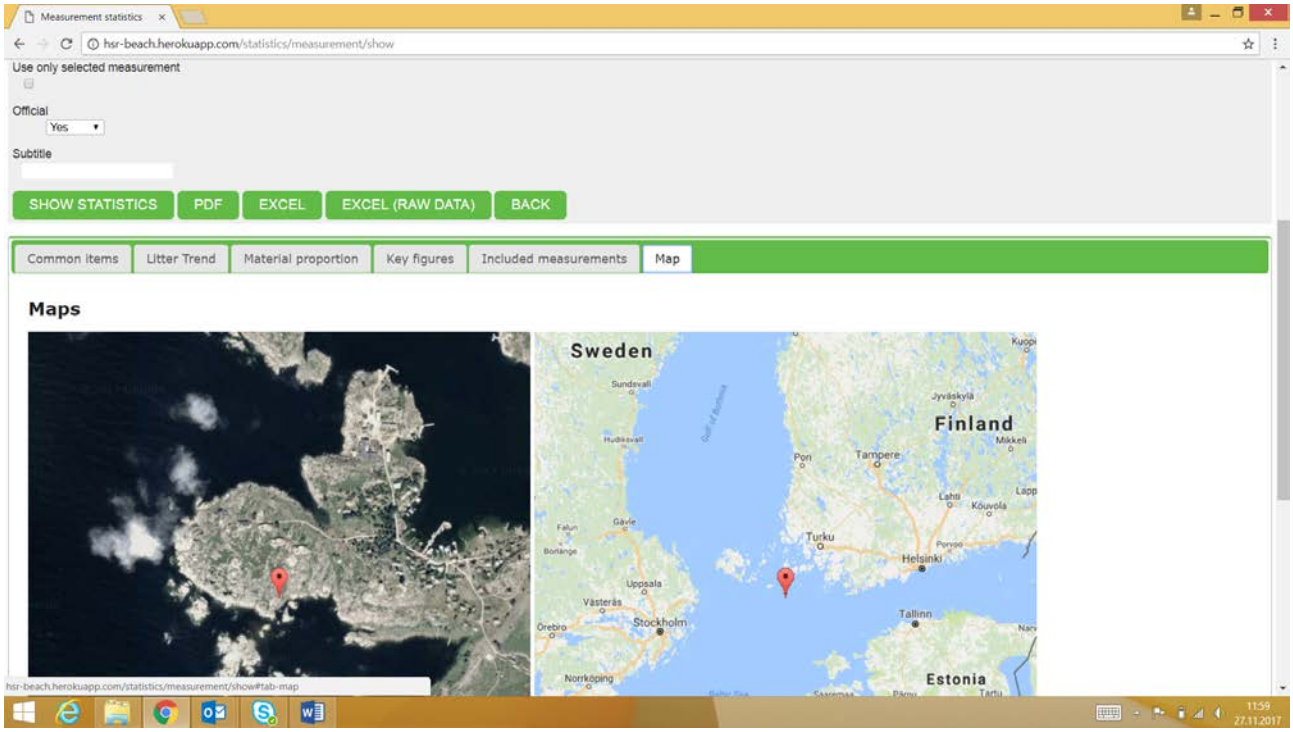


Figure 22. Statistics, litter data, web browser view of the report

By measurement

It is possible to study litter data more in detail by individual “measurements” (e.g. beach surveys). All the measurements in the database can be found in the dropdown menus (Figure 23).

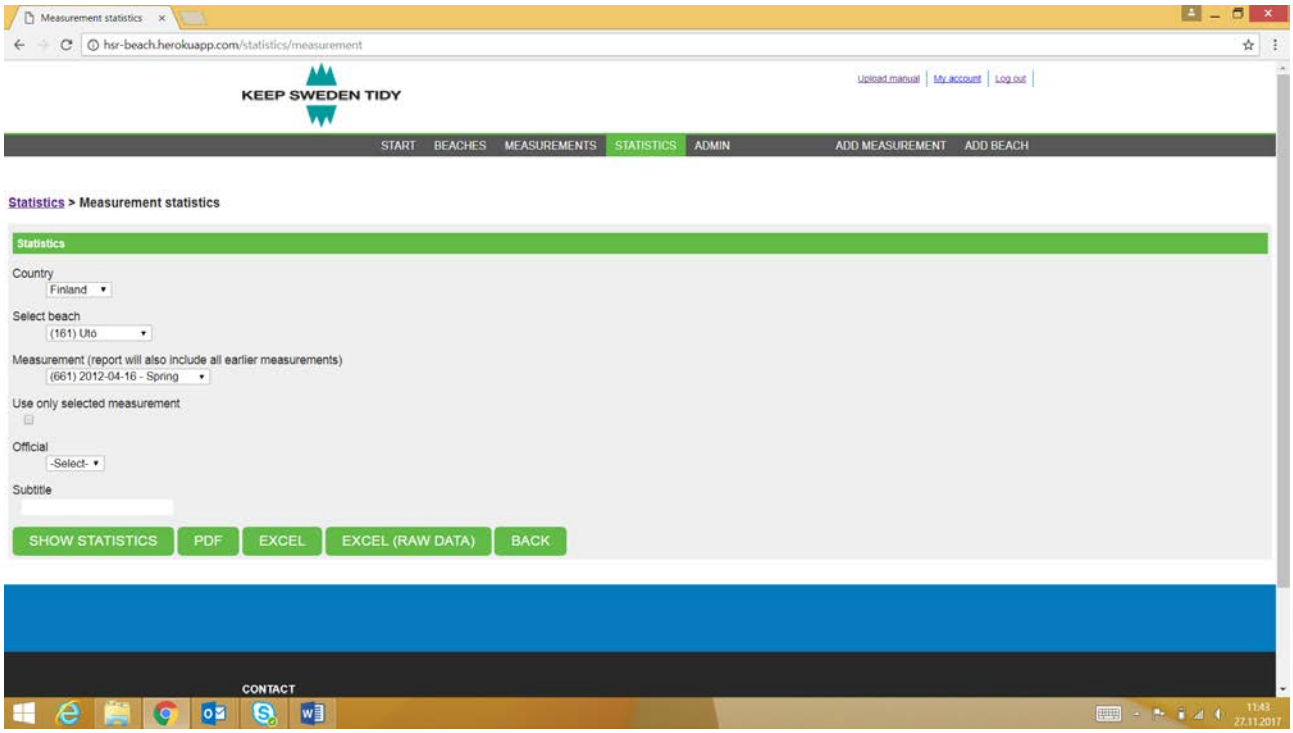


Figure 23. Statistics, litter data, measurement search filters

By beaches

Under statistics tool it is possible to study litter data by beaches. Data can be filtered by year and season. More than one beach can be included into the report and there is also the possibility to compare beaches or a group of beaches to other beaches (Figure 24 – Figure 27).

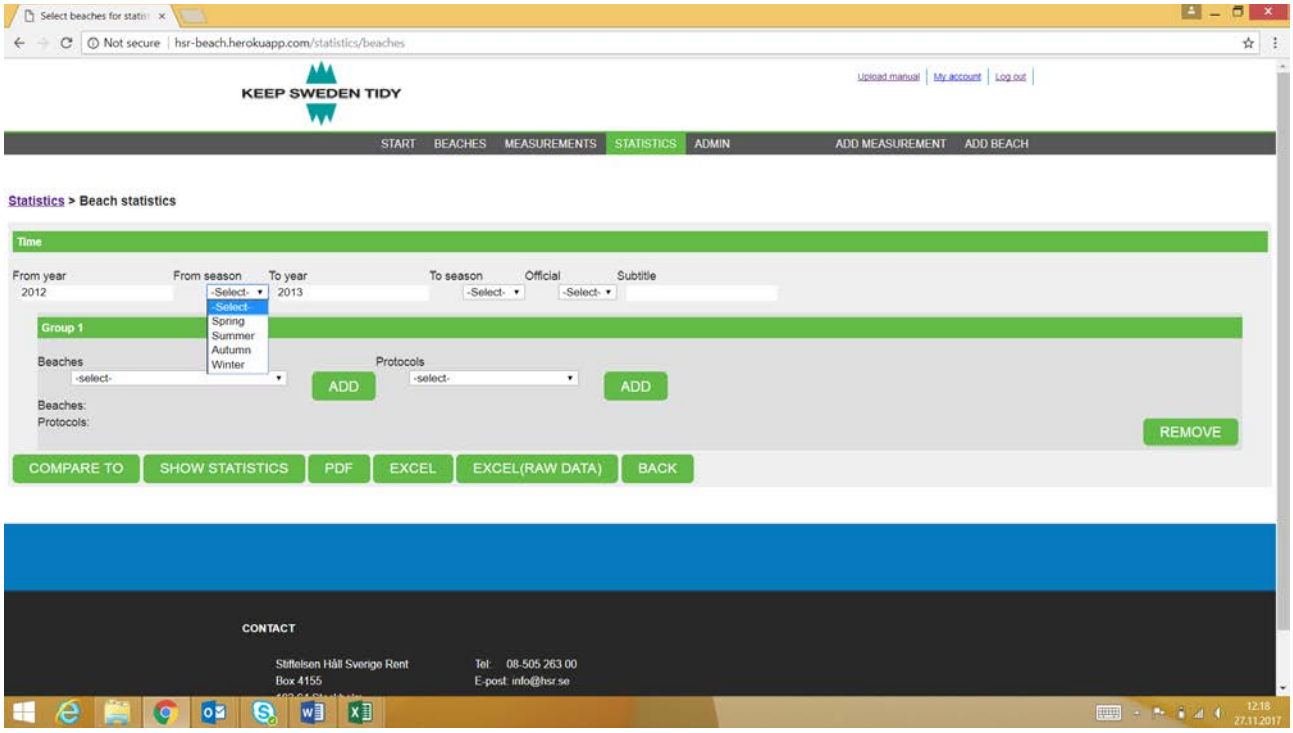


Figure 24. Statistics, litter data, beach search filters

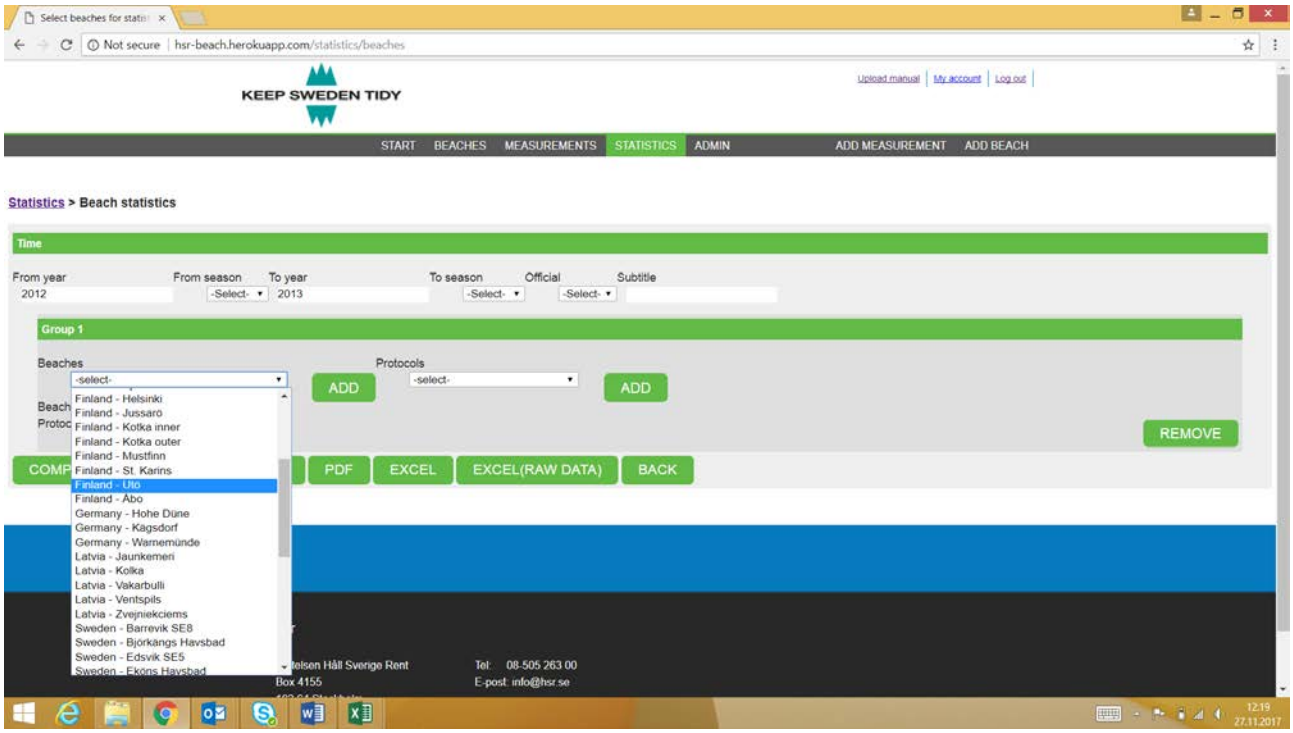


Figure 25. Statistics, litter data, beach search filters

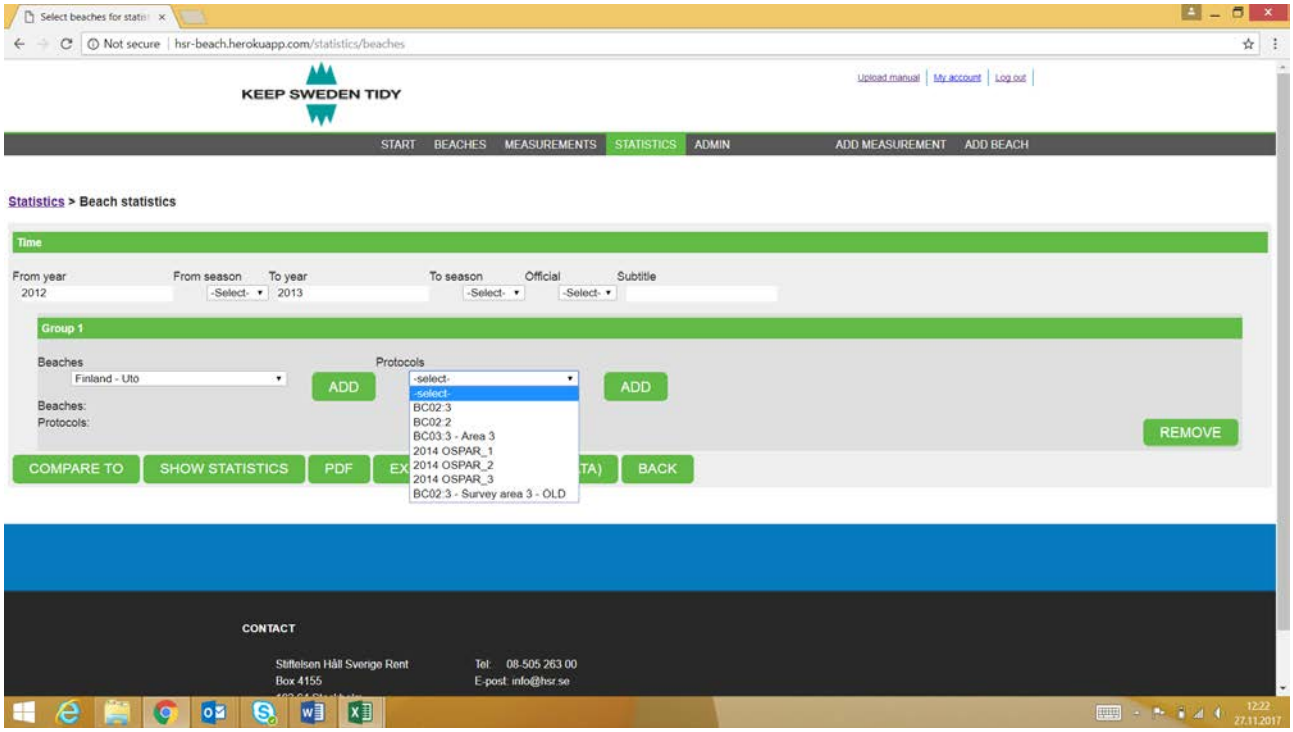


Figure 26. Statistics, litter data, beach search filters

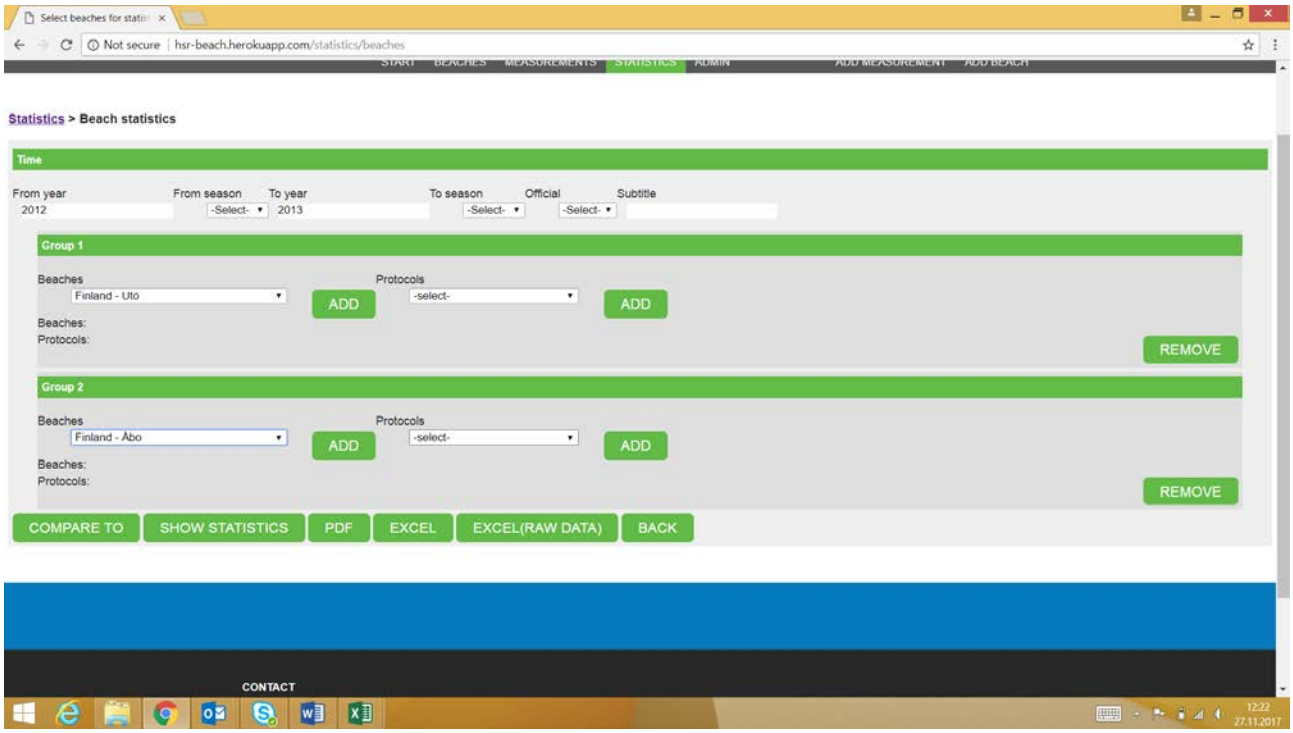


Figure 27. Statistics, litter data, beach search filters, comparison view

By filter

Under the statistics tool it is possible to study litter data through different filters. These filters include the following dropdown menus: country, water (in reference to sea area), location, characteristic and protocol. Also, as in other statistic tools, it is possible to filter data by year and season. More than one beach can be included in the report and it is possible to carry out comparisons between individual beaches or a group of them. All the possibile filters are presented in Figure 28 – Figure 31.

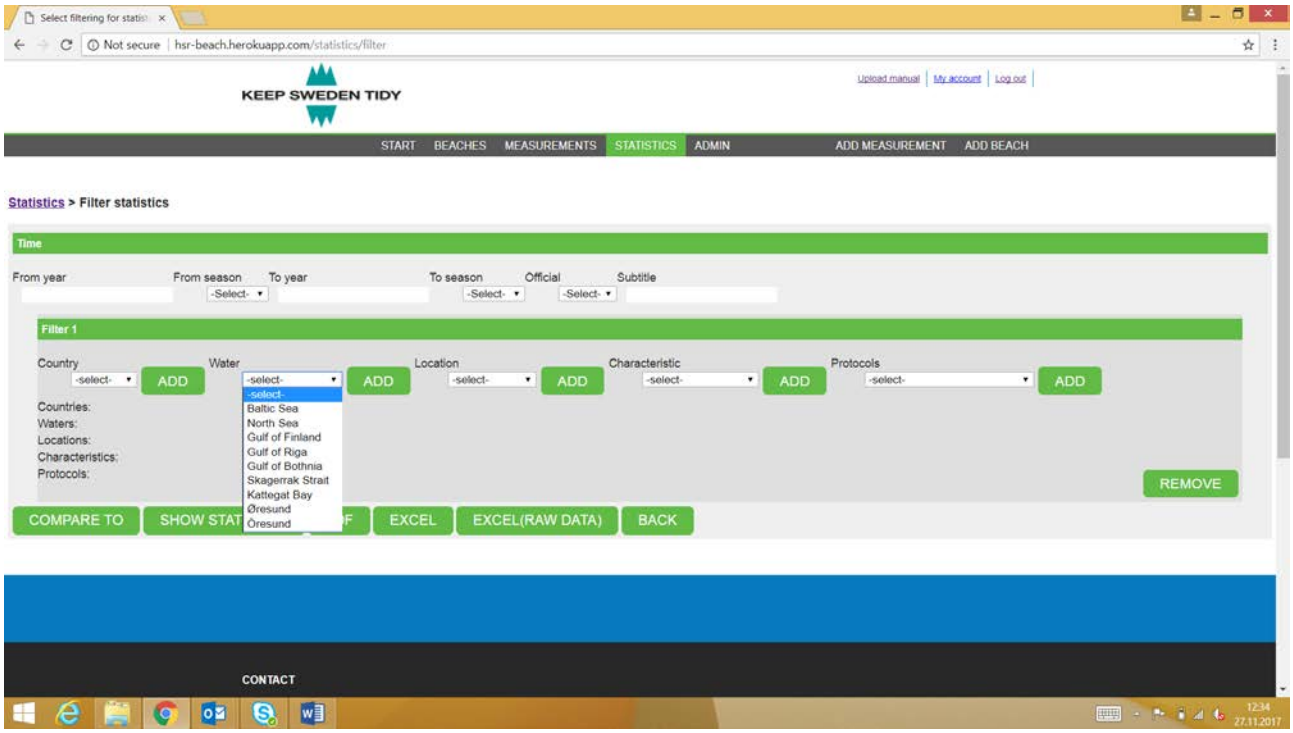


Figure 28. Statistics, litter data, different search filters

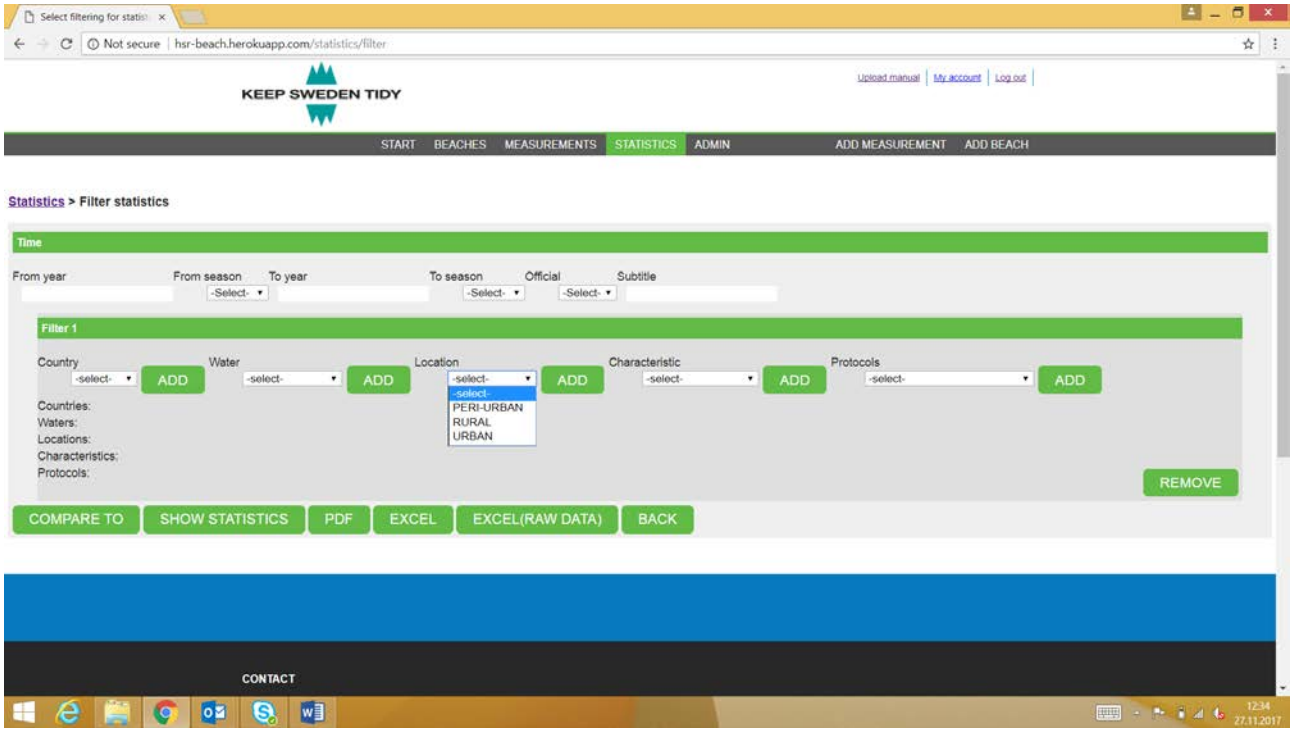


Figure 29. Statistics, litter data, different search filters

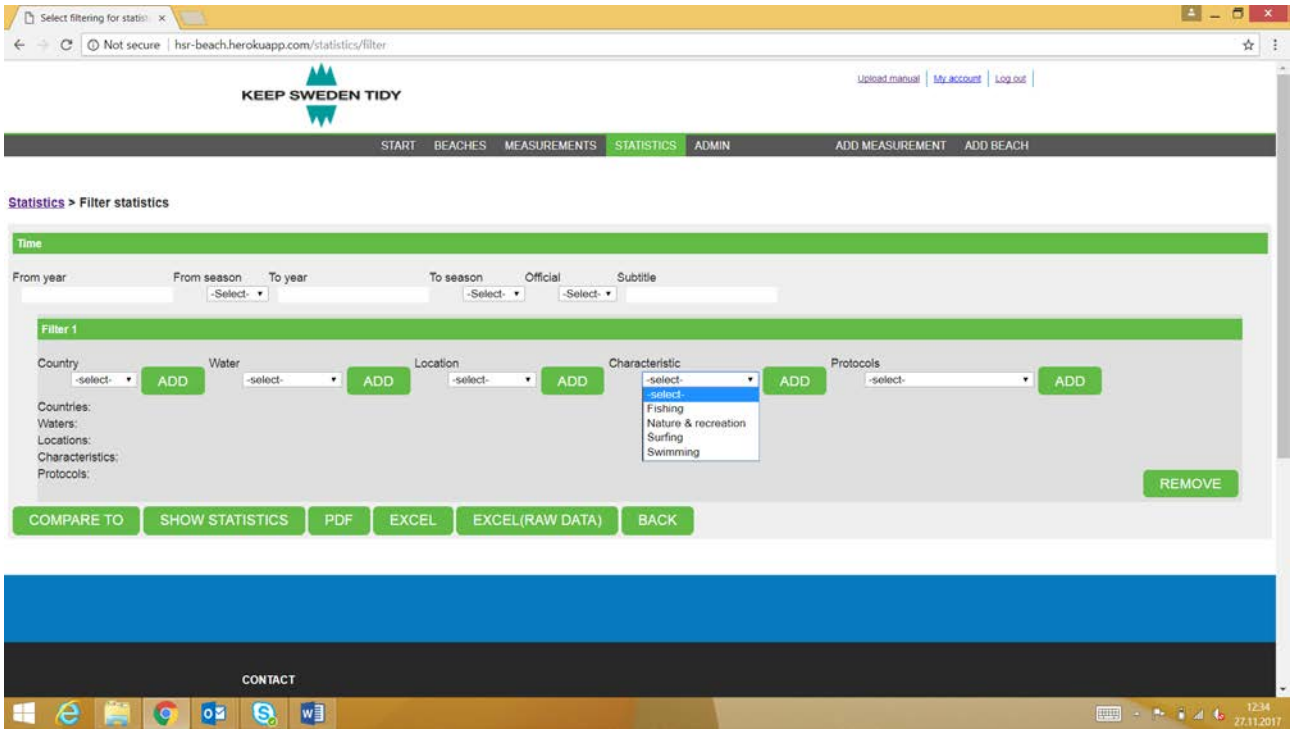


Figure 30. Statistics, litter data, different search filters

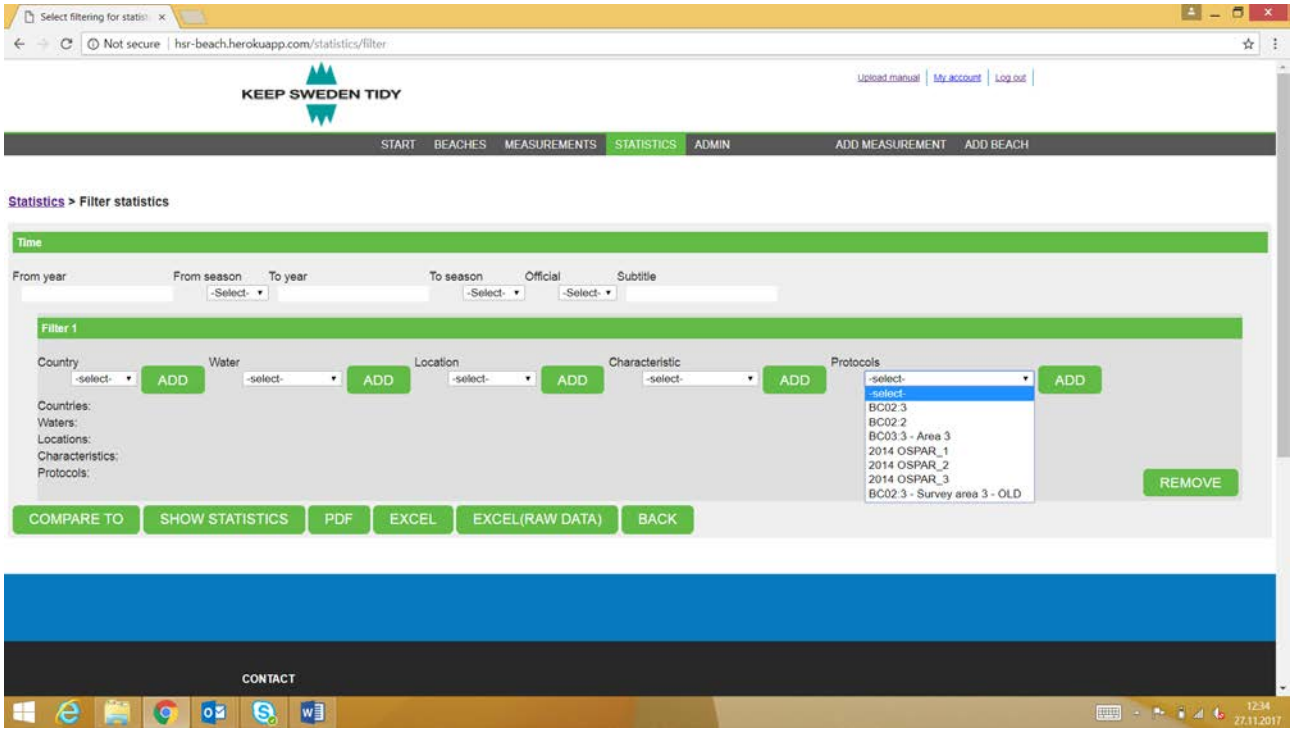


Figure 31. Statistics, litter data, different search filters

Data quality in the Marlin database

Data to the Marlin database is mostly collected by volunteers and NGO's. In most cases, it is an NGO who trains and educates people collecting litter and thus the data. Training and educating is essential in order to ensure the quality of data collected. It is crucial that guidelines on cleaning methods and protocol codes are followed accordingly. Data is in most cases used for national marine litter monitoring programs and other statistical means.

European Environment Agency database – Marine Litter Watch

Marine Litter Watch (MLW) is designed by the European Environment Agency (EEA) to support data collection events on beaches and on coast. MLW offers a mobile application, a web portal and a public database - to collect and share comparable data on marine litter on beaches.

MLW primarily consists of a mobile application. It allows users to conduct beach litter monitoring surveys and support national monitoring programs. The application also enables the collection of data from public clean-up campaigns. Data from popular clean-ups and national monitoring can be studied separately (Figure 32).

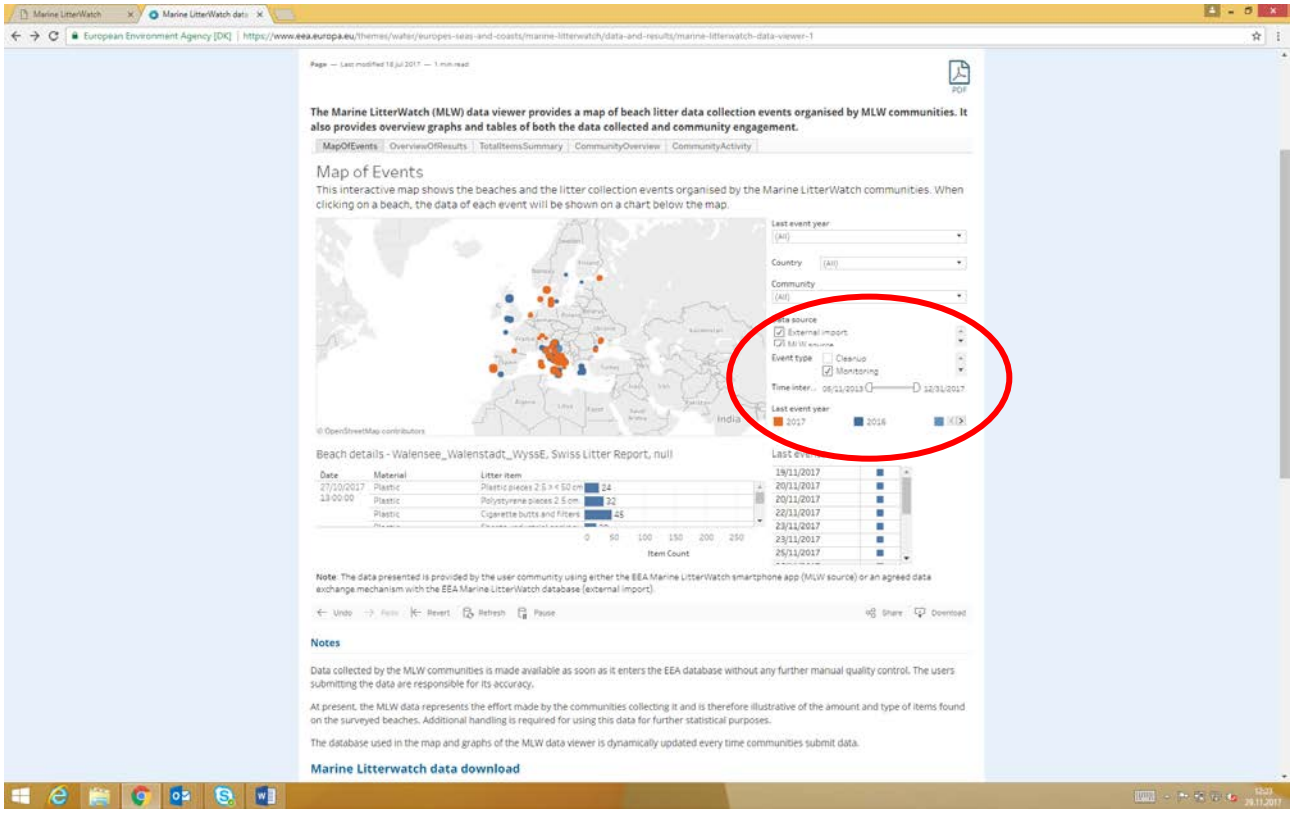


Figure 32. MLW, maps of events, statistics tool

MLW has three elements: organized groups (so called communities), a mobile application, and a database. Communities organize either clean-up or monitoring events on beaches and use the mobile application to report on litter items found. A web portal is also available for the communities for the management of their

cleaning events and data. The application uses a European harmonized list of items. Data is available through EEA´s website.

Technical

The MLW mobile application is available for Android & iPhone devices. Minimum standards recommended are 3G mobile network; iOS 7.0 or later (iPhone 4 or newer); Android v.3.0 (from 2012 onwards). The application can be downloaded free of charge from the Google Play Store and the App Store.

Web portal can be found at: https://marinelitterwatch.discomap.eea.europa.eu/

Marine Litter Watch in action

MLW is aimed for the larger public to use while monitoring beach litter. The MLW mobile application allows users to monitor, identify and report marine litter items found on beaches using the master list of categories of litter items by the JRC Guidance on Monitoring of Marine Litter in European Seas (2013). It needs to be noted that, only that particular master list is in use in the MLW, and it is not possible to report litter with UNEP or OSPAR litter categories.

Quality assurance is a key question in the use of MLW in order to have good data. Communities should make their volunteers aware of quality assurance and quality control issues to ensure that litter collection and classification follow the monitoring protocol and JRC Guidance, especially when conducting a monitoring assessment. This will also ensure consistency across the submitted surveys. Investment in communication and the training of the national, regional and local survey coordinators and managers is therefore critical. Communities are encouraged to contact their national bodies responsible for monitoring marine litter when designing their monitoring strategies (see Figure 33).

To set-up a monitoring event, communities should use the web interface available for this purpose and manage the community data.

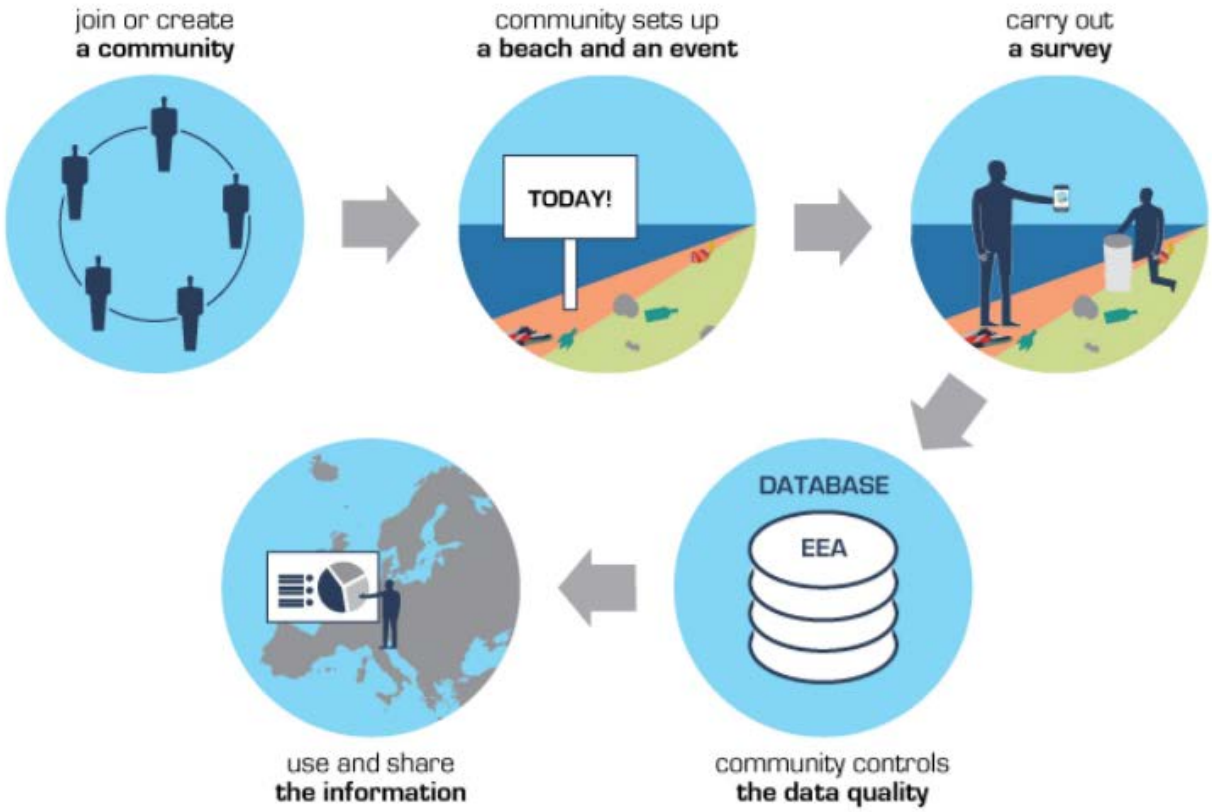


Figure 33. MLW process of collecting data into the database

New beach

New beach can be established with the mobile application or with the web interface. Location coordinates of the beach are determined with the map tool provided by the MLW. Map tool is provided by Earthstar Geographics (ESRI). It is noticeable that within beach details beach types available for choosing are urban, rural and near river mouth – peri-urban beaches, whereas reference beaches are not available (see Figure 34 – Figure 38).

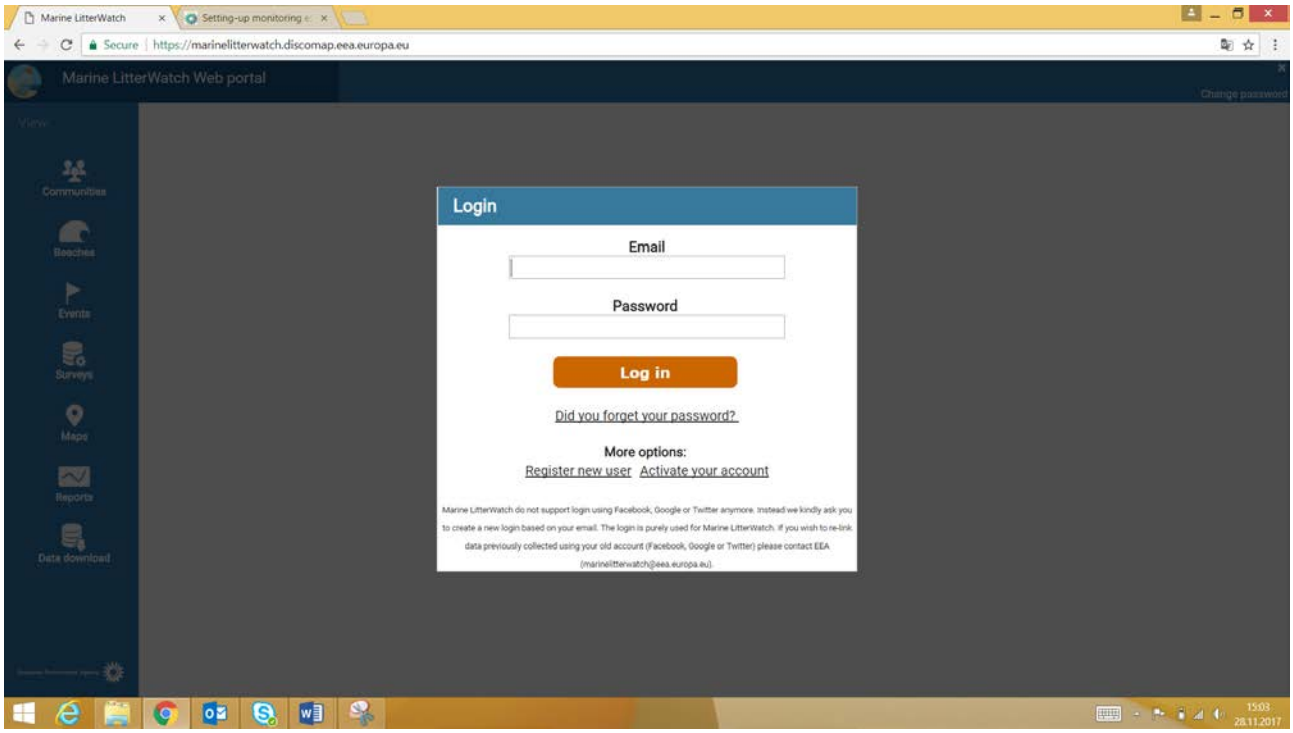


Figure 34. MLW startpage in the web interface

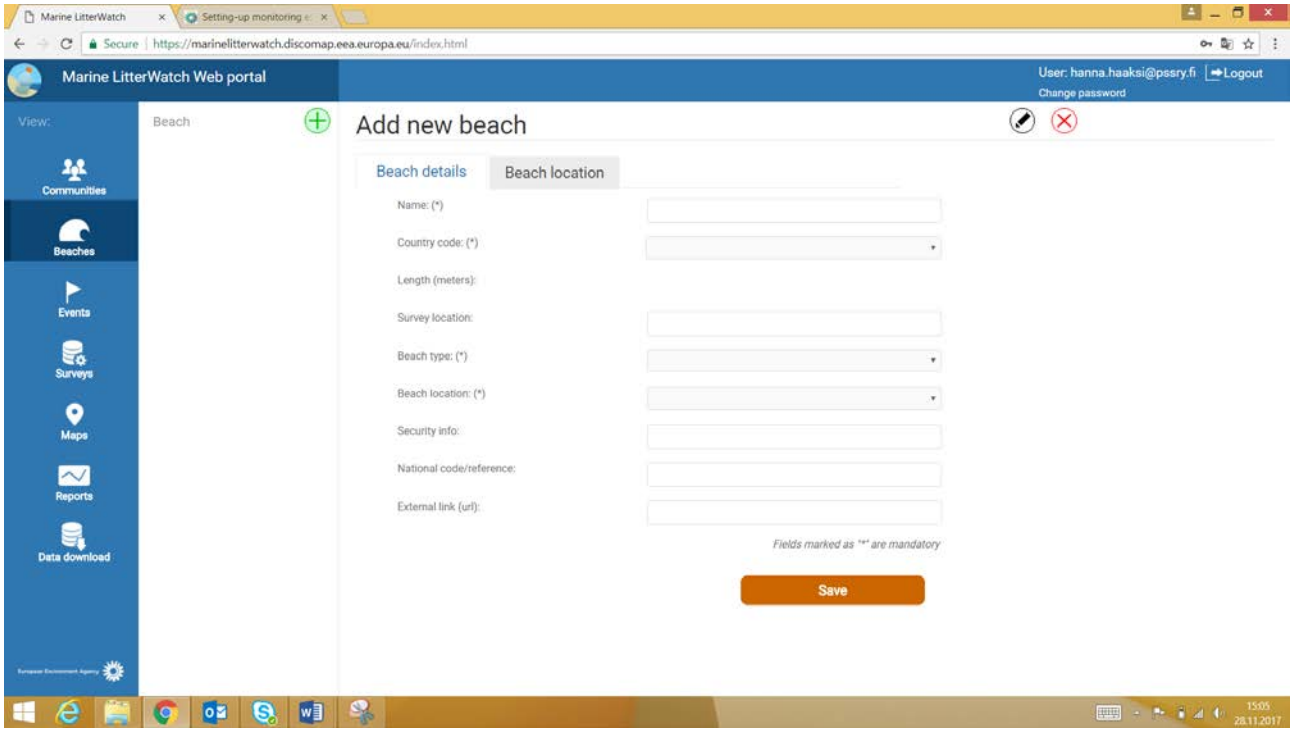


Figure 35. Adding a new beach into MLW in web interface

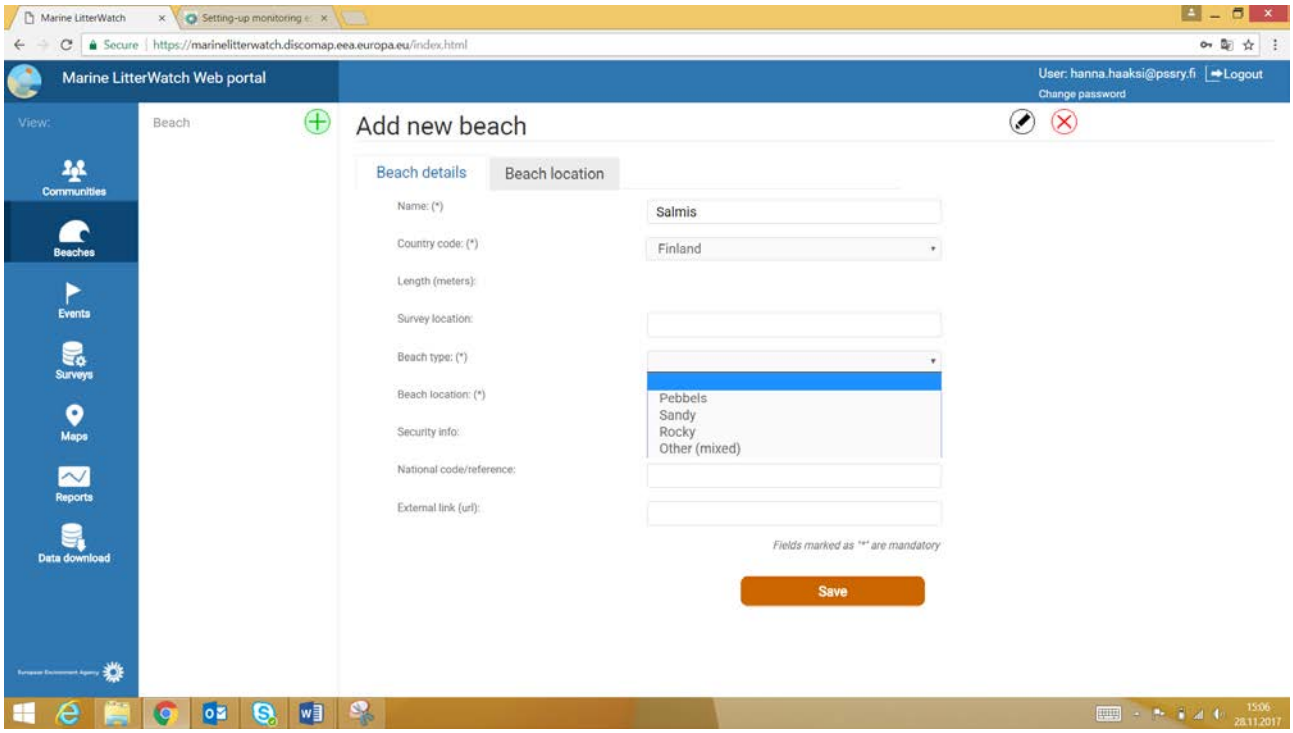


Figure 36. Adding a new beach into MLW in web interface

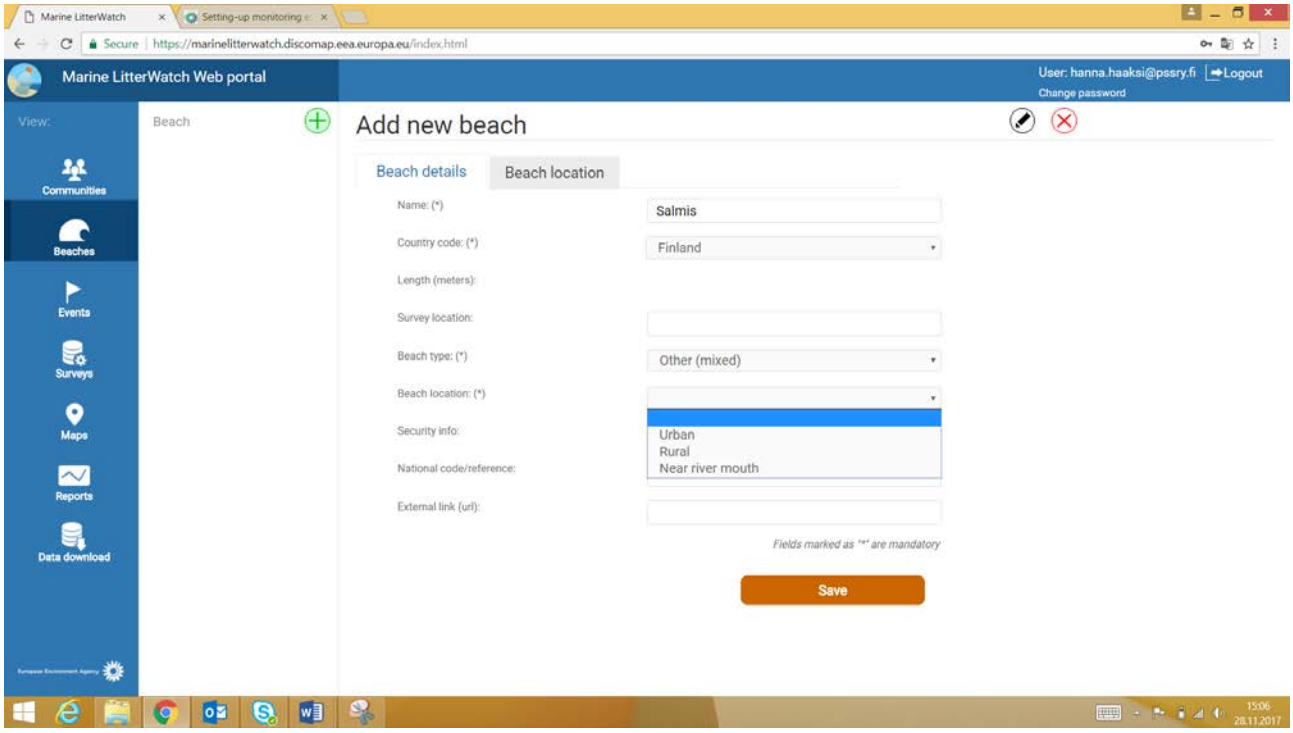


Figure 37. Adding a new beach into MLW in web interface

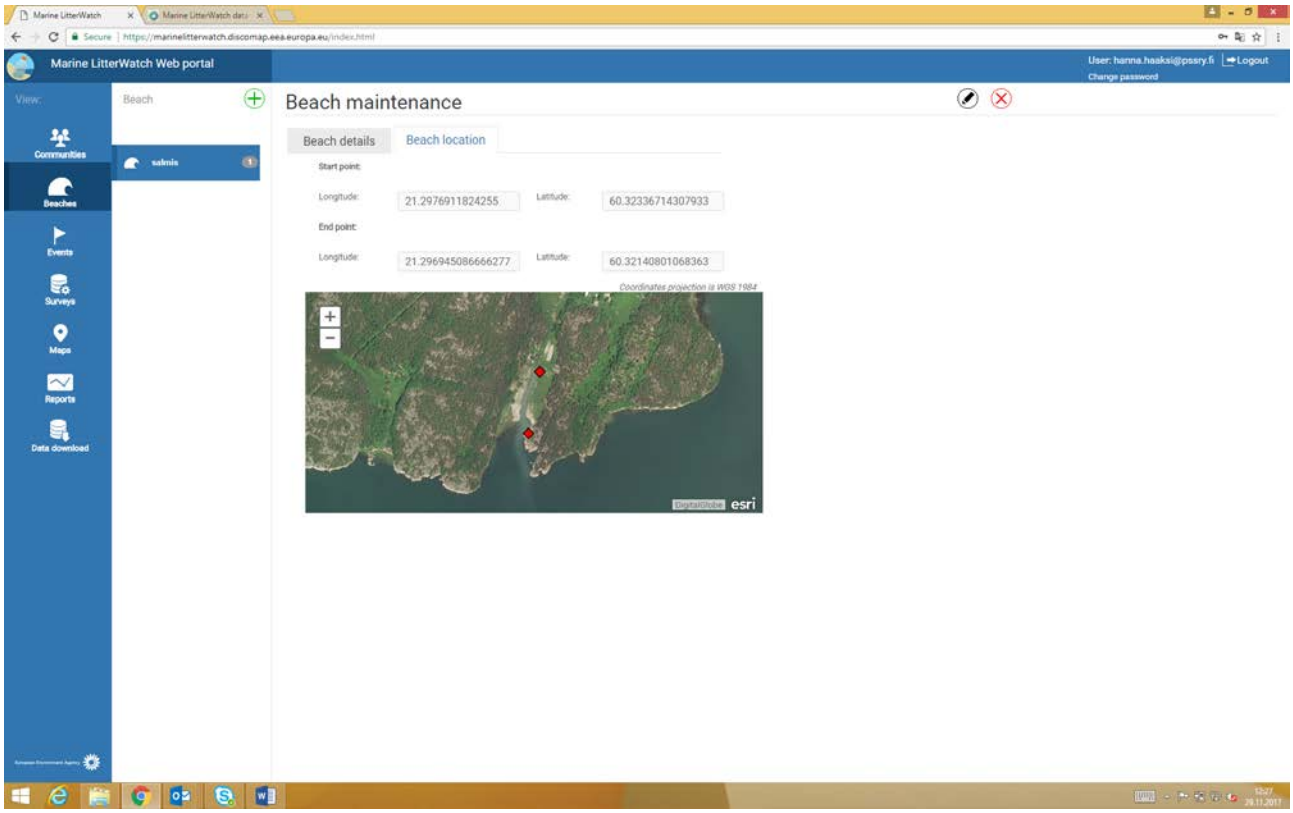


Figure 38. Adding a new beach into MLW in web interface

New event – new assessment and reporting

New events or assessments can be created with the mobile application or with the web interface. Each event has a separate event code which is created by the MLW. That code will then be distributed to those attending the event, in order for them to report litter through the application. When creating an event, it can be labelled either as a clean-up or as a monitoring assessment. The number of litter items found are simply reported with the MLW application by clicking as many times + -button on the screen as many litter items are found (see Figure 39 – Figure 41).

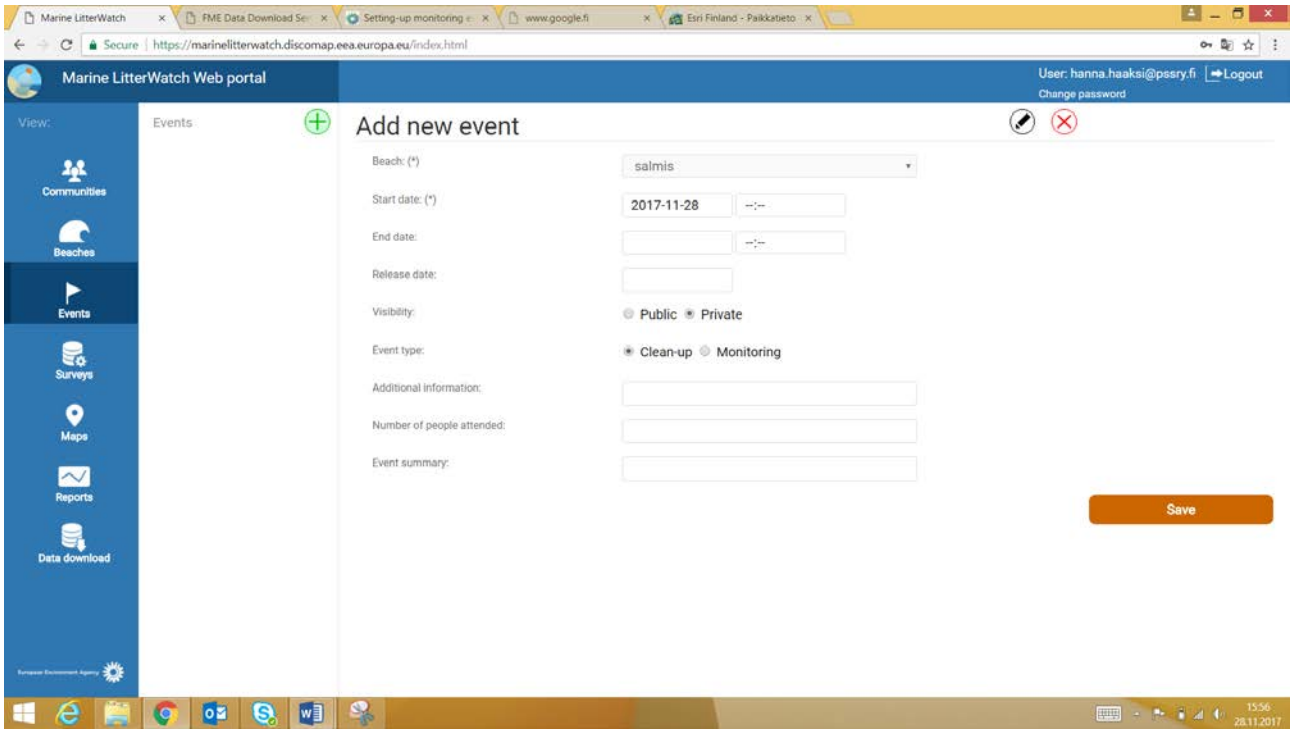


Figure 39. Adding a new event into MLW in web interface

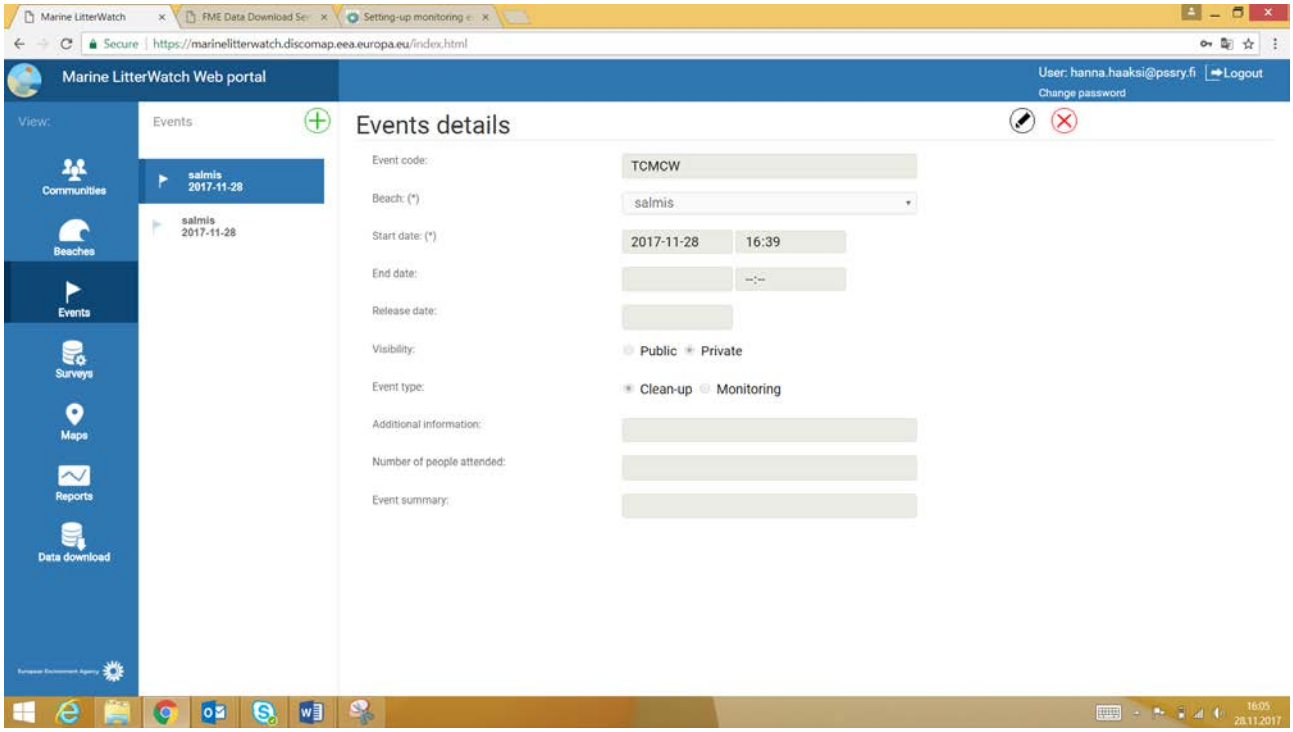


Figure 40. Adding a new event into MLW in web interface

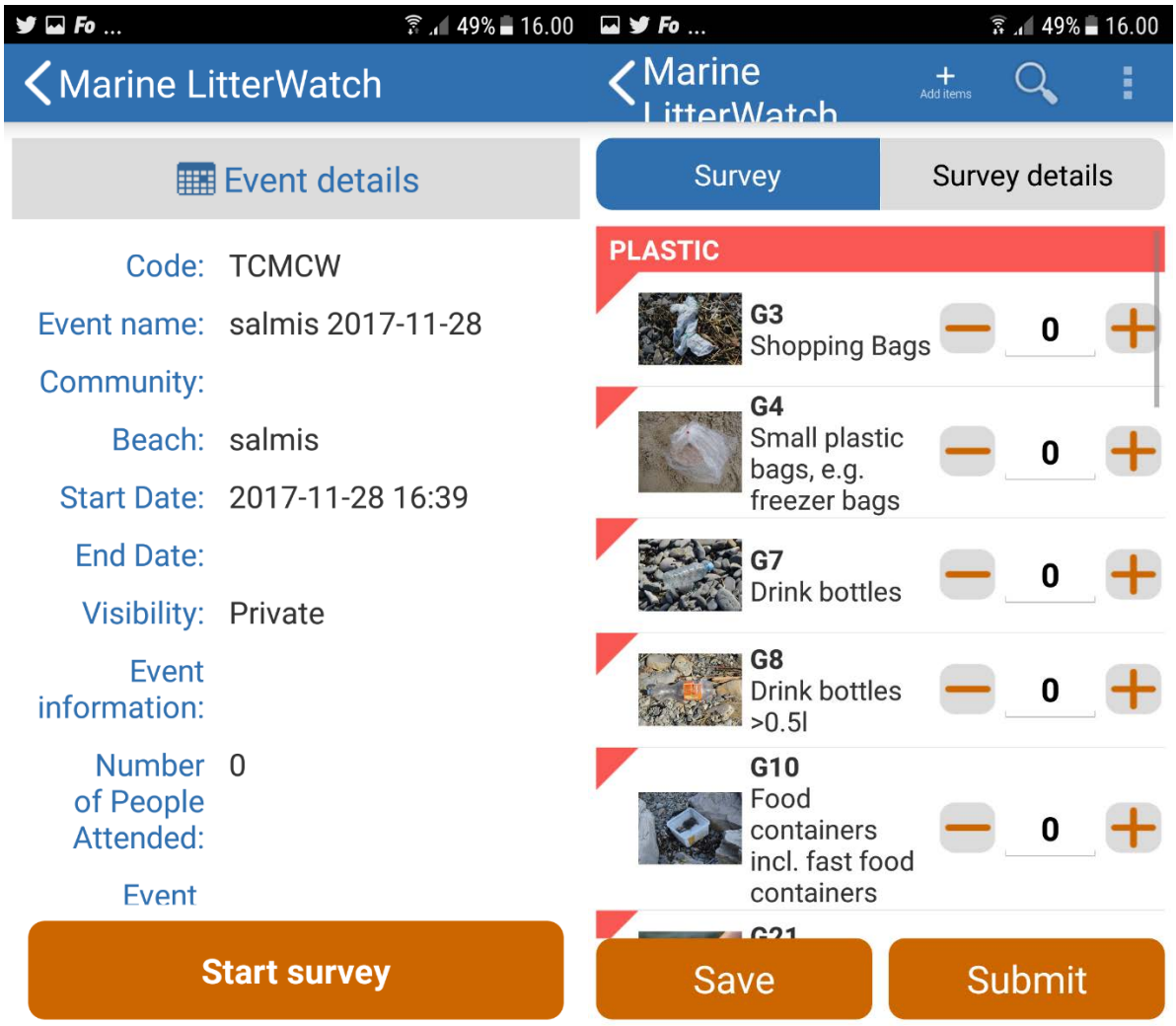


Figure 41. Reporting litter with MLW mobile application

Litter report

After the survey is completed on-site and submitted, the litter report is shown in the beach manager's web portal (Figure 42 – Figure 44) where it can be further analyzed.

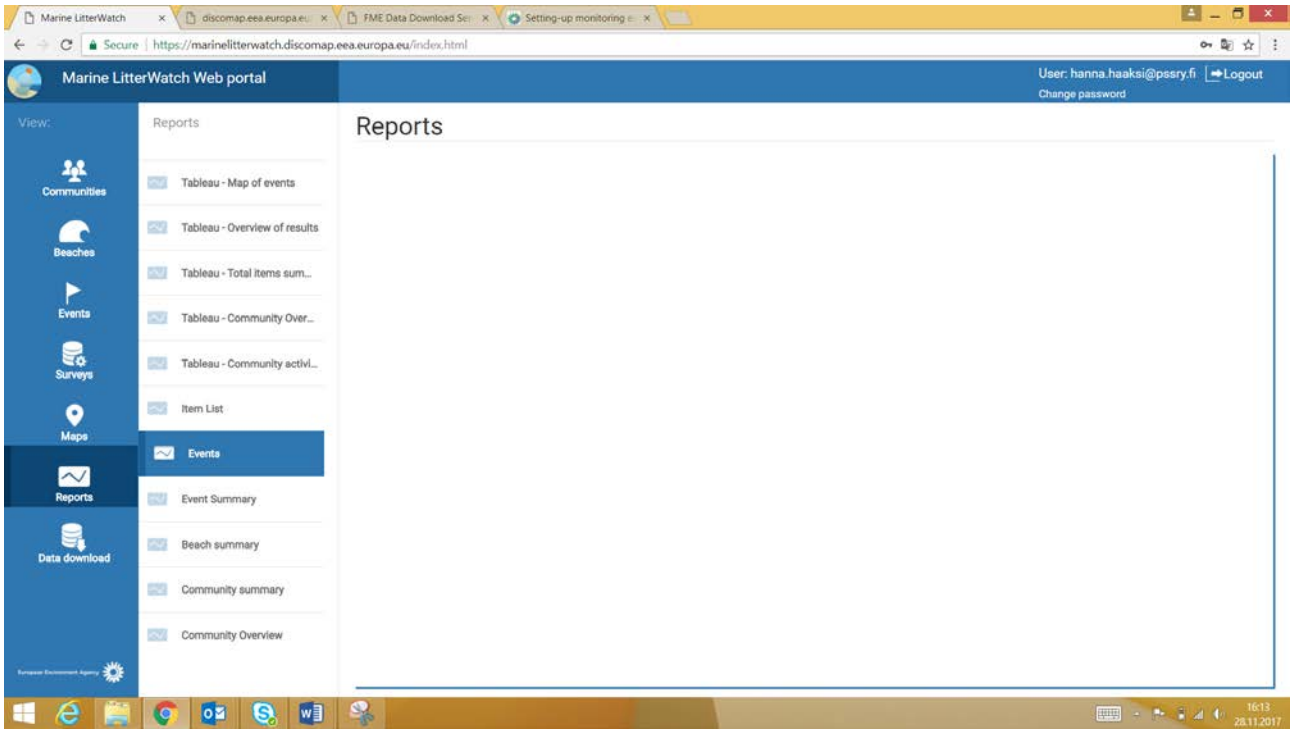


Figure 42. Studying a single survey litter report, web interface

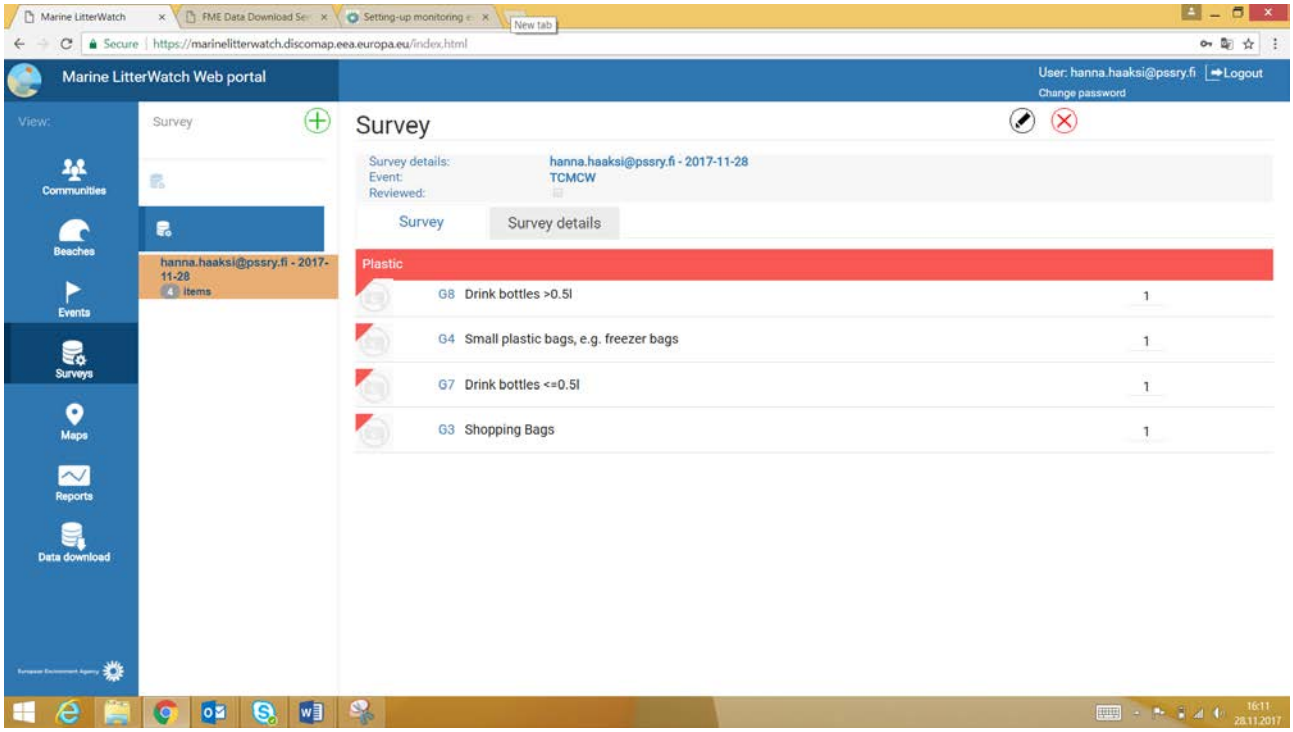


Figure 43. Studying a single survey litter report, web interface

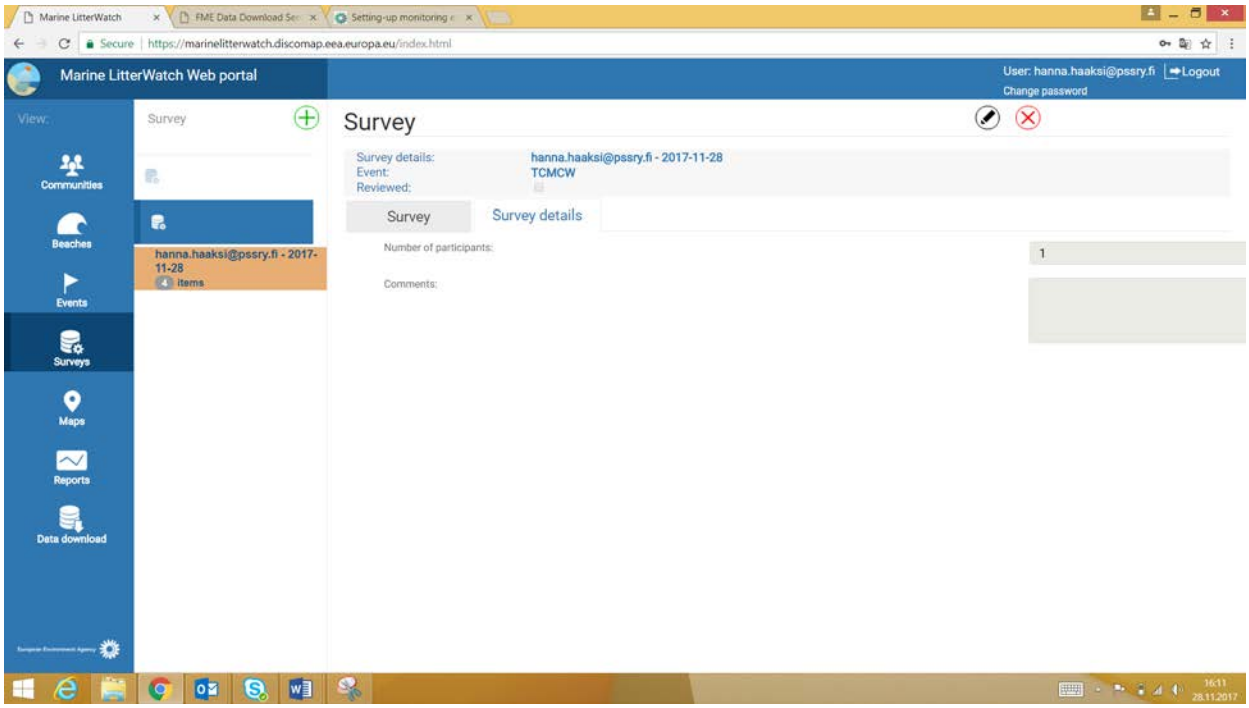


Figure 44. Studying a single survey litter report, web interface

Litter events to study

Each litter event can be studied in the web portal under the reports tool. The portal also produces a summary of the event, in which top ten litter items are presented. The report does not automatically provide proportions of the different litter materials. Further analyses can be done from the raw data which can be downloaded as an Excel/CSV file. The report tool also offers the possibility to study other matters, such as a map of events (see Figure 45 – Figure 47).

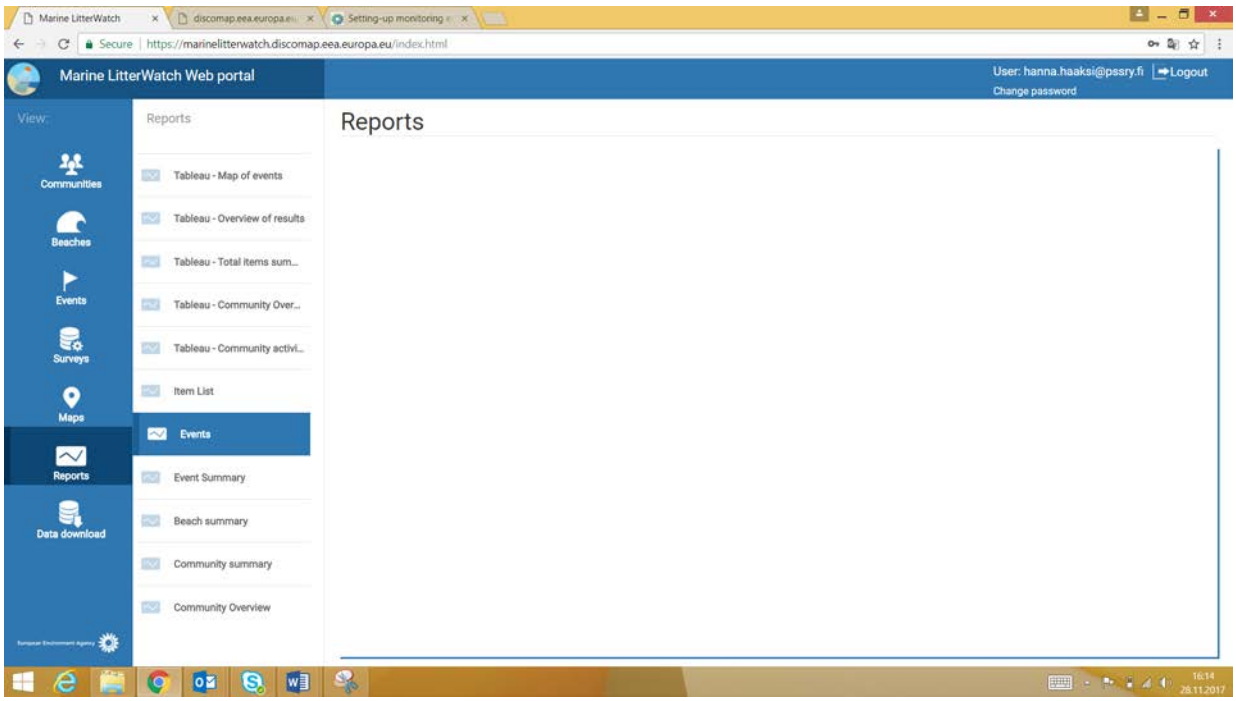
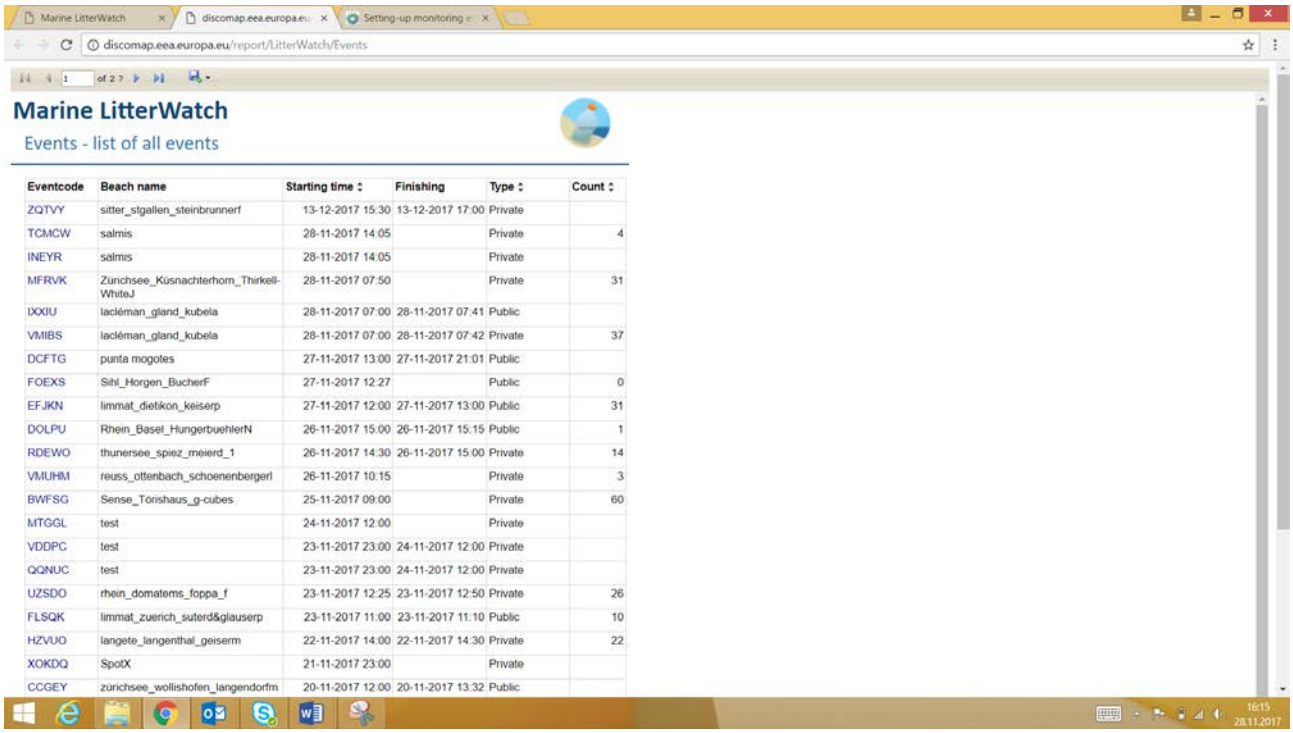
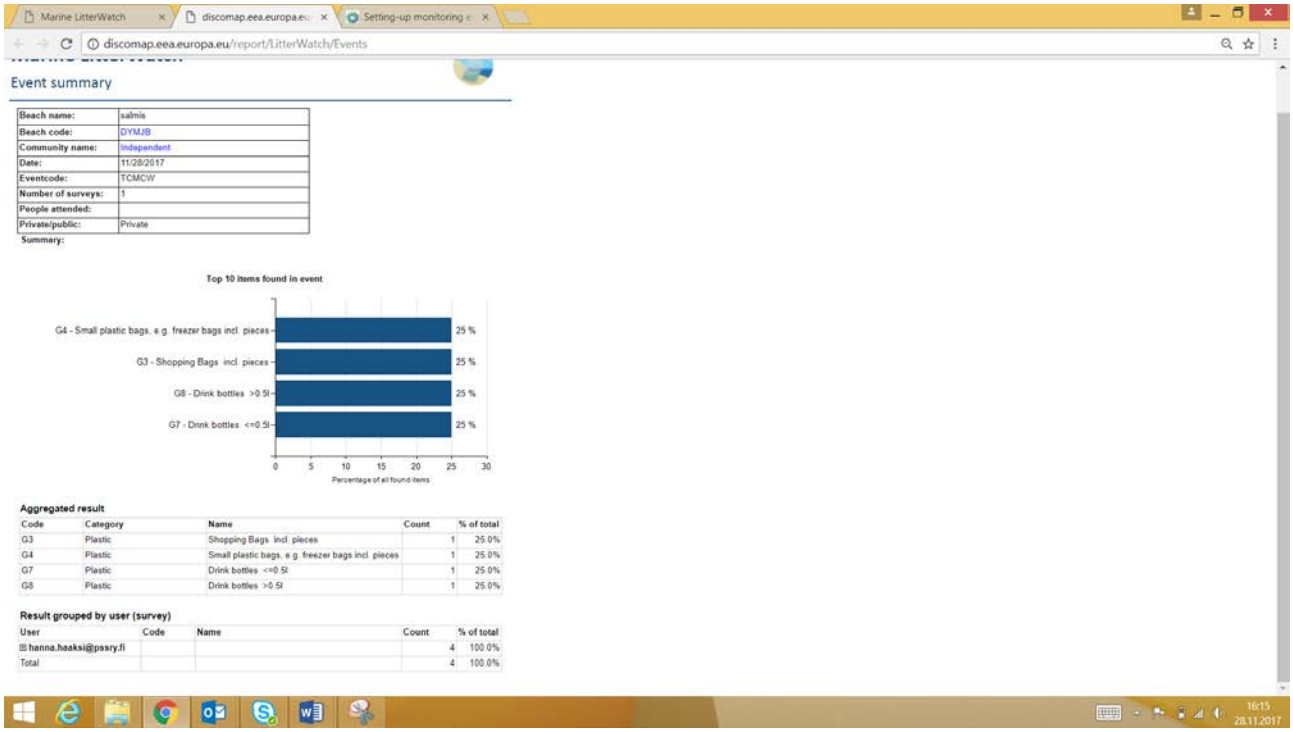


Figure 45. Litter report tools



Eventcode	Beach name	Starting time	Finishing	Type	Count
ZQTVY	sitter_stgallen_steinbrunnerf	13-12-2017 15:30	13-12-2017 17:00	Private	
TCMCW	salmis	28-11-2017 14:05		Private	4
INEYR	salmis	28-11-2017 14:05		Private	
MFRVK	Zürichsee_Küsnachterhorn_Thirkell-WhiteJ	28-11-2017 07:50		Private	31
IXXIU	lacléman_gland_kubela	28-11-2017 07:00	28-11-2017 07:41	Public	
VMIBS	lacléman_gland_kubela	28-11-2017 07:00	28-11-2017 07:42	Private	37
DCFTG	punta mogotes	27-11-2017 13:00	27-11-2017 21:01	Public	
FOEXS	Sihl_Horgen_BucherF	27-11-2017 12:27		Public	0
EFJKN	limmat_dietikon_keiserp	27-11-2017 12:00	27-11-2017 13:00	Public	31
DOLPU	Rhein_Basel_HungerbuehlerN	26-11-2017 15:00	26-11-2017 15:15	Public	1
RDEWO	thunersee_spiez_meierd_1	26-11-2017 14:30	26-11-2017 15:00	Private	14
VMUHM	reuss_ottenbach_schoenenbergerl	26-11-2017 10:15		Private	3
BWFSG	Sense_Torishaus_g-cubes	25-11-2017 09:00		Private	60
MTGGL	test	24-11-2017 12:00		Private	
VDDPC	test	23-11-2017 23:00	24-11-2017 12:00	Private	
QQNUC	test	23-11-2017 23:00	24-11-2017 12:00	Private	
UZSDO	rhein_domatems_foppa_f	23-11-2017 12:25	23-11-2017 12:50	Private	26
FLSQK	limmat_zuerich_suterd&glauserp	23-11-2017 11:00	23-11-2017 11:10	Public	10
HZVUO	langete_langenthal_geiserm	22-11-2017 14:00	22-11-2017 14:30	Private	22
XOKDQ	SpotX	21-11-2017 23:00		Private	
CCGEY	zürichsee_wollishofen_langendorfm	20-11-2017 12:00	20-11-2017 13:32	Public	

Figure 46. Litter report, list of events



Beach name:	salmis
Beach code:	DYMJB
Community name:	Independent
Date:	11/28/2017
Eventcode:	TCMCW
Number of surveys:	1
People attended:	
Private/public:	Private
Summary:	

Code	Category	Name	Count	% of total
G3	Plastic	Shopping Bags incl. pieces	1	25.0%
G4	Plastic	Small plastic bags, e.g. freezer bags incl. pieces	1	25.0%
G7	Plastic	Drink bottles <=0.5l	1	25.0%
G8	Plastic	Drink bottles >0.5l	1	25.0%

User	Code	Name	Count	% of total
⊞ hanna.haaksi@pssry.fi			4	100.0%
Total			4	100.0%

Figure 47. Litter report, web browser view

Data quality and availability of the Marine Litter Watch

Data collected by the MLW communities or independent users is made available in the application as soon as it enters the EEA database, without any further manual quality control. Users submitting the data are responsible for its accuracy. At present, the MLW data represents the effort made by the communities collecting it and is therefore illustrative of the amount and type of items found on the surveyed beaches. Additional handling is required for using this data for further statistical purposes.

OSPAR Database

The OSPAR beach litter database stores marine litter data collected on reference beaches using the standardized OSPAR beach litter monitoring guidelines. The database has been developed to manage the data and allow it to be interrogated at the regional, sub-regional and beach level.

Technical

The database is available online at: https://www.mcsuk.org/ospar/. The database is hosted and managed by the Marine Conservation Society. It is possible to study data in the database without having access to it (see Figure 48).

Database in action

The database provides an assessment tool for national assessment performers from the OSPAR region.

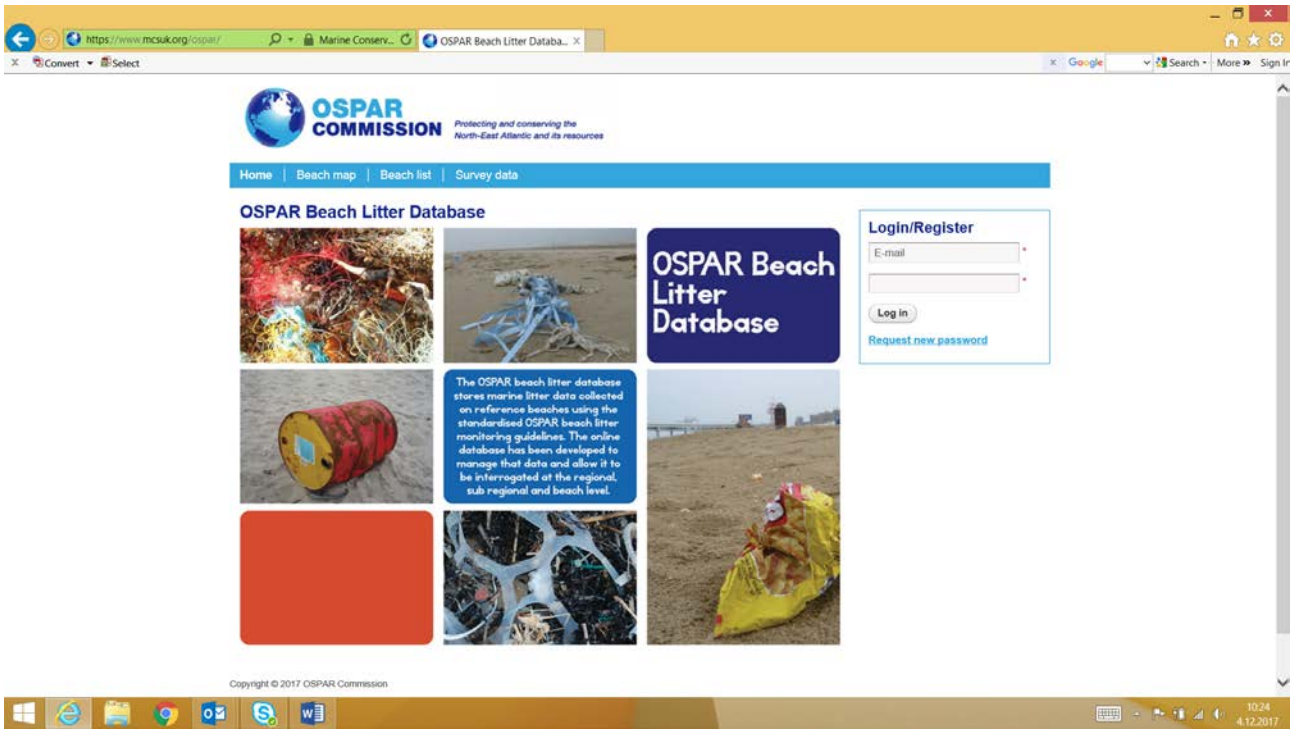


Figure 48. Start page of OSPAR database web application

Once the user has been granted access inside the database it is possible to add beaches, measurements and perform other modifications (Figure 49).

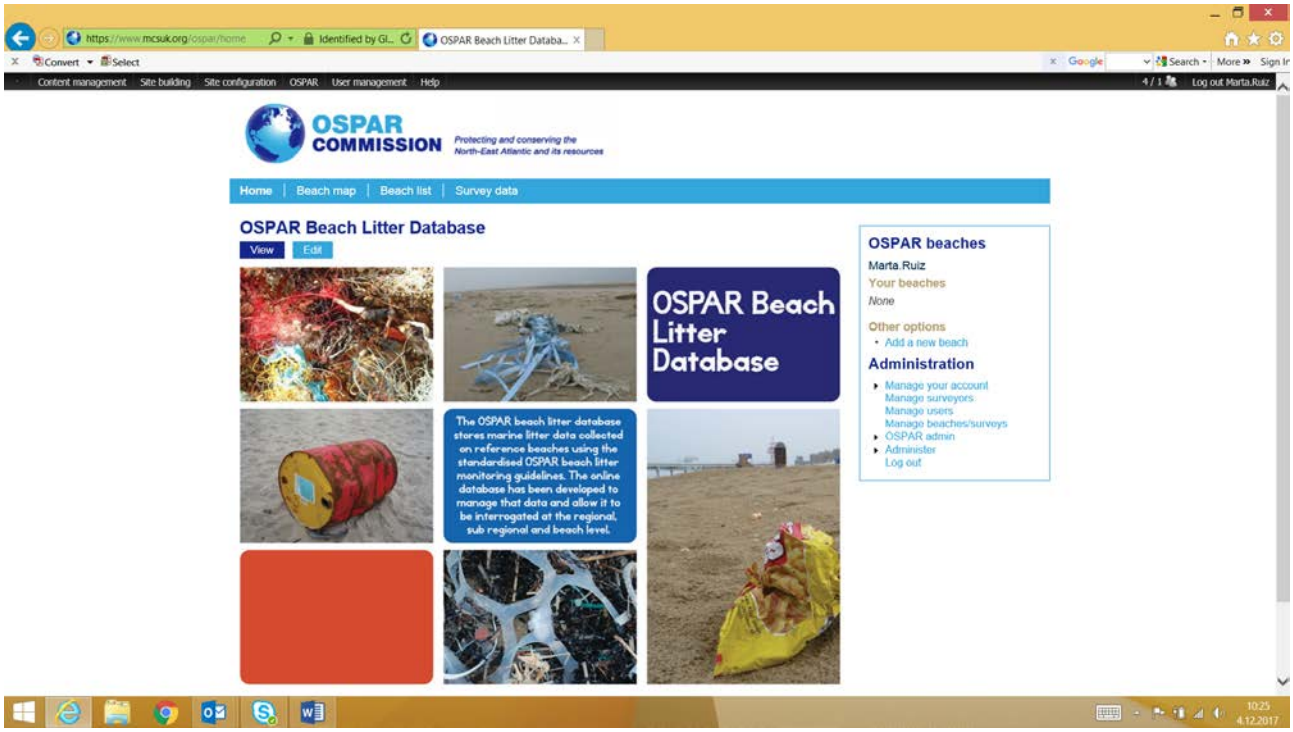


Figure 49. Start page of the OSPAR database web application when logged in as a user

Measurements

Search for litter data can be categorized by beach/country/region. The map tool enables the search for a location, and it also gives a thorough overview of the beaches in the database (Figure 50 – Figure 52).

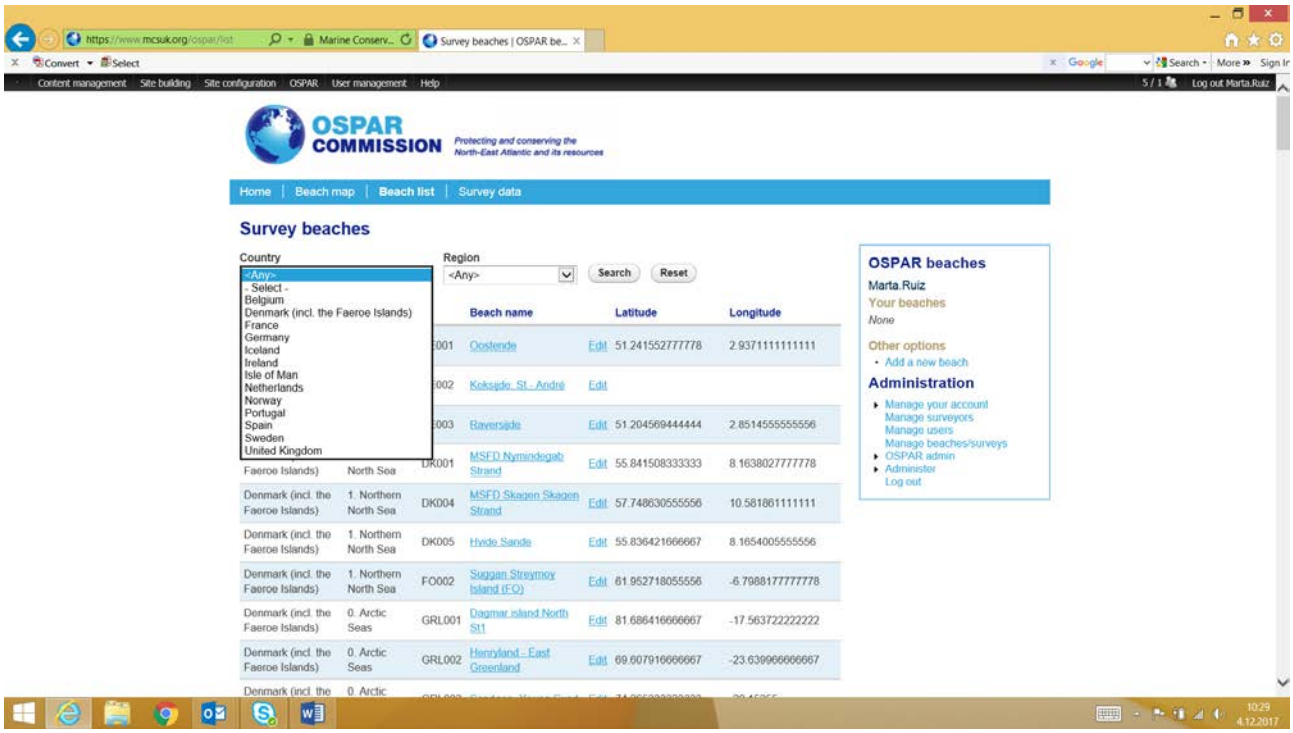


Figure 50. Measurement data search

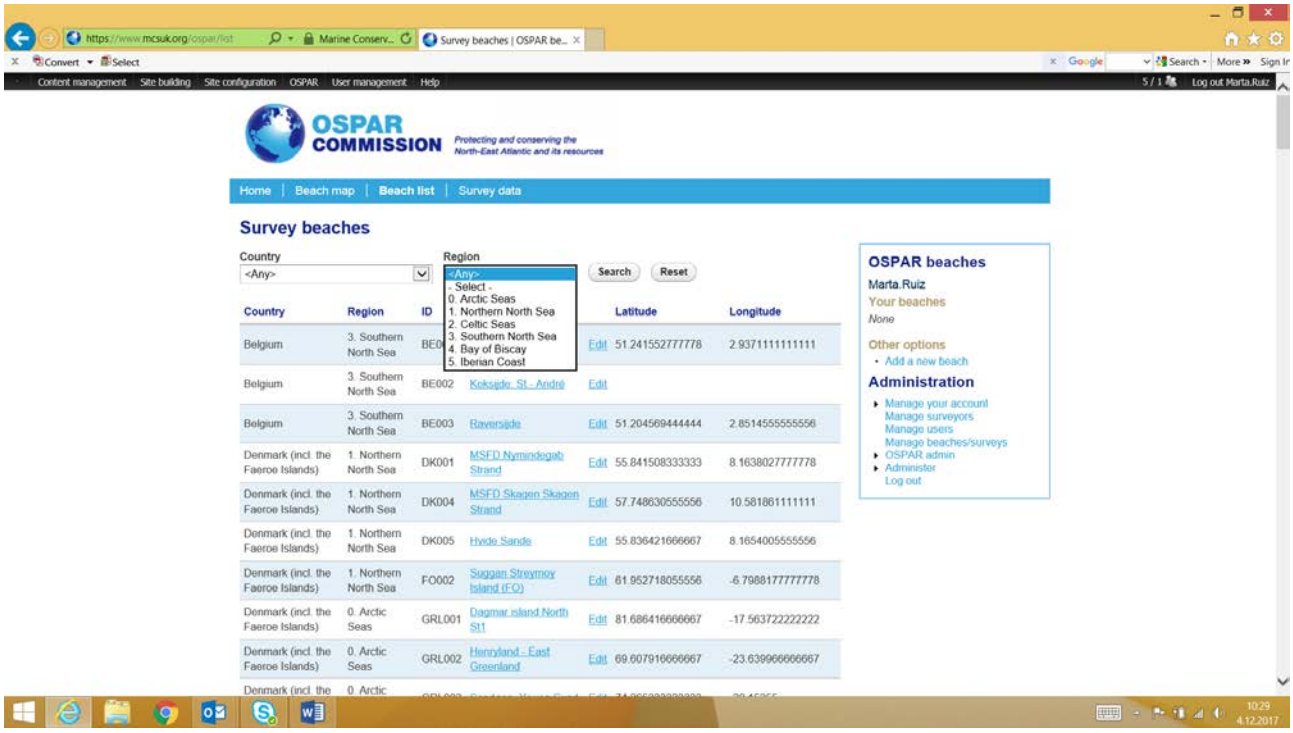


Figure 51. Measurement data search

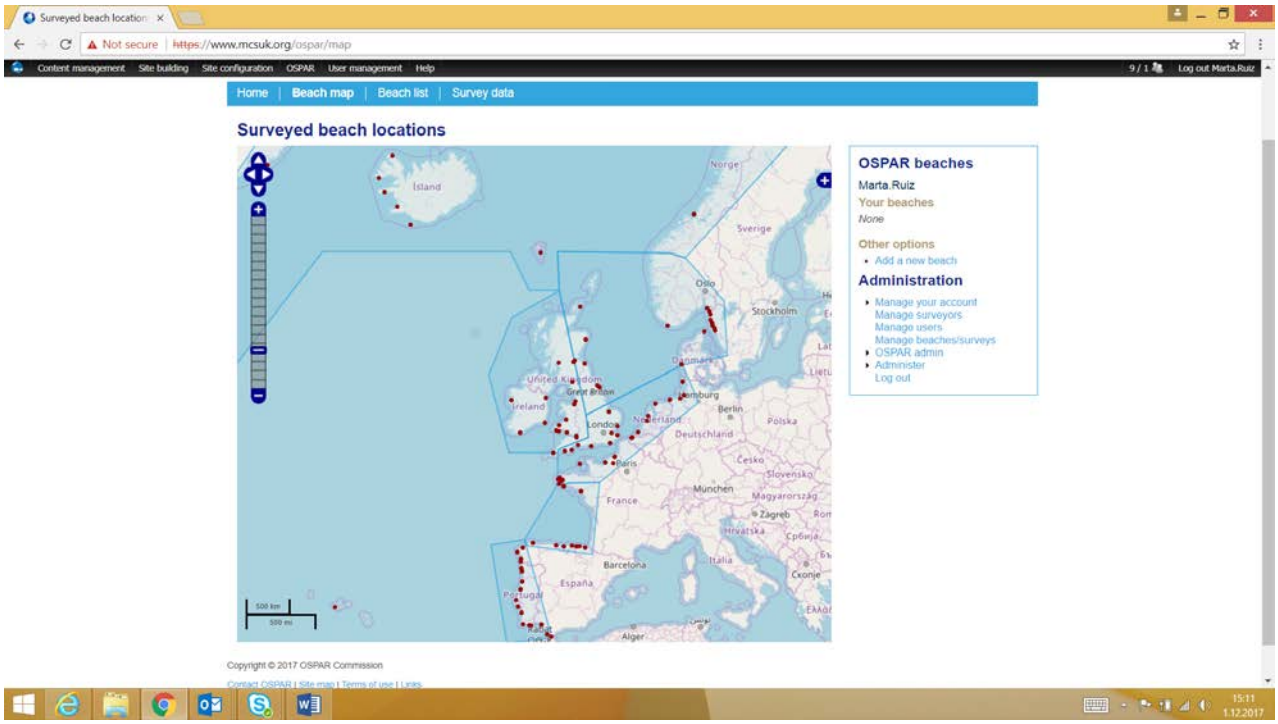


Figure 52. Measurement data search, map tool

Measurement data to study and beach information

Measurement data is found from the database by clicking on the particular beach and then finding the data to be studied (Figure 53). In the beach list –view it is possible to access the particular beach information and add background information. Beach location is determined with the map tool or with Earth Point tool provided by Google (Figure 54 – Figure 59).

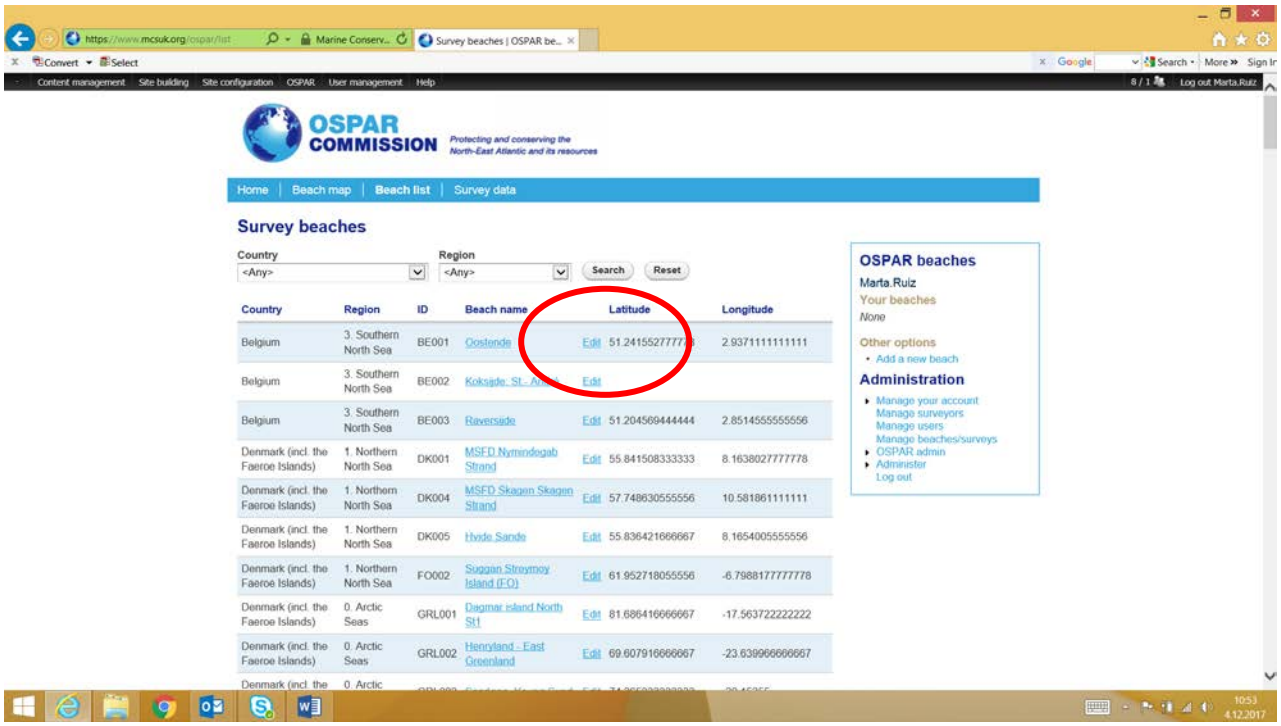


Figure 53. Beach list, edit tool

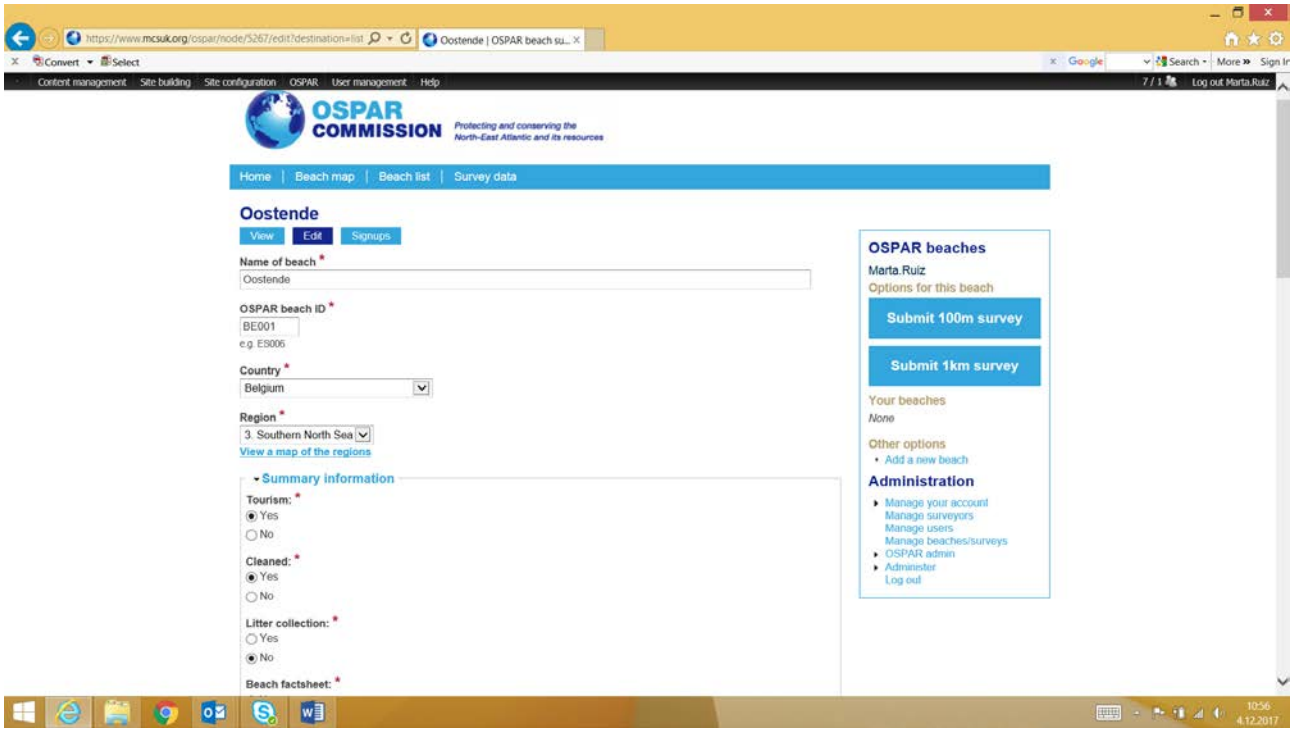


Figure 54. Beach information

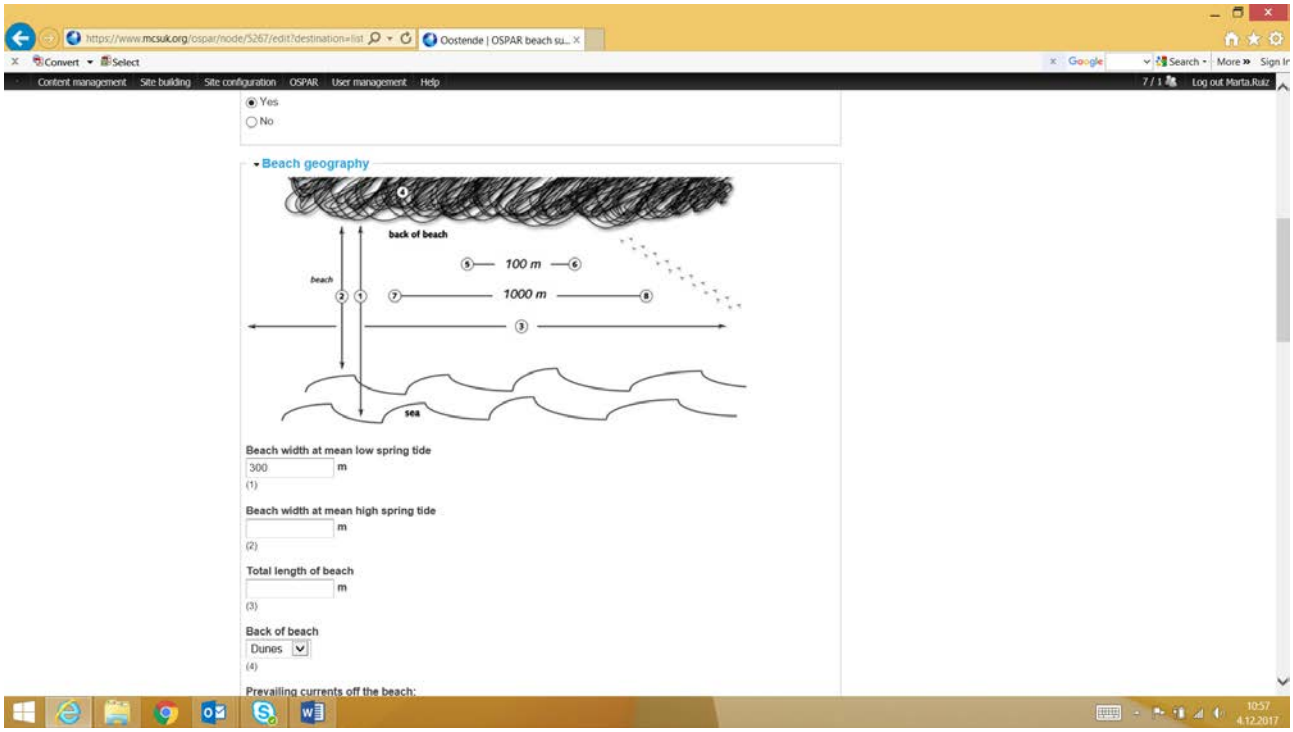


Figure 55. Beach information

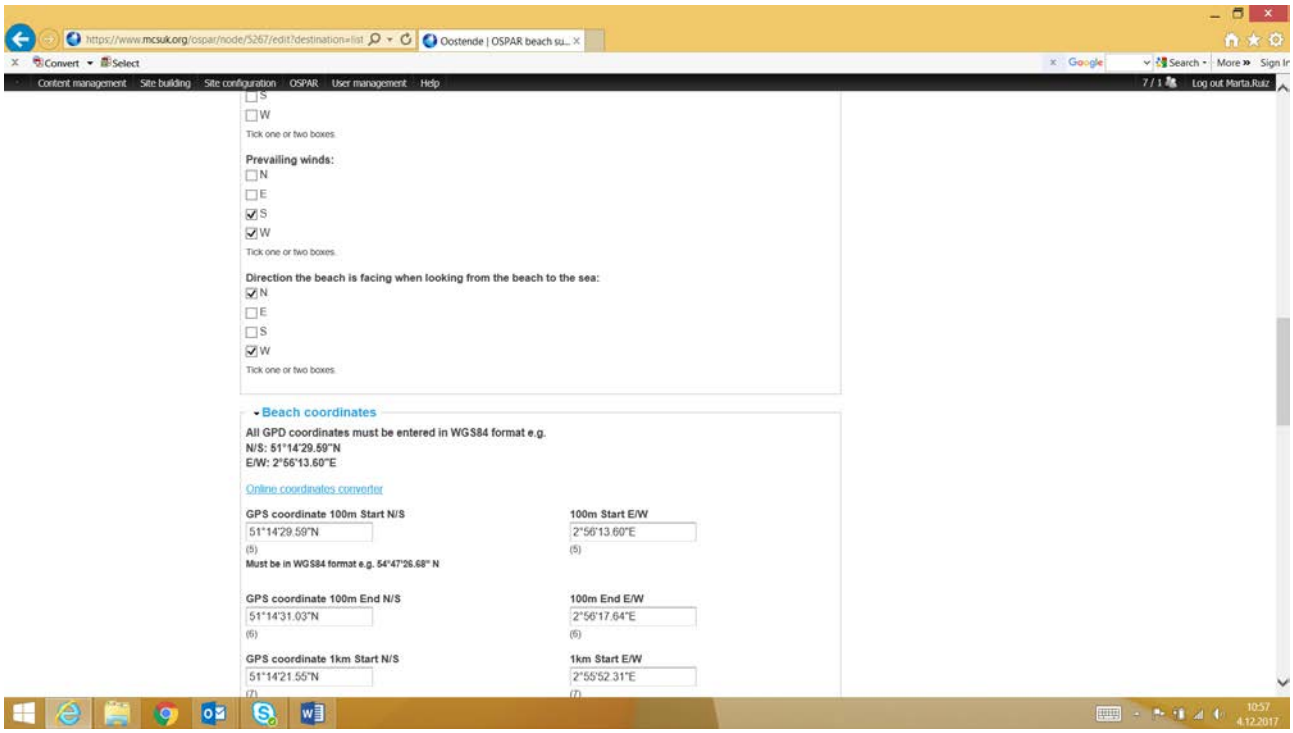


Figure 56. Beach information

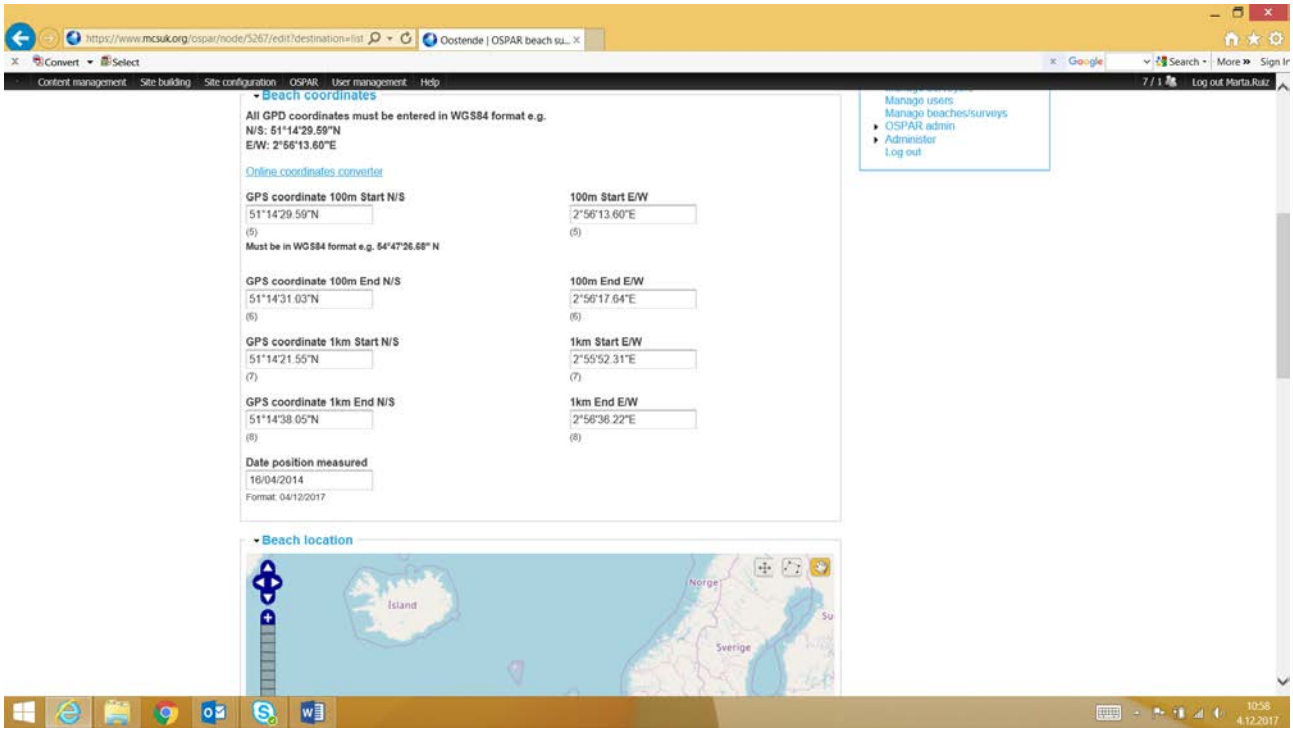


Figure 57. Beach information

Litter data of the particular beach is found on survey basis. By choosing a single survey to study, a summary of litter data on that survey opens up (Figure 58 - Figure 59).

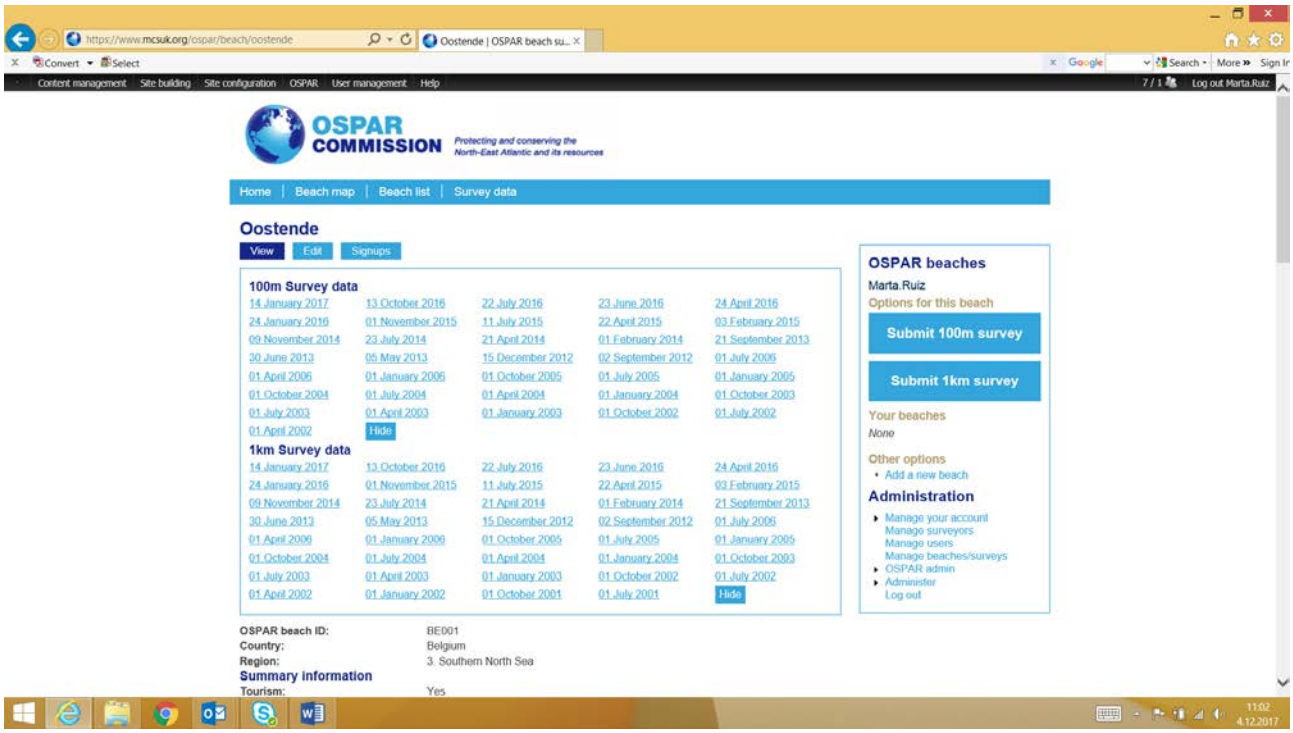


Figure 58. Beach information, list of surveys conducted

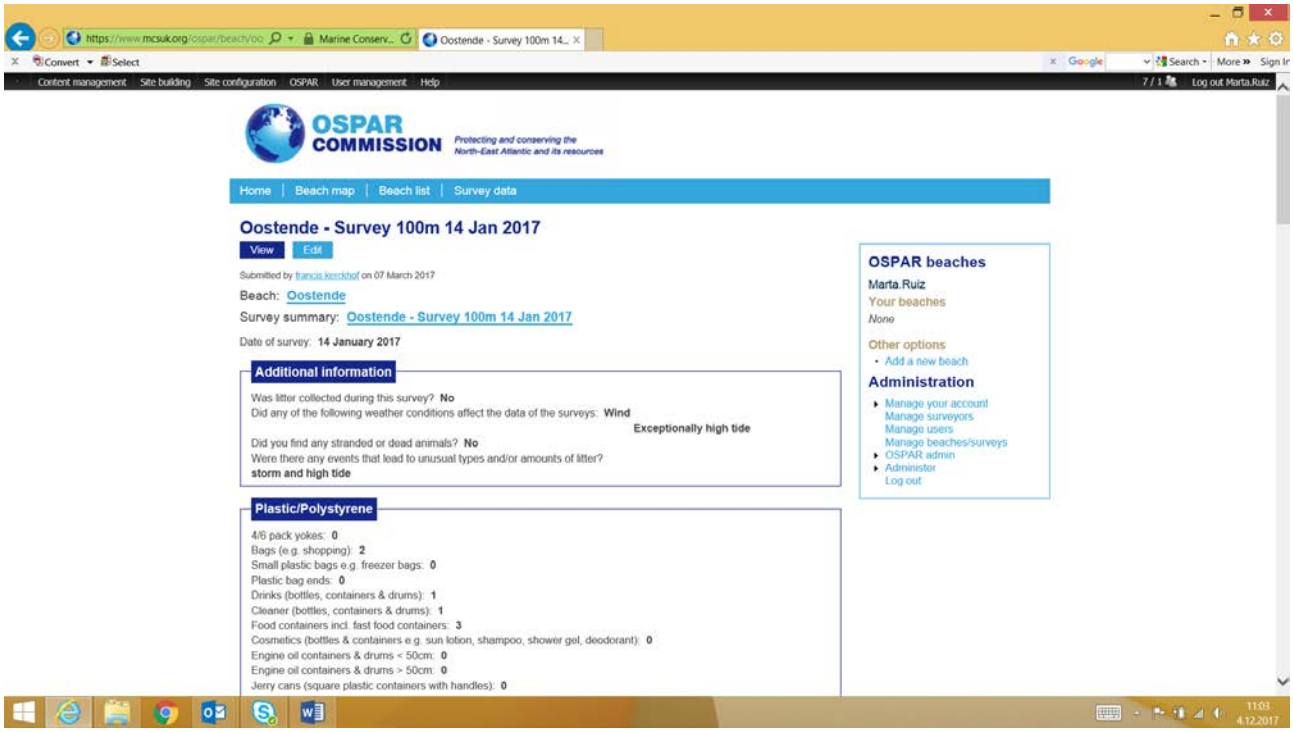


Figure 59. Litter data of a specific survey

Input of data

Litter data cannot be uploaded directly into the database. Number of litter items is input by litter category under different material categories. Alternatives for survey area are either 100 or 1000 meters stretch (Figure 60 – Figure 62=.

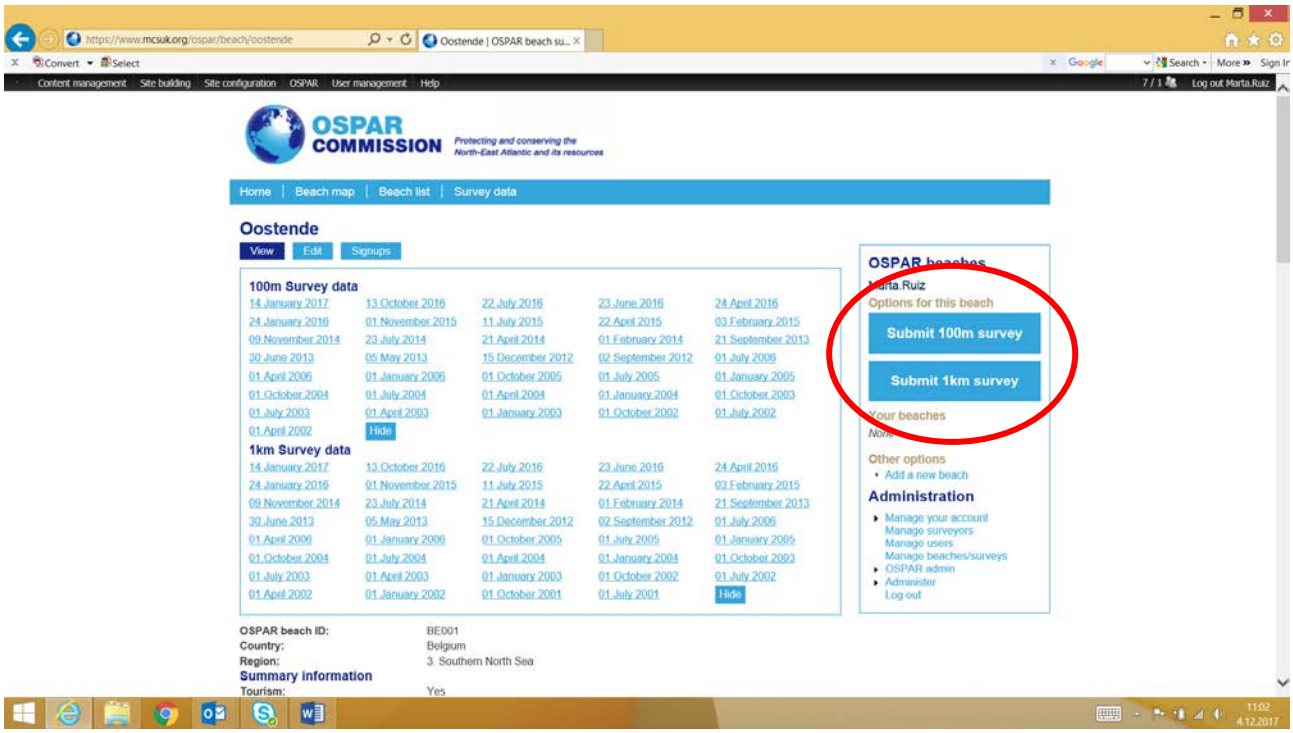


Figure 60. Collecting litter data

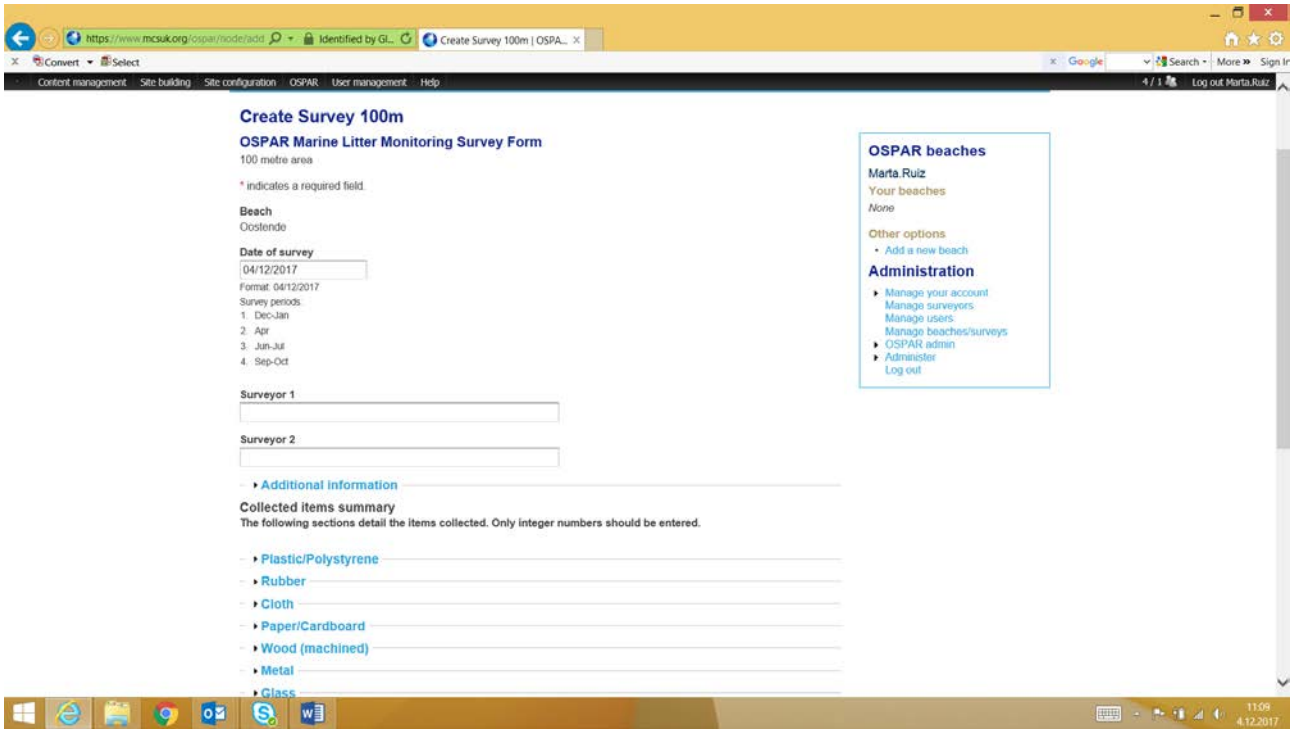


Figure 61. Collecting litter data

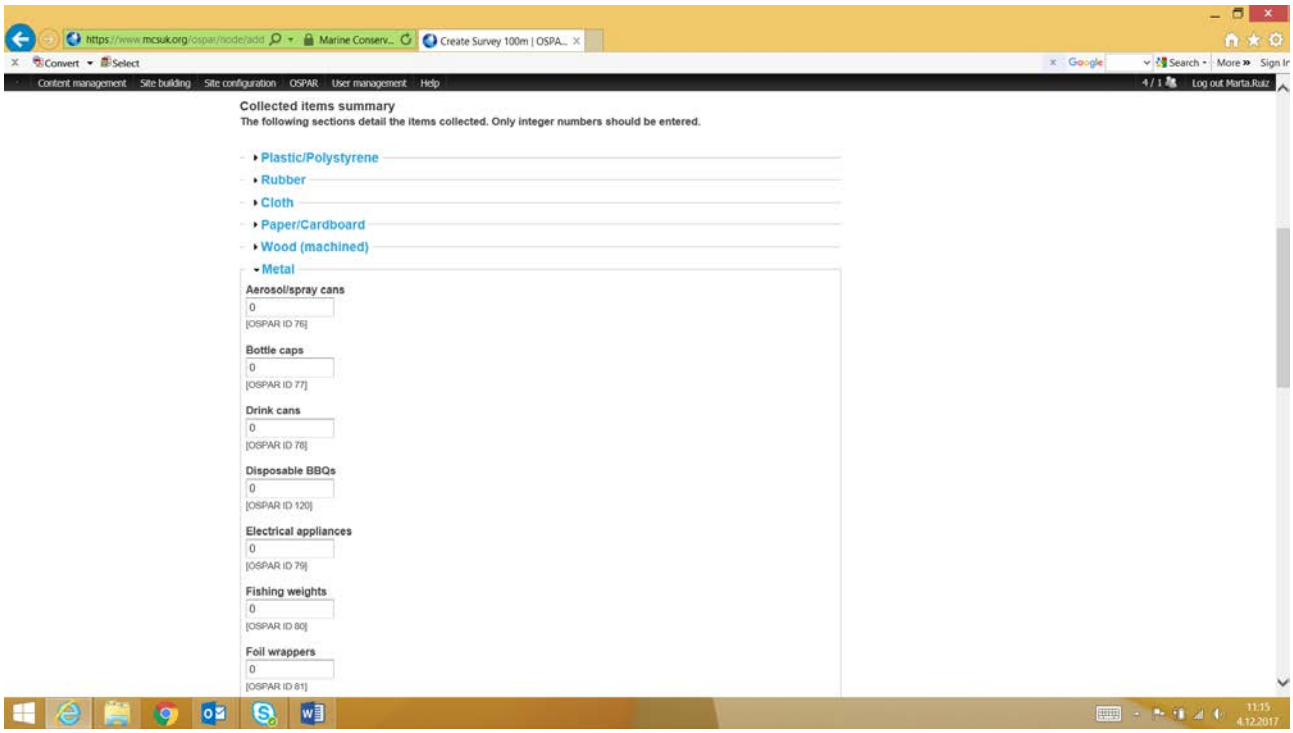


Figure 62. Collecting litter data

Adding a new beach

A new beach is added by choosing add a new page from the frontpage when signed in as a user. The information of the beach is then input step-by-step as guided by the website (Figure 63 – Figure 65). The information that is required is the same information that can be edited for existing beaches, as presented in Figure 54 – Figure 57.

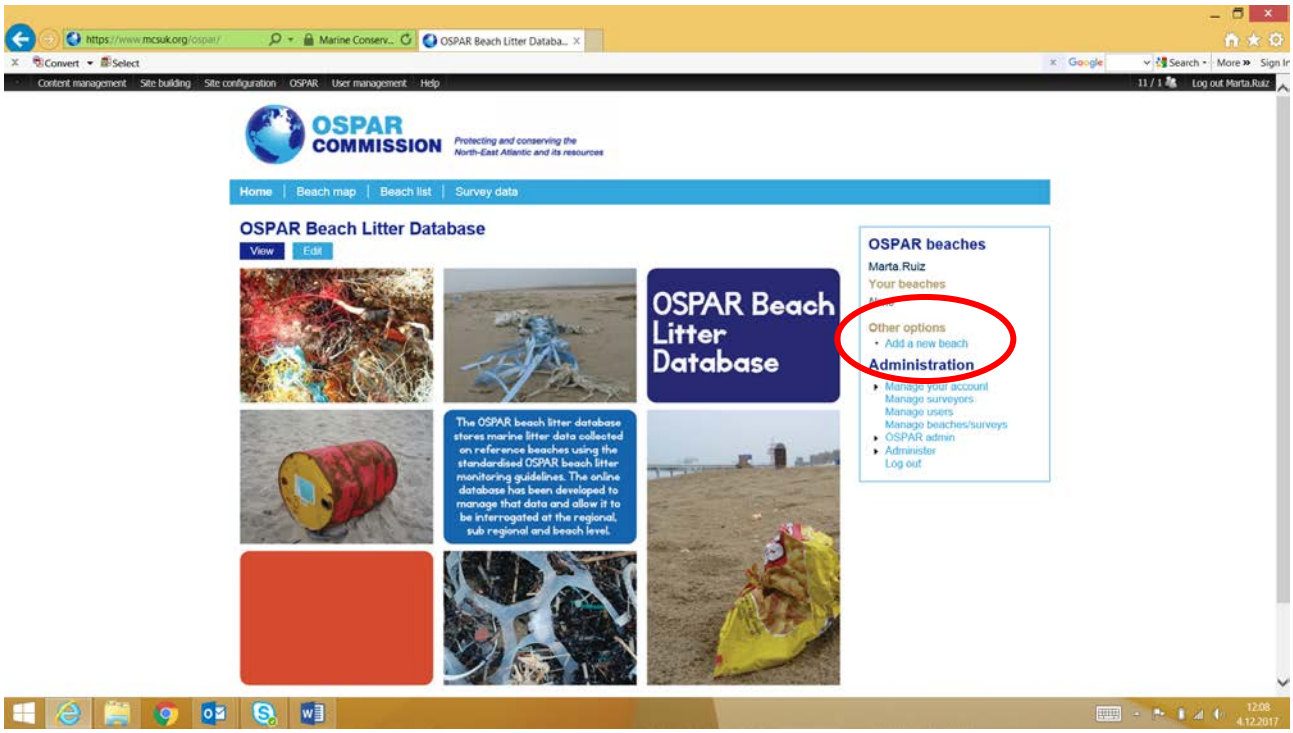


Figure 63. Creating a new monitoring beach

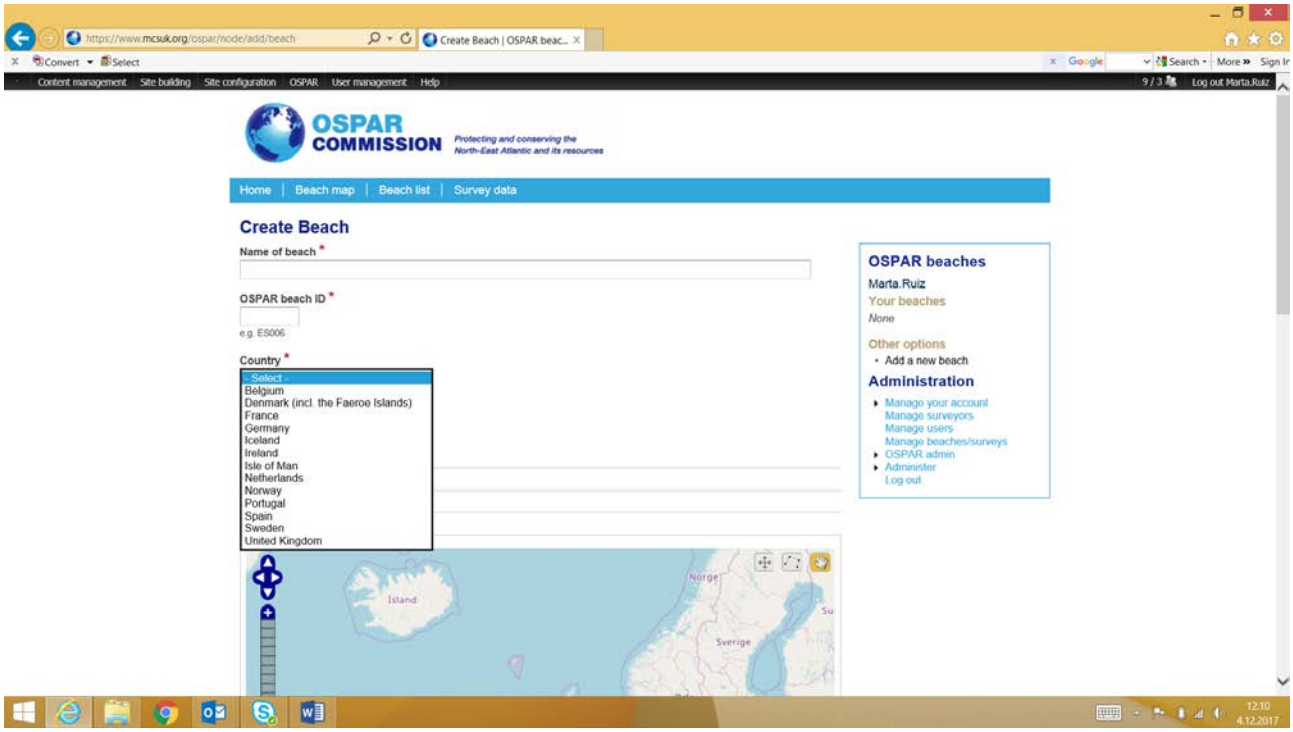


Figure 64. Creating a new monitoring beach

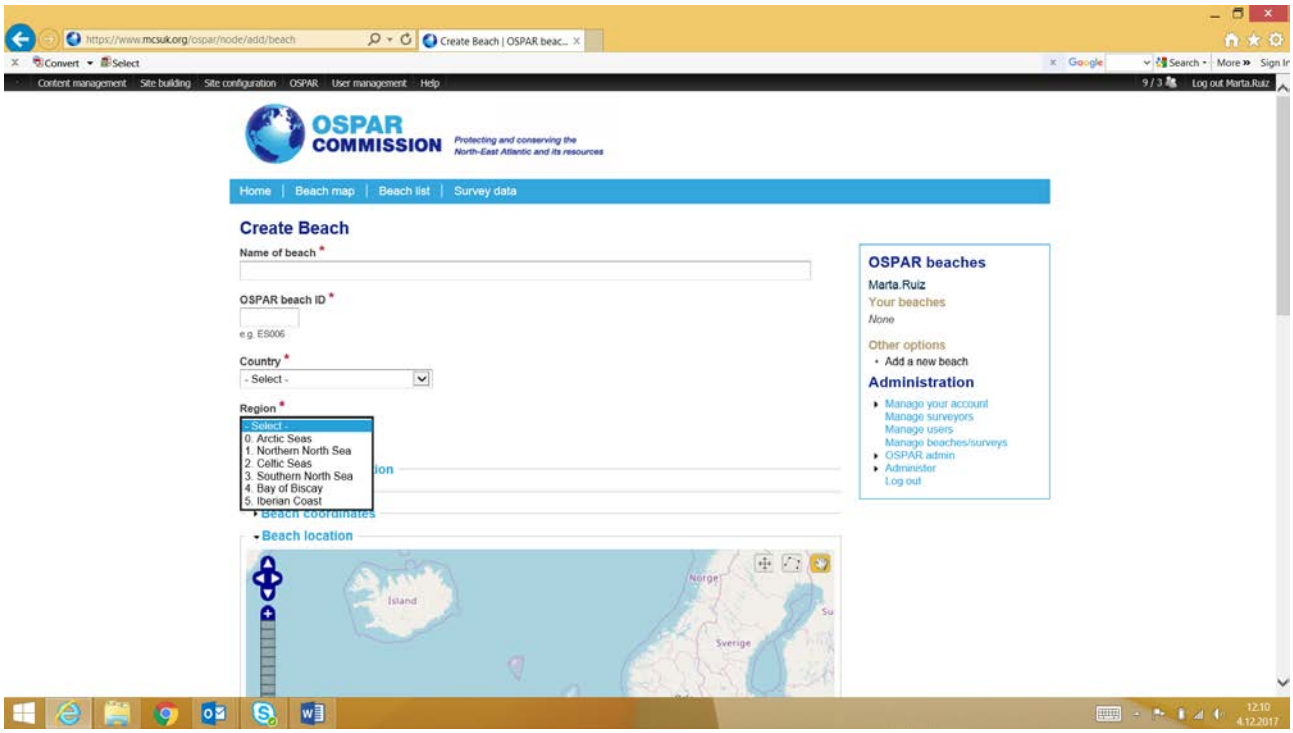


Figure 65. Creating a new monitoring beach

Analytic tools

All data in the database can be studied under the survey data –tool. With the tool it is possible to study the data more in detail as groups, year, date, country and region can be chosen as filtering possibilities. One or many filters can be used, but at least one is to be used. After choosing a country, it is also possible to choose a beach. The report produced contains information on material proportions and possible source indication (Figure 66 – Figure 69). Both of these charts can be downloaded as pdf, png, jpeg and svg files. It is not possible to see the charts, nor download them with Google Chrome browser.

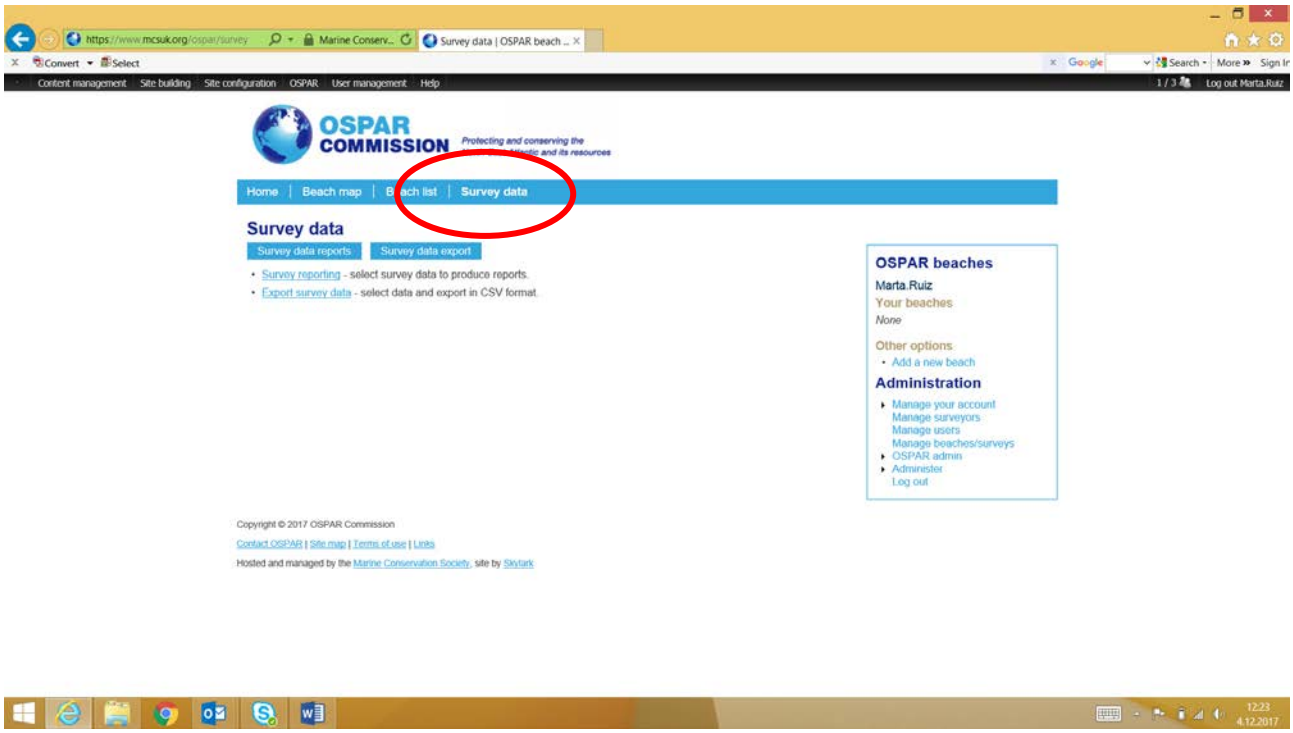


Figure 66. Studying litter data

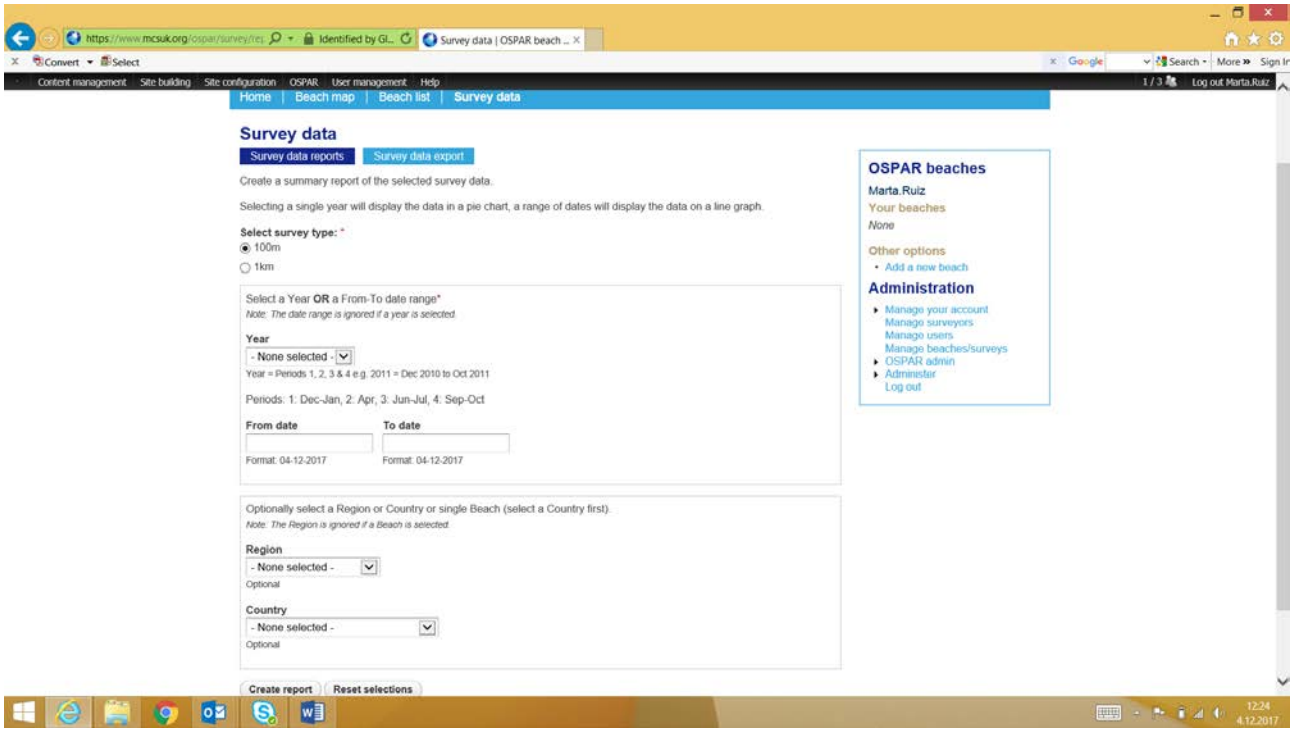


Figure 67. Studying litter data

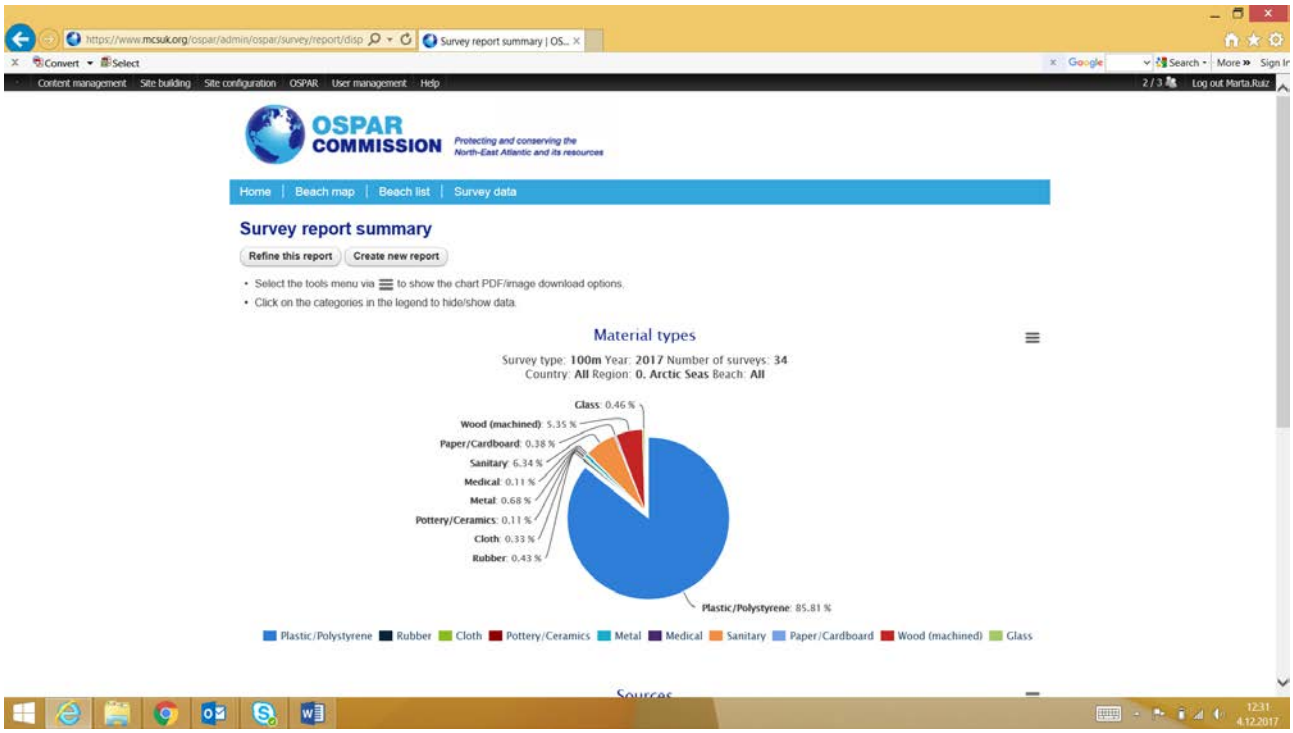


Figure 68. Litter data report

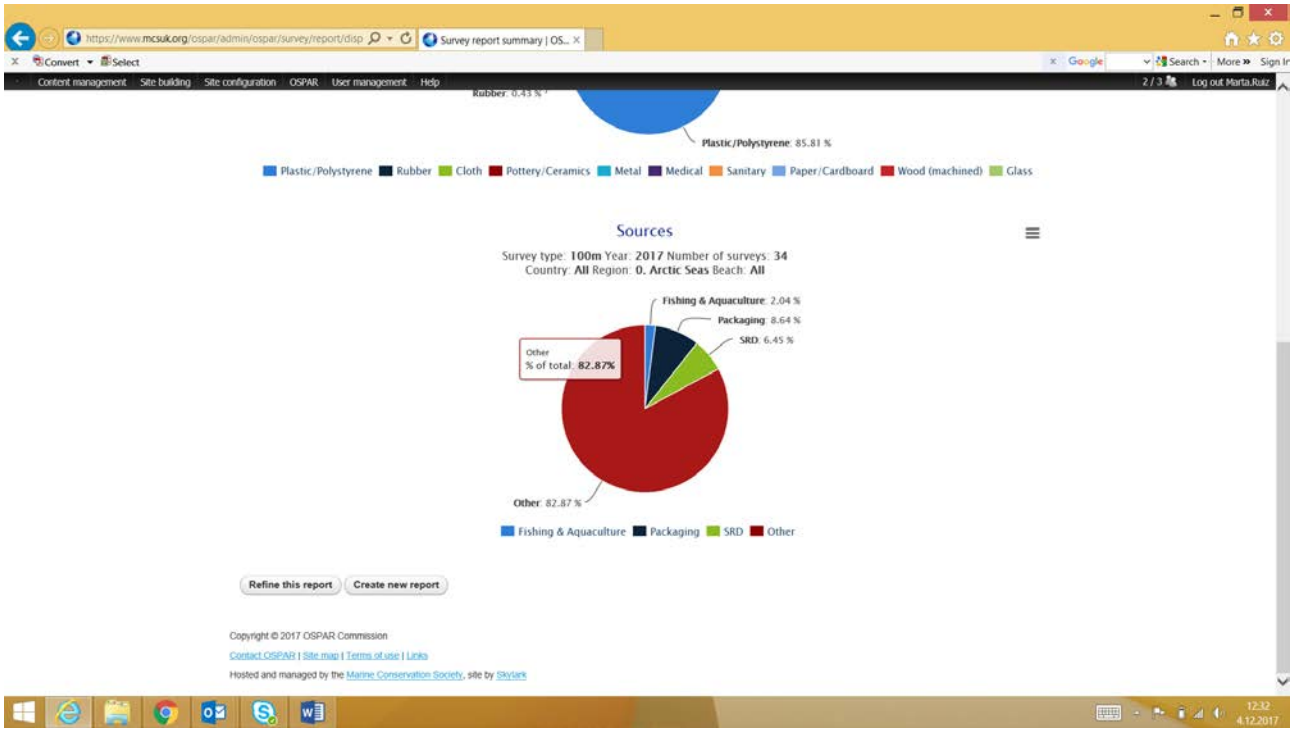


Figure 69. Litter data report

It is also possible to export the data from the database as a csv-file, with the same filters as those described above (Figure 70).

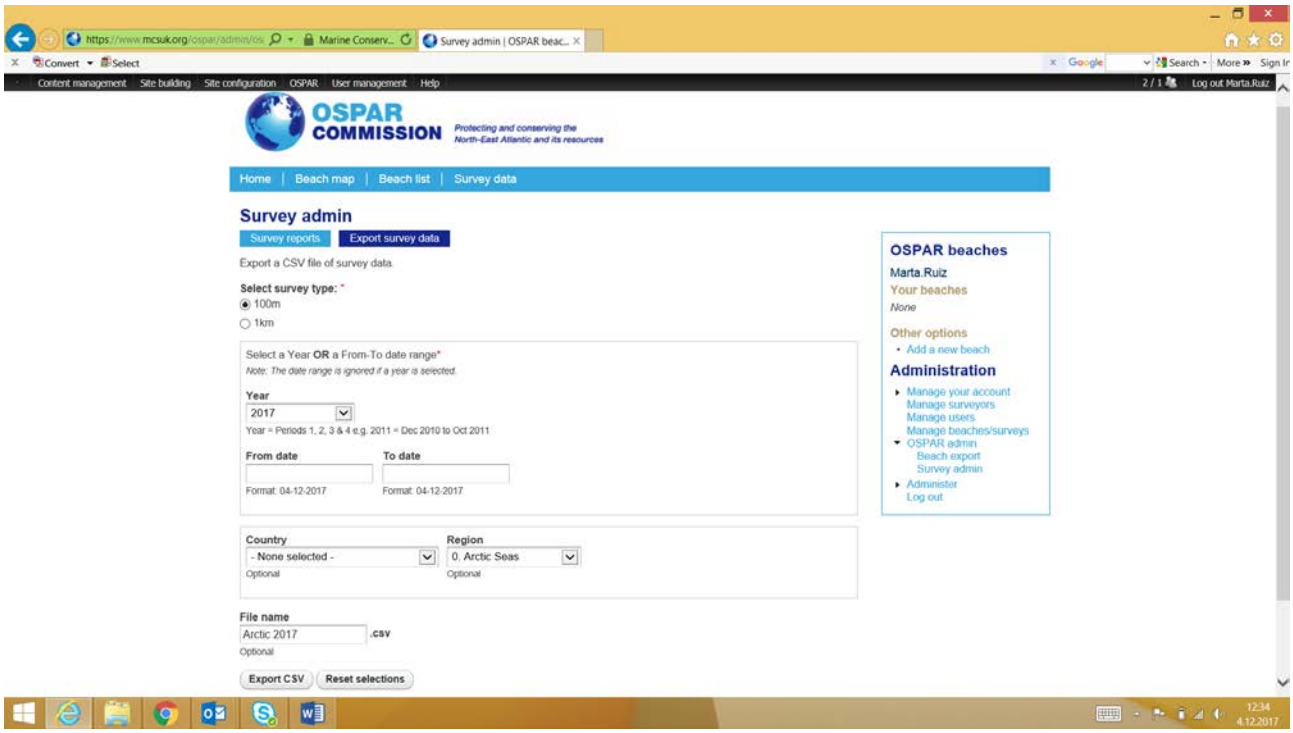


Figure 70. Litter data export

Statistical analyses from the litter data can be performed by the Litter Analyst software: https://www.amo-nl.com/software/litter-analyst/.The password needed to download the software can be requested through the website. The user manual of the software is also publicly available: https://www.amo-nl.com/pdf/User%20manual%20Litter%20Analyst.pdf.

Summary of key elements

	Marlin	**OSPAR**	**MLW**
Found at	http://hsr-beach.herokuapp.com	https://www.mcsuk.org/ospar/	https://marinelitterwatch.discomap.eea.europa.eu/
Mobile application	No	No	Yes, iPhone and Android
Map tool	Google maps	Earthpoint, Google	Earthstar Geographics, ESRI
Coordinates given automatically	Yes	Yes	Yes
Upload data	No	No	No
Download raw data	Excel	CSV	CSV, Excel pivot
Litter reports	pdf, Excel, web interface	pdf, jpeg, svg, web interface (does not work with Google Chrome)	Web interface

Top litter item list -report, which calculation method	Yes Simple method	No, Separate software developed for this, Litter Analyst available at https://www.amo-nl.com/software/litter-analyst/	Yes

Table 4. Summary of key elements from different databases

HELCOM database

At the moment there is no beach litter regional database in the HELCOM region. Important key element to consider, if a regional database is set up, to serve both decision makers and researchers, are compiled in Table 5-Table7.

	HELCOM database, basics
Found at	Under helcom.fi
Mobile application	Yes, especially important for the field work iPhone, Android
Special software	No, only mobile and web application
Usertypes	Main, country manager, beach manager, litter collector
Map tool	Yes E.g. Google maps
Coordinates given automatically	Yes
Upload data	Yes
Download raw data	Excel, CSV
Upload and download template	Used in HELCOM data call on marine litter, May 2017
Top litter item list -report, which calculation method	Yes Simple method Rank method
Litter reports	pdf, Excel, web interface

Table 5. Requirements of HELCOM database, basics

	HELCOM database, litter reports
Number of litter items	100m, 1km length 10m width
Number of litter items	seasonal change graph, trend
Litter categories separately	proportions
Litter categories separately	seasonal change graph, trend
Single litter items	proportions
Single litter items	seasonal change graph, trend
Top litter items	Simple method
Top litter items	Rank method
Compare tool	In the reports there needs to be the possibility to compare reports according to filters (described in table xx)

Table 6. Requirements of HELCOM database, litter reports

	HELCOM database, data filtering tools
By region	
By country	
By sub-basin	Level 3 according to the HELCOM Monitoring and Assessment Strategy
By beach	
By beachtype	Urban, rural, peri-urban
By assessment	
By season	
By year	
By litter item	
By protocol	The ones in use in the HELCOM region at that point. There needs to be the possibility to modify these easily.

Table 7. Requirements of HELCOM database, data filtering tools

Discussion

There are three different major databases in use in the HELCOM region. Many of the northern countries use the Marlin database, countries that are part of the OSPAR region use the OSPAR database. The MLW is more used by the occasional users that organize clean-ups, or by clean-up campaigns that are not part of the national marine litter monitoring conducted by countries.

Compared to the OSPAR database, the Marlin database is the database with more tools available for the user to easily analyse data. It also provides the possibility to export data for further analyses that would be conducted in Excel or in other software meant for that use. Neither Marlin non OSPAR database has a separate mobile applications developed, being both used through the web interface. This makes the use of the database out on the field a bit tricky, but not impossible. Maybe it is also due to this choice, that both of them seem to be more user friendly and bug free.

The Marlin database offers possibilities to use different survey protocols and categories (UNEP; OSPAR, TG ML. If the development of a common HELCOM database is foreseen as a goal, developing Marlin database into a Baltic Sea regional database could be the solution. The database has many analytical tools that would be appreciated by users who need to find data in a usable format quickly.

The MLW is a good tool for citizen science and collecting massive amounts of information. At the moment some of the tools do not work properly making the effort of studying the litter data time consuming. Collecting the data in the field is easy with the mobile application and it also removes one step of work – transferring the data from paper to database.

As there are three marine litter databases in use already in the HELCOM area, it is suggested to join forces to further develop one of these into a regional marine litter database. Especially the Marlin database is seen as a strong candidate for that. The regional database needs to meet the needs of research and decision makers.