



## **EMODnet Thematic Lot n° 4 - Chemistry**

### **Visualization products for Beach and Seafloor Litter data**

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# 1 Introduction

EMODnet Chemistry included in its last phase marine litter. Since the beginning of 2018, data of *beach litter*, *seafloor litter* and *floating micro litter* have been gathered and processed for creating the EMODnet Chemistry Marine Litter Database (MLDB from now). The litter data have been ingested in the database using specific data formats developed by the project with the base of existing formats and reporting practices. The EMODnet litter formats are described in guidelines available on the EMODnet Chemistry website:

[http://www.emodnet-chemistry.eu/doi/documents/Guidelines-Litter\\_Data\\_EMODnetChemistry3\\_rev\\_20181128.pdf](http://www.emodnet-chemistry.eu/doi/documents/Guidelines-Litter_Data_EMODnetChemistry3_rev_20181128.pdf)

<http://www.emodnet-chemistry.eu/doi/documents/Proposal-EMODnet-TG-ML-Micro-Litter-Data-Gathering-20180525.pdf>

More information about the beach data in the MLDB can be found in Addamo *et al.* (2018).

In addition to data collation, one of the objectives of EMODnet Chemistry is to offer marine litter products that allow the visualization of the data gathered in the EMODnet Chemistry database. The EMODnet Marine Litter Visualization Products have been designed attempting a homogeneous representation of the data, within the limits of compatibility of the data sampling methodologies.

The products described in this guideline refer to beach and seafloor litter data. The harmonization of all the data has been the most challenging task considering the heterogeneity of the data sources, sampling protocols and reference lists used on a European scale. In particular, the EMODnet Marine Litter Database contains data collected using several different protocols and reference lists of litter, as summarized in Table 1.

**Table 1 - Marine litter protocols used for data collection.**

	Beach litter	Seafloor litter
PROTOCOLS	OSPAR UNEP UNEP (modified by MARLIN project) TSG-ML Italian	ICES MEDITS
REFERENCE LISTS	OSPAR (100 m surveys) OSPAR (1000 m surveys) UNEP UNEP (modified by MARLIN project) Master List Italian	ICES MEDITS

The reference documents to the monitoring protocols are the following:

- OSPAR: Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area, 2010
- UNEP: UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter, 2009

- UNEP (modified by MARLIN project): Final report of Baltic Marine Litter project Marlin - litter monitoring and Raising awareness, 2011-2013
- TSG-ML: Guidance on Monitoring of Marine Litter in European Seas. MSFD Technical Subgroup on Marine Litter, 2013
- Italian: Monitoring program for the marine strategy of the Italian Ministry of Environment (Programmi di Monitoraggio Per la Strategia Marina Art. 11, D.lgs. 190/2010)
- ICES: Revised CEFAS Trawl litter survey parameters, 2013. Litter reference vocabularies defined by ICES for DATRAS litter data
- MEDITS: MEDITS-Handbook. Version n. 9, 2017, MEDITS Working Group: 106 pp.

For beach litter, data from official monitoring, research and cleaning operations have been stored in the database.

Regarding seafloor litter, within the same protocol, different gear types are deployed during fishing bottom trawl surveys.

This document describes the data management and computation methods used to produce the EMODnet Chemistry beach and seafloor litter visualization products. The heterogeneities in the data described above induced some normalization depending on the product. **The data used for the EMODnet Marine Litter Products have been homogenized and filtered in order to allow comparisons among countries. Thus, EMODnet Marine Litter products might not be comparable with source data accessible through other platforms.**

## 2 Data management

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OGS provided IFREMER an output of the MLDB.

➤ **For beach litter, the source reference database is in xlsx format.**

The MLDB output provided by OGS is in xlsx format. This format is not directly usable for data cartography. It has been transformed to facilitate the implementation of queries for the different calculation methods.

Data are divided into 4 separate tabs in the xlsx file:

- Beaches: descriptive data of the beaches.
- Surveys: descriptive data of the surveys.
- Animals: data of animals found during the surveys (this part is not used for mapping data).
- Litter: data of litter found during the surveys.

Each beach, surveys and litter tabs were saved in a csv table format so that they could be integrated via QGIS (DB manager) into an IFREMER PostgreSQL database used for the mapping analysis of beach litter data. In this database, the three tables keep the original structure.

From these three data tables, processing requests have been set up to create different products:

- Number of surveys and temporal coverage per beach.
- Total litter abundance.
- Material categories percentage.
- Specific litter group abundances (Cigarette related items, Fishing related items, Plastic bags).

These queries allow the creation of data analysis layers that are used in QGIS to work on their layout (graphic semiology) and can be exported in shape file format.

➤ **For seafloor litter, the source reference database is in csv format.**

The MLDB output provided by OGS is in csv format. This format is not directly usable geographically and to facilitate the implementation of queries for the different calculation methods, it has been transformed.

Dataset is composed of one table: Seafloor litter: Seafloor litter surveys. This table has been integrated via QGIS (BD manager) into a PostgreSQL database used for the cartographic analysis of seafloor litter. In this database, the table keeps the same structure.

From this table, processing requests have been set up to calculate the abundance per square kilometre per year for cartographic analysis.

This query allows the creation of data layers of the analysis tables that are used in QGIS to work on their layout (graphic semiology) and exportable in shapefile format.

A Web Map Service (WMS) has been set up to load the data analysis layers and the associated graphic semiology (symbolology, zoom levels, labelling, legend, etc.) produced through Mapserver.

Maps can be visualized through OceanBrowser (<http://ec.oceanbrowser.net/emodnet/>) and associated metadata are available through the Sextant Catalogue Service (<http://www.emodnet-chemistry.eu/products/catalogue#/search?from=1&to=20>)

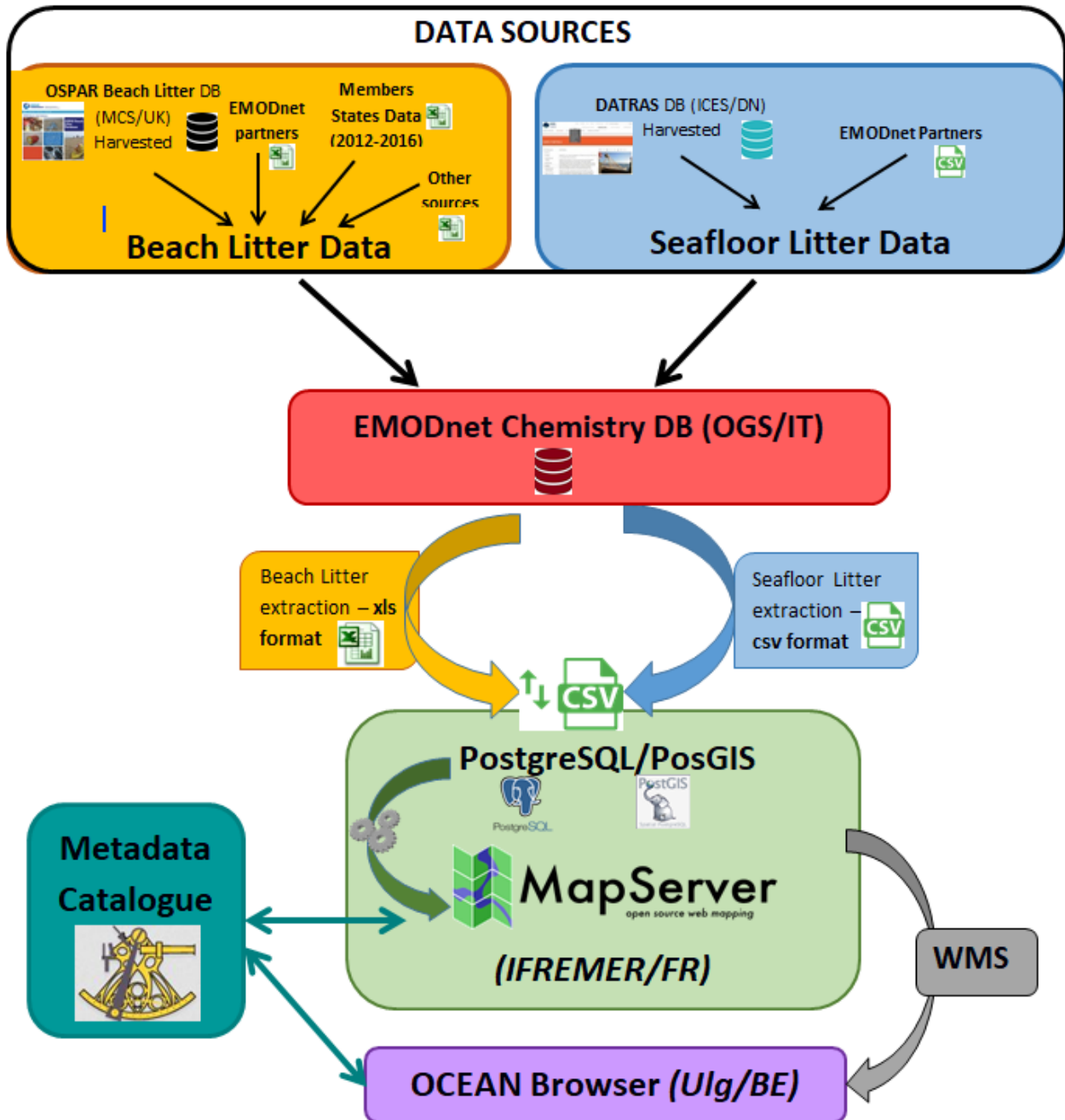


Figure 1 : Data management schema

## 3 Beach Litter Products

### 3.1 *Fields available in data tables*

In this section, the fields on each table are described according to the EMODnet litter formats.

- **Beaches**

**Table 2 : Columns in the table beaches.**

Field	Description
BeachCode	Code for the beach. In case you don't have a code, it has to be created with the country code and a number code (6 digits)
BeachName	Name of the beach
Country	Identifier for the country that performed the survey from ISO countries reference code list
BeachInfoAmendment	Is this an amendment to an existing beach info questionnaire?
FillingDate	Date when the questionnaire was filled in. Date format ISO 8601 (YYYY-MM-DD)
FillingName	Name of the person who filled the questionnaire
FillingPhone	Phone number of the person who filled the questionnaire
FillingMail	E-mail of the person who filled the questionnaire
FillingInstitute	Institution in charge of filling the questionnaire
UrbanizationDegree	Degree of urbanization of the beach area (Urban: Densely populated area, 500 inhabitants/km <sup>2</sup> and total population at least 50,000 inhabitants. Periurban: Intermediate area, 100 inhabitants/km <sup>2</sup> and at least 50,000 inhabitants or adjacent to a densely populated area. Rural: Thinly populated area)
ReferenceBeach	Indicate if the beach is considered a sampling unit within any litter survey programme
BeachWidthLow	Beach width in metres at mean low spring tide
BeachWidthHigh	Beach width in metres at mean high spring tide
BeachLength	Total length of the beach in metres
BeachLatitude	Latitude of the beach position (Degree.Decimal Degree of latitude)
BeachLongitude	Longitude of the beach position (Degree.Decimal Degree of latitude)
CoordinateSystem	Coordinate reference system used: if not differently specified WGS84 (EPSG:4326) reference system is assumed. Please specify the "Identifier"
BeachBack	Elements on the back of the beach
BeachBackOther	If the beach back category cannot be selected from the dropdown list ("BeachBack" field) it should be listed here.
BeachBackDevelopment	Is there any development behind the beach?
DevelopmentDescription	Description of the development behind the beach
PositionMeasurementDate	Date when the position of the beach was measured. Date format ISO 8601 (YYYY-MM-DD)
CurrentsDirection	Prevailing currents off the beach
WindsDirection	Prevailing winds
BeachOrientation	In which direction the beach is facing when looking from the beach to the sea?
BeachMaterial	Define beach sediment as in EMODnet Geology five class sediment categorization (Modified from Folk Triangle)
BeachTopography	Short description of the beach topography
Obstacles	Objects in the sea that influence the currents
Usage1	Usage of the beach



Usage1Seasonality	Is the usage seasonal?
Usage2	Usage of the beach
Usage2Seasonality	Is the usage seasonal?
Usage3	Usage of the beach
Usage3Seasonality	Is the usage seasonal?
BeachAccess	Possibilities of access to the beach
BeachCleaningSeasonality	Is the beach cleaning seasonal?
SeasonalityMonths	List the number of the months in which the cleaning is accomplished
CleaningFrequency	Indicate the frequency of beach cleaning
OtherDescription	If frequency is "Other", please de- scribe it
CleaningMethod	Cleaning method used
CleaningResponsible	Responsible for cleaning
Notes	Additional comments and observations about the beach

## • Surveys

**Table 3 : Columns in the table surveys.**

Field	Description
BeachCode	Code for the beach referring Beach metadata sheet. In case you don't have a code, it has to be created with the country code and a number code (6 digits)
SurveyCode	Number code that must be unique within the whole file
SurveyType	Type of survey
SurveyDate	Date of the survey. Date format ISO 8601 (YYYY-MM-DD)
Originator	EDMO code for data originator organization
Collator	EDMO code for data collator organization
ProjectCode	Project code from ED- MERP (European Directory of Marine Environ- mental Research Pro- jects)
SurveyStartLatitude	Latitude of the survey starting point (Degree.Decimal Degree of latitude)
SurveyStartLongitude	Longitude of the survey starting point (Degree.Decimal Degree of latitude)
SurveyEndLatitude	Latitude of the survey ending point (Degree.Decimal Degree of latitude)
SurveyEndLongitude	Longitude of the survey ending point (Degree.Decimal Degree of latitude)
CoordinateSystem	Coordinate reference system used: if not differently specified WGS84 (EPSG:4326) reference system is assumed. Please specify the "Identifier"
SurveyLength	Length of the survey in metres
SurveyWidth	Width of the survey in metres
Surveyor1Name	Name of the surveyor 1
Surveyor1Phone	Phone number of the surveyor 1
Surveyor1Mail	E-mail of the surveyor 1
Surveyor2Name	Name of the surveyor 2
Surveyor2Phone	Phone number of the surveyor 2
Surveyor2Mail	E-mail of the surveyor 2
TownName	Name of the nearest town
TownDistance	Distance to the nearest town in kilometres
TownPosition	Position of the town in relation to survey area
TownPopulation	Residential population of the nearest town
WinterTourists	Number of tourists during winter
SpringTourists	Number of tourists during spring
SummerTourists	Number of tourists during summer
AutumnTourists	Number of tourists during autumn
FoodOutlets	Are there food and/or drink outlets on the beach?
FoodOutletsDistance	Distance of the nearest food/drink outlet in kilometres in relation to survey area
FoodOutletsSeasonality	Is the opening seasonal?
SeasonalityMonths	List the number of the months in which the outlets are present

FoodOutletsPosition	Position of the nearest food outlet in relation to survey area
ShippingLaneDistance	Distance from the beach to the nearest shipping lane in kilometres
ShippingLaneTraffic	Estimated traffic of the shipping lane (number of ships/year)
ShippingLaneTypes	Type of ships that navigate along this lane
ShippingLanePosition	Position of the nearest shipping lane in relation to survey area
HarbourName	Name of the nearest harbour
HarbourDistance	Distance from the beach to the nearest harbour in kilometres
HarbourPosition	Position of harbour in relation to survey area
HarbourType	Type of Harbour
HarbourSize	Total number of ships
RiverName	Name of the nearest river
RiverDistance	Distance from the beach to the nearest river mouth in kilometres
RiverPosition	Position of river mouth in relation to survey area
WasteWaterDischarges	Is the beach located near waste water discharges?
WasteWaterDistance	Distance from the beach to the nearest discharge point in kilometres
WasteWaterPosition	Position of the nearest discharge point in relation to survey area
LitterPresence	Was litter collected during this survey?
LastCleaning	When was the last beach cleaning . Date format ISO 8601 (YYYY-MM- DD)
WeatherConditions	Did any weather conditions affect the data of the surveys?
WeatherConditionsOther	If any other weather conditions affected the survey, describe it
AnimalsFound	Did you find stranded or dead animals?
AnimalsNumber	If so, how many?
SurveyCircumstances	Any circumstances influencing the survey (e.g. tracks on the beach...)
SpecialEvents	Events that lead to unusual types and/or amounts of litter on the beach
Notes	Additional comments and observations about the survey

- Litter

**Table 4 : Columns in the table litter.**

Field	Description
SurveyCode	Number code referring Survey metadata sheet that must be unique in the whole file
LitterReferenceList	Name of the Litter reference list used. It is strongly recommended the use of TSG_ML General code
ItemCode	Litter parameter code of the Litter Reference list used
ItemName	Litter parameter name of the Litter Reference list used
ParameterOriginalName	Litter parameter name as reported by the surveyor (can be also in national original language)
NoItems	Number of items; for "other Pollutants" frequency (estimated number/m ); for Pellets Y/N)
Notes	Special observations

## 3.2 Preliminary processing

### 3.2.1 Protocol exclusion

Data collected using “OSPAR 1000” protocol have been removed for all the products for now, following the approach of OSPAR that it is not including these data anymore in the monitoring.

### 3.2.2 Survey type: Official monitoring / other sources

Because the quality of the data may vary depending on the purpose of the survey, the different survey types present in the database have been separated. Beaches surveyed for official monitoring activities, following recognized protocols, have been separated from beaches where data have been collected for other purposes (as research or cleaning activities). Therefore, the visualization products are organized under two groups:

- Official monitoring.
- Other sources.

In all the cases, the survey type is indicated among the survey metadata.

### 3.2.3 Beaches locations

Coordinates of the survey (or the beach) are needed to create the maps. Therefore, the following condition has been applied to exclude surveys/beaches without geographic information: *“geom\_point IS NOT NULL”*.

As a consequence, the following surveys/beaches without coordinates have been excluded from the products:

- ✓ BE002
- ✓ DE004

### 3.2.4 Surveys normalization

#### ➤ Surveys lengths 100 m

Depending on countries and protocols applied for performing the beach litter surveys, the survey lengths may be different (e. g. 100 metres in OSPAR, varying in UNEP\_MARLIN, etc.). In order to compare the data, normalization has been set up using a **coefficient to get the number of litter per 100 linear metres**. The coefficients applied are shown in Table 6.

**Table 5 : Length of the surveys found in the data and normalization coefficient applied, divided by the reference lists used.**

Reference list	Length	Coefficient
ITA	26	3,846
ITA	28	3,571
ITA	29	3,448
ITA	30	3,333
ITA	31	3,226
ITA	32	3,125
ITA	33	3,030

ITA	34	2,941
ITA	35	2,857
ITA	36	2,778
ITA	37	2,703
ITA	41	2,439
ITA	43	2,326
ITA	44	2,273
ITA	45	2,222
ITA	90	1,111
OSPAR	50	2,000
OSPAR	100	1,000
TSG_ML	50	2,000
TSG_ML	100	1,000
TSG_ML	194	0,515
TSG_ML	200	0,500
TSG_ML	300	0,333
TSG_ML	447	0,224
TSG_ML	1000	0,100
TSG_ML	2511	0,040
UNEP	50	2,000
UNEP	200	0,500
UNEP	250	0,400
UNEP	300	0,333
UNEP	400	0,250
UNEP	500	0,200
UNEP	1000	0,100
UNEP	1500	0,067
UNEP_MARLIN	10	10,000
UNEP_MARLIN	100	1,000
UNEP_MARLIN	110	0,909
UNEP_MARLIN	118	0,847
UNEP_MARLIN	152	0,658
UNEP_MARLIN	300	0,333
UNEP_MARLIN	320	0,313
UNEP_MARLIN	326	0,307
UNEP_MARLIN	350	0,286
UNEP_MARLIN	400	0,250
UNEP_MARLIN	500	0,200
UNEP_MARLIN	600	0,167
UNEP_MARLIN	800	0,125
UNEP_MARLIN	1000	0,100
UNEP_MARLIN	2500	0,040
UNEP_MARLIN	3000	0,033

### ➤ UNEP\_MARLIN surveys

UNEP\_MARLIN protocol<sup>1</sup> foresees 3 different types of length for each survey. In order to be able to ingest data from UNEP\_MARLIN into the MDLB database, each survey has been divided into three different ones according to their length (Figure 1). These surveys have been aggregated. In order to aggregate for the products, a query has been set up to calculate the number of surveys on each year in order to obtain the correct number of surveys per year.

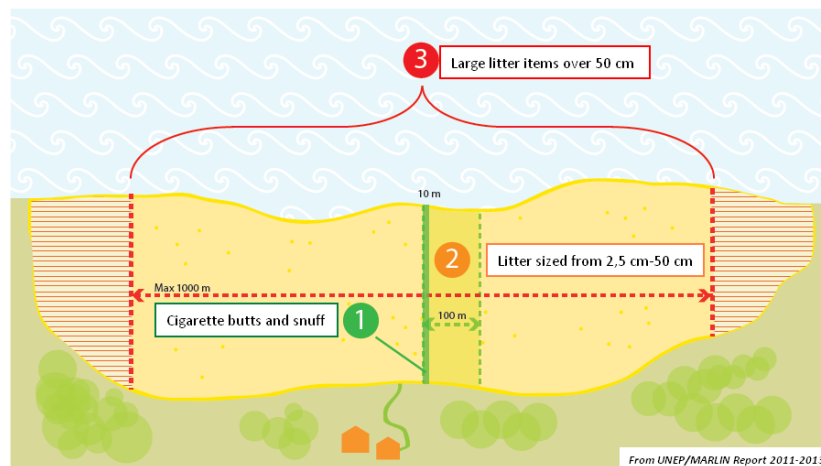


Figure 2. Scheme of survey definition according to the UNEP MARLIN protocol

### ➤ Surveys number

Because the number of surveys performed in a year differs between beaches, the data displayed in the different products have been also normalized taking into account the **number of surveys performed on the beach in each solar year**.

### 3.2.5 Categories & litter types removed

The heterogeneity of the data set does not permit a complete homogenization of the data. Data acquired with different reference lists are not always compatible (i.e., not all the types are present in all the lists; some types are classified under different material categories in different lists). Even if using the same reference lists, some items are not assessed (i.e., plastic fragments in some OSPAR surveys), or litter is collected following different criteria (i.e., cigarette butts in the UNEP MARLIN protocol are counted only over 10 m surveys). For this reason, some of the litter types have been removed from the analysis.

In particular, small fragments (**paraffin and wax; items < 2.5 cm**) and **cigarette butts** have been excluded for the products. These types may present very large abundances, depending on the beach and the protocol used, hence introducing a bias the analysis. This approach has been also taken for the litter baselines work by TG-ML (W. van Loon *et al*, *work ongoing*). Cigarette items have been only used for the specific product on “Smoking related items”.

<sup>1</sup> UNEP/MARLIN Final report of Baltic Marine Litter Project- Litter Monitorign and Raising Awareness 2011-2013 – Beach Litter Monitoring method p 9.

Additionally, because of their organic composition inducing relatively rapid biodegradability and as they are not considered as litter, two material categories have been removed from the following products: **Faeces**, **Food waste and Organic**.

### 3.3 Visualization products and calculations

#### 3.3.1 Total abundance per beach per year

Quantities of litter in this product are obtained applying normalizations described in the previous sections (§3.2) and with the following computation for each beach and year:

$$Total\ abundance = \frac{\sum number\ of\ items\ (normalized\ by\ 100\ m)}{Number\ of\ surveys\ on\ the\ year}$$

The legend of the maps shows 4 classes obtained with Percentiles 50, 75 & 95.

#### 3.3.2 Material categories percentage per beach per year

The material categories differ between reference lists. In order to apply a common procedure for all the surveys, the material categories have been harmonized as shown in Table 6 : Material categories in each reference list and the one harmonized categories applied to the products.

**Table 6 : Material categories in each reference list and the one harmonized categories applied to the products.**

	Harmonised material categories showed on the maps	OSPAR Material categories	ITA Material categories	TSG_ML Material categories	UNEP Material categories	UNEP_MARLIN Material categories
1	Artificial polymer materials	Plastic/ Polystyrene	Plastic and Polystyrene	Artificial polymer materials	Plastic	Plastic
					Foamed Plastic	Foamed Plastic
2	Cloth/Textile	Cloth	Fabrics	Cloth/Textile	Cloth	Cloth
3	Glass/Ceramics	Glass	Ceramic glass	Glass/Ceramics	Glass & ceramic	Glass & ceramic
		Pottery/Ceramics				
4	Medical litter	Medical waste	Medical litter			
5	Metal	Metal	Metal	Metal	Metal	Metal
6	Other			Undefined	Other	Other
				Unidentified		
7	Paper/Cardboard	Paper/Cardboard	Cardboard paper	Paper/Cardboard	Paper cardboard	Paper cardboard
8	Pollutants	Pollutants		Chemicals		
9	Processed/Worked wood	Wood	Wood	Processed/Worked wood	Wood	Wood
10	Rubber	Rubber	Rubber	Rubber	Rubber	Rubber
11	Sanitary litter	Sanitary waste	Sanitary litter			

The percentage of the harmonised material categories has been computed on each beach and year, applying normalizations described in the previous sections and with the following computation:

$$\text{Material \%} = \frac{\sum \text{number of items (normalized at 100 m) of each material category}}{\sum \text{number of items (normalized at 100 m) of all categories}} * 100$$

The legend of the maps shows 11 classes obtained with the main harmonised material categories present in Table 7.

### 3.3.3 Smoking related items / Fishing related items / Plastic bags related items abundance per beach per year



Because of their importance and presence on European legislations, litter types related with smoking activities, fishing activities and plastic bags have been considered for specific products. Tables 8, 9 and 10 summarize the litter types that have been taken into account for these products.

**Table 7 : Litter types by reference lists aggregated in the smoking related items product.**

Reference list	Item code	Smoking related items
OSPAR	16	Cigarette lighters
OSPAR	63	Cigarette packets
OSPAR	64	Cigarette butts
TSG_ML	G25	Tobacco pouches / plastic cigarette box packaging
TSG_ML	G26	Cigarette lighters
TSG_ML	G27	Cigarette butts and filters
TSG_ML	G152	Cigarette packets
UNEP	PL10	Cigarette lighters
UNEP	PL11	Cigarettes, butts & filters
UNEP_MARLIN	PL10	Cigarette lighters
UNEP_MARLIN	PL11	Cigarettes, butts & filters
ITA	IT31	Packets of cigarettes or parts
ITA	IT32	Cigarette butts and filters

**Table 8 : Litter types by reference lists aggregated in the fishing related items product.**

Reference list	Item code	Fishing related items
OSPAR	26	Crab/lobster pots
OSPAR	27	Octopus pots
OSPAR	28	Oyster nets or mussel bags including plastic stoppers
OSPAR	29	Oyster trays (round from oyster cultures)
OSPAR	30	Plastic sheeting from mussel culture (Tahitians)
OSPAR	32	String and cord (diameter less than 1 cm)

<b>OSPAR</b>	33	Tangled nets/cord/rope and string
<b>OSPAR</b>	34	Fish boxes
<b>OSPAR</b>	35	Fishing line (angling)
<b>OSPAR</b>	37	Floats/Buoys
<b>OSPAR</b>	71	Crab/lobster pots
<b>OSPAR</b>	80	Fishing weights
<b>OSPAR</b>	87	Lobster/crab pots and tops
<b>OSPAR</b>	95	Octopus pots
<b>OSPAR</b>	114	Lobster and fish tags
<b>OSPAR</b>	115	Nets and pieces of net < 50 cm
<b>OSPAR</b>	116	Nets and pieces of net > 50 cm
<b>OSPAR</b>	119	Fish boxes
<b>TSG_ML</b>	G42	Crab/lobster pots and tops
<b>TSG_ML</b>	G43	Tags (fishing and industry)
<b>TSG_ML</b>	G44	Octopus pots
<b>TSG_ML</b>	G45	Mussels nets, Oyster nets
<b>TSG_ML</b>	G46	Oyster trays (round from oyster cultures)
<b>TSG_ML</b>	G47	Plastic sheeting from mussel culture (Tahitians)
<b>TSG_ML</b>	G50	String and cord (diameter less than 1cm)
<b>TSG_ML</b>	G52	Nets and pieces of net
<b>TSG_ML</b>	G53	Nets and pieces of net < 50 cm
<b>TSG_ML</b>	G54	Nets and pieces of net > 50 cm
<b>TSG_ML</b>	G55	Fishing line (entangled)
<b>TSG_ML</b>	G56	Tangled nets/cord
<b>TSG_ML</b>	G57	Fish boxes - plastic
<b>TSG_ML</b>	G58	Fish boxes - expanded polystyrene
<b>TSG_ML</b>	G59	Fishing line/monofilament (angling)
<b>TSG_ML</b>	G61	Other fishing related
<b>TSG_ML</b>	G62	Floats for fishing nets
<b>TSG_ML</b>	G63	Buoys
<b>TSG_ML</b>	G132	Bobbins (fishing)
<b>TSG_ML</b>	G142	Rope, string and nets
<b>TSG_ML</b>	G163	Crab/lobster pots
<b>TSG_ML</b>	G164	Fish boxes
<b>TSG_ML</b>	G182	Fishing related (weights, sinkers, lures, hooks)
<b>TSG_ML</b>	G183	Fish hook remains
<b>TSG_ML</b>	G184	Lobster/crab pots
<b>TSG_ML</b>	G206	Glass buoys
<b>TSG_ML</b>	G207	Octopus pots
<b>UNEP</b>	CL04	Rope & string
<b>UNEP</b>	FP03	Foam buoys
<b>UNEP</b>	ME07	Fishing related (sinkers, lures, hooks, traps & pots)
<b>UNEP</b>	PL14	Plastic buoys



UNEP	PL15	Mesh bags (vegetable, oyster nets & mussel bags)
UNEP	PL17	Fishing gear (lures, traps & pots)
UNEP	PL20	Fishing net
UNEP_MARLIN	CL04	Rope & string
UNEP_MARLIN	FP03	Foam buoys
UNEP_MARLIN	GC06	Glass buoys
UNEP_MARLIN	ME07	Fishing related (sinkers, lures, hooks, traps & pots)
UNEP_MARLIN	PL14	Plastic buoys
UNEP_MARLIN	PL15	Mesh bags (vegetable, oyster nets & mussel bags)
UNEP_MARLIN	PL17	Fishing gear (lures, traps & pots)
UNEP_MARLIN	PL20	Fishing net
UNEP_MARLIN	WD02	Fishing traps and pots
ITA	IT9	Fenders / floats / buoys
ITA	IT15	Boxes and boxes for fish in polystyrene
ITA	IT16	Plastic containers for lures / fishing lines and fishing line in nylon (fishing) / plastic boxes and boxes for fish / nets and network pieces / ropes and tops
ITA	IT17	Baskets for the cultivation of oysters / nets or bags for mussels or oysters (socks) / plastic plates used in aquaculture or fishing / lobster pots
ITA	IT41	Leads / fishing weights / hooks

Table 9 : Litter types by reference list aggregated in the plastic bags related items product.

Reference list	Item code	Plastic bag related items
OSPAR	2	Bags (e.g. shopping)
OSPAR	3	Small plastic bags, e.g., freezer bags
OSPAR	60	Bags
OSPAR	112	Plastic bag ends
TSG_ML	G2	Bags
TSG_ML	G3	Shopping Bags incl. pieces
TSG_ML	G4	Small plastic bags, e.g. freezer bags incl. pieces
TSG_ML	G5	Plastic bag collective role; what remains from rip-off plastic bags
UNEP	PL07	Plastic bags (opaque & clear)
UNEP_MARLIN	PL07	Plastic bags (opaque & clear)
ITA	IT1	Envelopes, shoppers, garbage bags / small plastic bags, e.g., freezer bags / central part tear-off roll of plastic bags

Abundances for those specific items have been obtained on each beach and year using the following computation:

$$\text{Specific items abundance} = \frac{\sum \text{number of specific items (normalized at 100m)}}{\text{Number of surveys on the year}}$$

The legend of the maps shows 4 classes obtained with Percentiles 50, 75 & 95 obtained taking into account data from all years.

Due to the differences in the sampling of surveys based on protocol of UNEP Marlin (§3.2.4<sup>2</sup>), a separate map has been produced for the “smoking related items” of these surveys.

## 4 Seafloor Litter Products

### 4.1 Fields available in the table

The fields on the seafloor table are described according to the EMODnet litter formats.

**Table 10 : Columns in the table seafloor.**

Field	Description
ite_id	Ite identifier
survey_id	Survey identifier
surveyname	Survey name. If it doesn't exist, it will be provided by the ingestion system following this key: Country code, EDMO Code (4-digit length), year, six-digit number code for each survey (ex. IT22762012000001)
project_id	Project code from EDMERP (European Directory of Marine Environmental Research Projects)
date	Date of the cruise. Format ISO 8601 (YYYY-MM-DD)
ship	Last four-character code from the identifier in ICES Platform reference code
gear	Gear type code from Sampler Type "SMTYP" ICES vocab list
country	Identifier for the country that performed the survey from ISO countries reference code list
originator	EDMO code for data originator organization
collator	EDMO code for data collator organization
stno	Station code
haulno	Sequential numbering of hauls during cruise
coordrefsys	Coordinate reference system used: if not differently specified WGS84 (EPSG:4326) reference system is assumed. Please specify the "Identifier"
shootlat	Haul Start Latitude ( <b>Degree.Decimal Degree</b> ) - when the net is launched
shootlong	Haul Start Longitude ( <b>Degree.Decimal Degree</b> ) - when the net is launched
haullat	Haul End Latitude ( <b>Degree.Decimal Degree</b> ) - when the net is floated back
haullong	Haul End Longitude ( <b>Degree.Decimal Degree</b> ) when the net is floated back
hauldepth	Trawling measure depth in <b>metres</b>
distance	Distance in <b>metres</b> between haul start and haul end point
wingspread	Linear distance in metres of wingspread
ltref	Litter reference list. Reference code of the list used for categorizing litter. It is

	strongly recommended the use of the Master List of Litter Categories ( <b>TSG-ML</b> )
param	Litter parameter code from the chosen litter reference list
ltszc	Litter size code. If multiple objects of same type were counted in different sizes, group by size category.
ltsrc	Litter source. If the source of litter origin is possible to identify, the appropriate option should be reported here.
typpl	Type of polymer. If litter is a recognizable polymer (by f.ex. a recycling stamp or a lab analysis), enter the respective code for the polymer type
ltprp	Litter properties that may be deemed important for reporting
unitwgt	Weight units
lt_weigh	Weight of the litter category (by type, size, and additional parameters) in units specified by the previous field
unititem	Units used to report amount of items in trawl survey litter
lt_items	Number of items within the given litter category (by type, size, and additional parameters) in units specified by the previous field
shot_timestamp	Start UTC timestamp of haul. Format ISO 8610(YYYY-MM-DDThh:mm:ssZ)
hauldur	Haul duration in <b>minutes</b> . Start time is the moment when the gear settles at the bottom at the stated towing speed. Stop is defined as the start of hauling of the gear

## 4.2 Visualization products and calculations

### 4.2.1 Trawls location map

This product shows the location of all the surveys present in the database. Different fishing gears used are represented using different colours.

### 4.2.2 Total litter density per trawl per year

To calculate the density i.e. the number of items per km<sup>2</sup>, the swept area is required. The swept area is calculated from the wingspread (which depends on the fishing gear type) and the distance trawled. In the cases where the wingspread and/or the trawled distance are unknown, effective values were calculated from available information, when possible, specifically, the distance:

$$Distance = Haul\ duration * Ground\ speed$$

While the calculation of the effective wingspread is based in a general formula (van Hal, 2017) which considers other parameters known of the net, thus introducing some inaccuracies:

$$Wingspread = doordpread * 0.18870 + 5.87280$$

$$Doorspread = 14.2 * \log(\text{Depth}) = 16.72 * \log(\text{Warp\_length}) + 18.49$$

This method may be improved in the future.

The used formula for the swept area and density is:

$$\text{Density (number of items per km}^2\text{)} = \frac{\sum \text{number of items}}{\text{Swept area}}$$

Percentiles 50, 75 & 95 have been calculated taking into account data from all years.

#### 4.2.3 Material categories percentage

At first step, harmonization of the material categories between ICES and MEDITS lists has been performed. Table below shows categories obtained:

**Table 11. Material categories in each reference list and the one harmonized categories applied to the products.**

Harmonized material categories	ICES Material categories	MEDITS Material categories
<b>Glass/Ceramics</b>	Glass/Ceramics	Glass / Ceramic
<b>Metal</b>	Metals	Metal
<b>Miscellaneous</b>	Miscellaneous	
<b>Cloth (textile) / Natural fibres</b>		Cloth (textile) / Natural fibres
<b>Other</b>		Other + Unspecified
<b>Natural products</b>	Natural products	
<b>Paper and Cardboard</b>		Paper and Cardboard
<b>Wood processed (palettes, crates, etc.)</b>		Wood processed (palettes, crates, etc.)
<b>Plastic</b>	Plastic	Plastic
<b>Rubber</b>	Rubber	Rubber

Then, the following calculation has been applied:

$$\text{Material \%} = \frac{\sum \text{number of items of each material category}}{\sum \text{number of item of all material categories}} * 100$$

#### 4.2.4 Fishing related items / Plastic bags related items abundance per trawl per year

The specific types taken into account for the fishing related items and plastic bag related items grouping are shown in Tables 13 and 14.

**Table 12 : Litter types by reference list aggregated in the seafloor fishing related items product.**

Reference list	Item code	Fishing related Items
ICES	A5	Plastic fishing line (monofilament)
ICES	A6	Plastic fishing line (entangled)
ICES	A7	Synthetic rope
ICES	A8	Plastic fishing net
ICES	B3	Fishing related metal
ICES	C3	Rubber bobbins (fishing)
MEDITS	L1i	Synthetic Ropes / Strapping bands
MEDITS	L1g	Fishing lines (polymers)
MEDITS	L1f	Fishing nets (polymers)
MEDITS	L3f	Fishing related (hooks, spears, etc.)
MEDITS	L5c	Natural fishing ropes

**Table 13. Litter types by reference list aggregated in the seafloor plastic bags related items product.**

Reference list	Item code	Plastic bags related Items
ICES	A3	Plastic bag
MEDITS	L1a	Plastic bags

Density for those specific items has been obtained for each trawl and year using the following computation:

$$\text{Density of specific Litter items (number of items per Km}^2\text{)} = \frac{\sum \text{number of specific items}}{\text{Swept area}}$$

## 5 References

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### 5.1 *Beach Litter references*

- OSPAR – Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area - 2010
- OSPAR – Intermediate assessment 2017 – Beach litter – Abundance, Composition and Trends
- JRC Technical Reports – Top Marine Beach Litter Items in Europe – 2017
- JRC Scientific and Policy Reports – Guidance on Monitoring of Marine Litter in European Seas – 2013
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- UNEP - Marine Litter Assessment in the Mediterranean – 2015
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- Ministero dell’Ambiente e della Tutela del Territorio e del Mare - Programmi di Monitoraggio per la Strategia Marina, Art. 11, D.lgs. 190/2010 – 2014
- EMODnet Chemistry - Guidelines and forms for gathering marine litter data –2018
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### 5.2 *Seafloor Litter references*

- OSPAR (2017). “Intermediate Assessment 2017: Beach Litter - Abundance, Composition and Trends”. <https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/>
- Protocole for Monitoring Marine Litter on a voluntary basis in MEDITS-Handbook, Version n. 7, 2013, MEDITS Working Group - p 115-118
- Collection of marine litter from trawl – Chapter 3.4 + Annex 15 in Manual for the International Bottom Trawl Surveys. Series of ICES Survey Protocols. SISP 1-IBTS VIII. 2012. p36.
- MSFD – Evaluation 2018 de l’état écologique de la DCSMM pour le Descripteur 10 Déchets marins - O. Gérigny et al
- EMODnet Chemistry - Guidelines and forms for gathering marine litter data –2018
- Seafloor Litter monitoring – R. Van Hal - IBTS 2017

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