EMODnet

European Marine Observation and Data Network

EMODnet Thematic Lot n° 4 - Chemistry

Visualization products for Seafloor Litter data

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History

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I. Introduction

EMODnet Chemistry included marine litter in its last phase. 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 Data Management Systems. In particular, beach litter and seafloor litter data have been ingested in a database (MLDB) 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[1] (Galgani *et al*, 2020; M. Vinci *et al,* 2021).

In addition to data collection, 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 to consistently represent data within the limits of compatibility of the data sampling methodologies.

The products described in this guideline refer to seafloor litter data. The harmonization of all 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. 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 of seafloor litter.

PROTOCOLS	REFERENCE LISTS
ICES[2]	C-TS-REV: Revised CEFAS Trawl Litter Survey parameters (2013) RECO_LT: ICES RECO litter list
MEDITS	MEDITS
TSG-ML	Master List[3]

The reference documents to the monitoring protocols are the following:

- ICES:
  - Manual for the International Bottom Trawl Surveys (ICES, 2012).
- MEDITS:
  - MEDITS-Handbook (MEDITS, 2017).
- TSG-ML:
  - Guidance on Monitoring of Marine Litter in European Seas (MSFD Technical Subgroup on Marine Litter Group, 2013).

More information can also be find in the “Guidelines and forms for gathering marine litter data” (Galgani *et al*, 2020).

Within the same protocol, different types of gear are deployed during bottom trawling surveys.

[1] https://www.emodnet-chemistry.eu/about/documents

[2] https://vocab.ices.dk/?ref=1381

[3] These products are based on general codes from the Masterlist established in 2013. The latest Joint List of Litter Categories for Macrolitter Monitoring made in 2021 (general codes and J-codes) (Fleet *et al*., 2021) will be considered in the next phase of the project.

This document describes the data management and computation methods used to produce the EMODnet Chemistry 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.**

II. Data management

OGS has implemented an Application Programming Interface (API) to allow Ifremer to access continuously updated data from the MLDB in comma-separated values format (.csv).
This format is not directly usable for data cartography. It has been transformed to facilitate the implementation of queries for the different calculation methods.
Dataset consists of a table that contains seafloor litter surveys and results. This table has been integrated via QGIS (BD manager) into an Ifremer PostgreSQL database used for the mapping analysis of seafloor litter data. In this database, the table keeps the same structure.
From this table, processing requests have been set up to create different products:

- The trawls locations;
- The marine litter material categories percentage per trawl per year;
- The density of seafloor litter per trawl per year;
- The density of fishing related items per trawl per year;
- The density of plastic bags related items per trawl per year.

A Web Map Service (WMS) has been set up to load the data analysis layers and the associated graphic semiology (symbology, labeling, legend, etc.) produced through Mapserver.
Maps can be visualized through OceanBrowser[4] and associated metadata are available through the Sextant Catalogue Service[5]. A Web Feature Service (WFS) has also been set up to allow data to be downloaded.

[4] http://ec.oceanbrowser.net/emodnet/

[5] http://www.emodnet-chemistry.eu/products/catalogue/

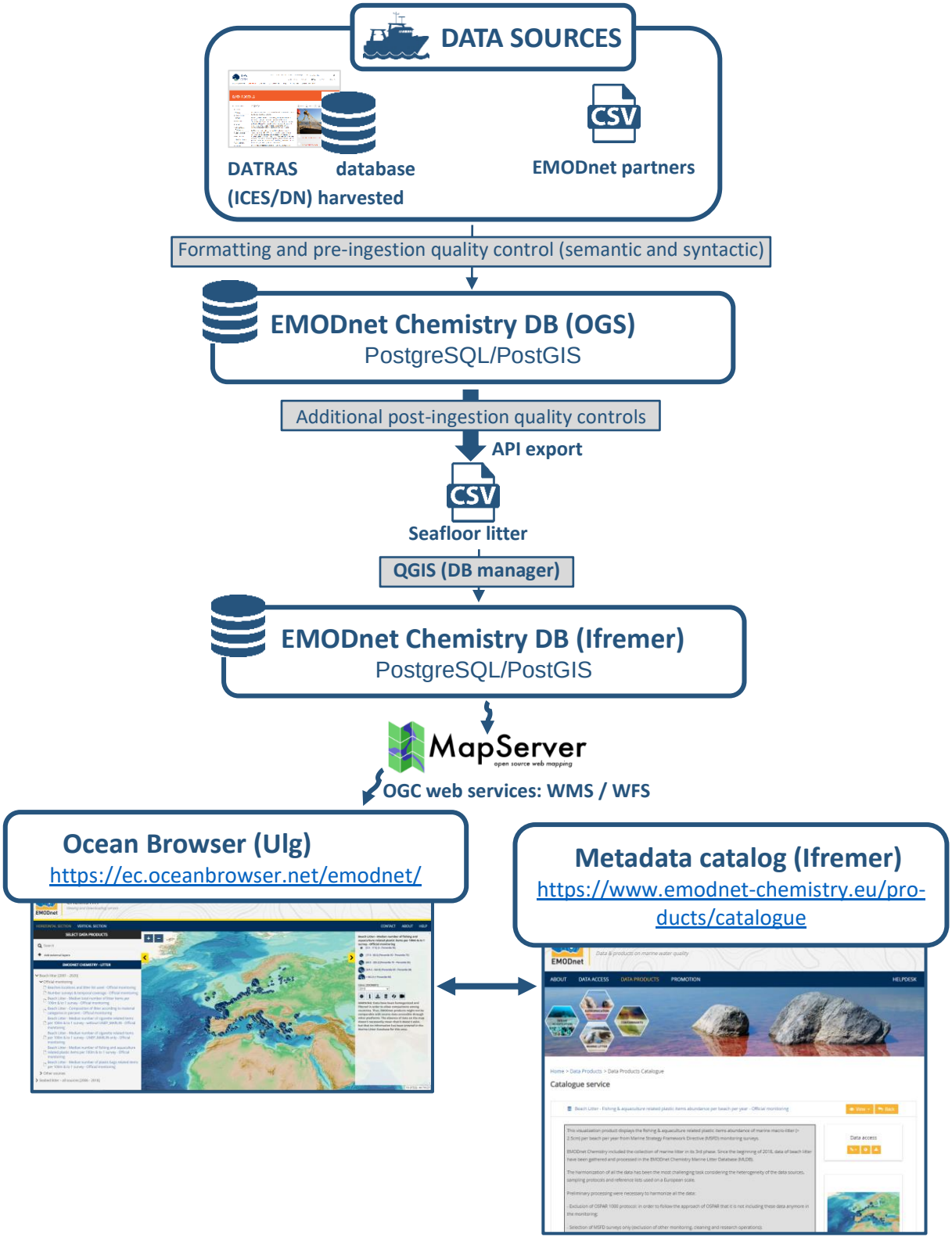

Figure 1: Data management scheme.

III. Data description

1. Fields available in data tables

In this section, the fields of the seafloor table are described according to the EMODnet litter formats.

Table 2: Columns in the table seafloor (Galgani *et al*, 2020).

Field	Description	Reference
SurveyName	Survey name. If it does not 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).	
ProjectCode	Project code from EDMERP (European Directory of Marine Environmental Research Projects).	https://edmerp.seadatanet.org/search
DataPolicy	Data access restriction policies.	http://vocab.nerc.ac.uk/collection/L08/current
Date	Date of the cruise. Format ISO 8601 (**YYYY-MM-DD**).	
Ship	Last four characters code from the identifier in ICES Platform reference code.	https://vocab.ices.dk/?ref=315
Gear	Gear type code from ICES vocab list.	https://vocab.ices.dk/?ref=2
Country	Identifier for the country that performed the survey from ISO 3166 countries reference code list.	https://vocab.ices.dk/?ref=337
Originator	EDMO code for data originator organization.	https://edmo.seadatanet.org/
Collator	EDMO code for data collator organization.	https://edmo.seadatanet.org/
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 **(Degree.Decimal Degree**) - when the net is launched. Value between -90 and 90.	
ShootLong	Haul start longitude (**Degree.Decimal Degree**) - when the net is launched. Value between -180 and 180.	
HaulLat	Haul end latitude (**Degree.Decimal Degree**) - when the net is floated back. Value between -90 and 90.	
HaulLong	Haul end longitude (**Degree.Decimal Degree**) - when the net is floated back. Value between -180 and 180.	
Depth	Trawling measure depth in **metres**.	
Distance	Distance in **metres** between haul start and haul end point.	
GroundSpeed	Ground speed of towing in **knots**.	
WingSpread	Linear distance in metres of wingspread in **metres**.	
DoorSpread	Linear distance in metres of door spread in **metres**.	
WarpLength	Length of warp in **metres**.	
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 (**TSG-ML**).	http://vocab.ices.dk/?ref=1381
PARAM	Litter parameter code from the chosen litter reference list.	

Field	Description	Reference
LTSZC	Litter size code. If multiple objects of same type were counted in different sizes, group by size category.	http://vocab.ices.dk/?ref=1380
LTSRC	Litter source. If the source of litter origin is possible to identify, the appropriate option should be reported here.	http://vocab.ices.dk/?ref=1382
TYPPL	Type of polymer. If litter is a recognizable polymer (e.g., a recycling stamp or a lab analysis), enter the respective code for the polymer type.	http://vocab.ices.dk/?ref=1385
LTPRP	Litter properties that may be deemed important for reporting.	http://vocab.ices.dk/?ref=1403
UnitWgt	Weight units.	http://vocab.ices.dk/?ref=1421
LT_Weight	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.	http://vocab.ices.dk/?ref=1422
LT_Items	Number of items within the given litter category (by type, size, and additional parameters) in units specified by the previous field.	
Shoot_timestamp	Start UTC timestamp of haul. Format ISO 8601 (**YYYY-MM-DDThh:mm:ssZ**).	
HaulDur	Haul duration in **minutes**. 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.	
LocalCDI	Survey identifier preceded by “2000”.	

The Annex B – Trawl scheme shows the distinction between wingspread and door spread measurements.

2. Preliminary processing

a. ICES reference list

The Revised CEFAS Trawl Litter Survey parameters (C-TS-REV) and ICES RECO litter list (RECO_LT) reference lists have been replaced with "ICES" in the "Original litter reference list" field of the visualization products attribute table.

b. Data exclusion

Surveys with an unknown number of items were excluded from all products (even if the weight is reported). Moreover, surveys with an unknown wingspread were excluded from density maps (see §3.c).

3. Visualization products and calculations

a. Trawls location map

This visualization product displays the location of all the surveys present in the EMODnet marine litter database (MLDB). The different fishing gears used are represented by different colours.

Unlike the density maps, all trawls surveyed since 2006 are included in this map even if the wingspread is unknown.

b. Material categories percentage

This visualization product displays the marine litter material categories percentage per trawl per year.

Unlike the density maps, all trawls surveyed since 2007 are included in this map even if the wingspread is unknown (and the material categories are not specified in the 2006 data).

The harmonization of the material categories between the ICES and MEDITS lists has been achieved. The table below shows categories obtained:

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

Table 3. Material categories in each reference list and the harmonized categories applied to the products.

Then, the following calculation has been applied:

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

c. Density maps

Three types of density maps are available:

- Density of seafloor litter per trawl per year for all items;
- Density of seafloor litter per trawl per year for fishing related items;
- Density of seafloor litter per trawl per year for plastic bags related items.

For these maps, in cases where the wingspread and/or number of items were unknown, data could not be used because these fields are needed to calculate the density. This is the reason why data acquired before 2011 are not visible in these products.

Sometimes the distance reported in the data is null. In this case, if the ground speed and the haul duration are known, the distance was calculated using the following formula:

$$Distance\ (km) = Haul\ duration\ (h) * Ground\ speed\ (km/h)$$

If these two fields were not filled in, the distance was calculated from the trawl coordinates.

Then, the swept area is calculated from the wingspread (which depends on the fishing gear type) and the distance trawled:

$$Swept\ area\ (km^2) = Distance\ (km) * Wingspread\ (km)$$

Finally, densities could be calculated for each trawl and year using the following calculation:

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

The 50, 75, 95 and 99 percentiles were calculated using data from all years to define the threshold values for symbol size.

- **List of items included in the map of the density of the fishing related items**

Reference list	Item code	Fishing related Items
ICES (C_TS_REV)	A5	Plastic fishing line (monofilament)
ICES (C_TS_REV)	A6	Plastic fishing line (entangled)
ICES (C_TS_REV)	A7	Synthetic rope
ICES (C_TS_REV)	A8	Plastic fishing net
ICES (C_TS_REV)	B3	Fishing related metal
ICES (C_TS_REV)	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 4. Litter types by reference list aggregated in the seafloor fishing related items product.

- **List of items included in the map of the density of the plastic bags related items**

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

Table 5. Litter types by reference list aggregated in the seafloor plastic bags related items product.

References

Fleet D., Vlachogianni Th. and Hanke G., 2021. A Joint List of Litter Categories for Marine Macrolitter Monitoring. EUR 30348 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-21445-8, doi:10.2760/127473, JRC121708.

Galgani F., Giorgetti A., Le Moigne M., Brosich A., Vinci M., Lipizer M., Molina Jack M. E., Holdsworth N., Schlitzer R., Hanke G., Moncoiffe G., Schaap D., Giorgi G., Addamo A., Chaves Montero M.D.M., 2020. Guidelines and forms for gathering marine litter data, 11/01/2021, 58 pp., DOI: 10.6092/15c0d34c-a01a-4091-91ac-7c4f561ab508.

ICES, 2012. Manual for the International Bottom Trawl Surveys. Series of ICES Survey Protocols. SISP 1-IBTS VIII. 68 pp. ISBN 978-87-7482-112-0. http://doi.org/10.17895/ices.pub

Institute for Environment and Sustainability (Joint Research Centre), MSFD Technical Subgroup on Marine Litter Group (2013). Guidance on Monitoring of Marine Litter in European Seas. JRC83985 EUR 26113 EN – ISSN 1831-9424 (online), ISSN 1018-5593 (print) ISBN 978-92-79-32709-4 (pdf) ISBN 978-92-79-32710-0 (print). https://doi.org/10.2788/99816 ; https://doi.org/10.2788/99475

MEDITS, 2017. MEDITS-Handbook. Version n. 9. 106 pp.

OSPAR, 2017. Composition and Spatial Distribution of Litter on the Seafloor. Intermediate Assessment. Available at: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/marine-litter/composition-and-spatial-distribution-litter-seafloor

Vinci M., Giorgetti A., Galgani F., Moncoiffe G., Fichaut M., Molina Jack M.E., Schlitzer R., Hanke G., Schaap D., Partescano E., 2021. Guidelines and formats for gathering and management of micro-litter data sets on a European scale (floating and sediment micro-litter). Version 0, 26/04/2021, 28 pp., DOI:10.6092/d3e239ec-f790-4ee4-9bb4-c32ef39b426d.

Acronyms

API	Application Programming Interface
C-TS-REV	Revised CEFAS Trawl Litter Survey parameters
DATRAS	Database of Trawl Surveys
DB	Database
EDMERP	European Directory of Marine Environmental Research Projects
EDMO	European Directory of Marine Organisations
EMODnet	European Marine Observation and Data Network
EPSG	European Petroleum Survey Group
GES	Good environmental status
ICES	International Council for the Exploration of the Sea
Ifremer	French Research Institute for Exploitation of the Sea
ISO	International Organization for Standardization
MEDITS	International bottom trawl surveys in the Mediterranean
MLDB	Marine Litter Database
MSFD	Marine Strategy Framework Directive
OGS	National Institute of Oceanography and Applied Geophysics (Italy)
RECO_LT	ICES RECO litter list
TSG-ML	MSFD GES Technical Subgroup on Marine Litter
Ulg	University of Liège
WFS	Web Feature Service
WMS	Web Map Service

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Annex B – Trawl scheme

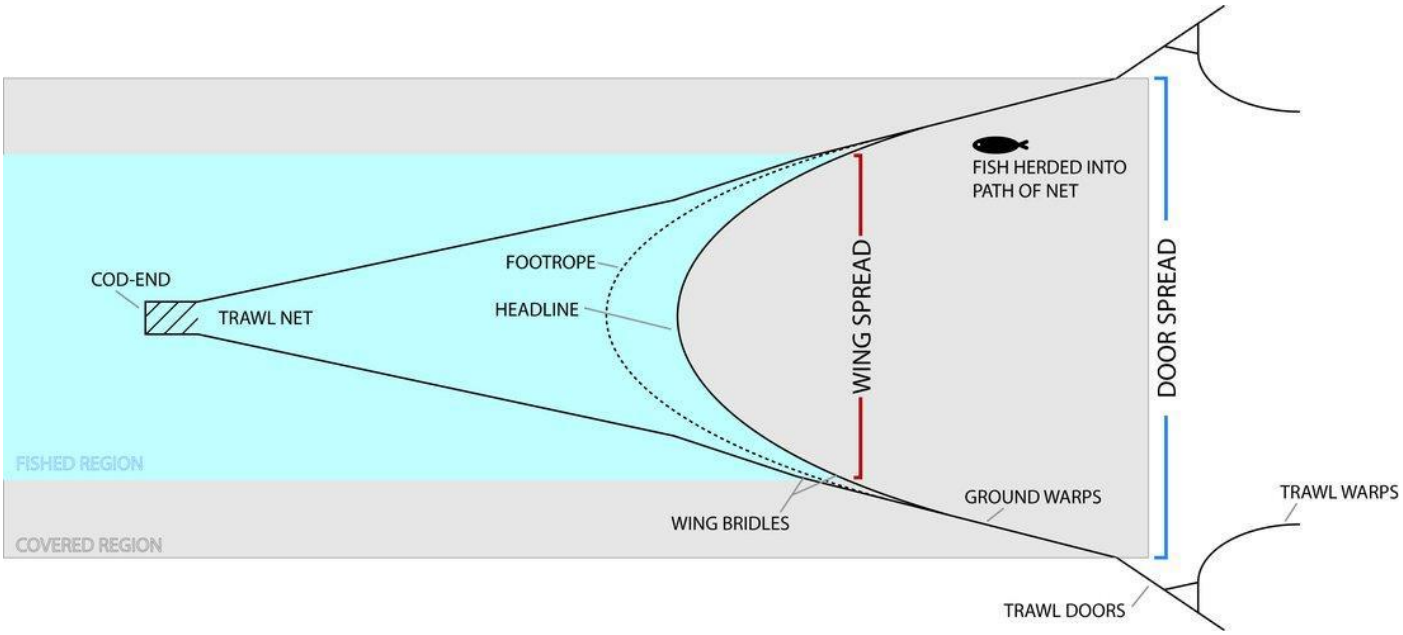

Figure 2. Scheme of the trawl elements (OSPAR, 2017; Galgani *et al*, 2020).