# ICES WGML REPORT 2018

HUMAN ACTIVITIES, PRESSURES AND IMPACTS STEERING GROUP

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# Interim Report of the Working Group on Marine Litter (WGML)

23–27 April 2018

ICES Headquarters, Copenhagen, Denmark

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

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## Executive summary

The newly established ICES Working Group on Marine Litter (WGML) held its first meeting at ICES HQ, Copenhagen, Denmark, 23–27 April 2018. The meeting attracted 17 participants representing 9 ICES member countries. In addition, ICES staff members from the Data Centre, Anna Osypchuk and Marilynn Sørensen, participated in the meeting.

The goal of the WGML is to provide scientific guidance towards the international harmonisation of monitoring data for seafloor litter and microlitter. In addition, the WGML will function as a knowledge base for other international organisations regarding these two issues. The WGML mapped seafloor litter/microplastic monitoring approaches & issues amongst group members and discussed the best channels to distribute key information produced by WGML by establishing an overview of national and international drivers and linkages. Work on a combined road map on seafloor litter and microplastic for the next 1/5/10 years was initiated. The annual meeting was split into sessions on seafloor litter and microplastic (2.5 days each).

The activities towards seafloor litter focused on reviewing and assessing the quality and potential uses of current data in ICES DATRAS. In general, coverage by year and country is quite good, but some data gaps exist. Issues with the existing data and methods were highlighted and used as a basis to outline approaches for harmonising sampling and categorisation approaches. These data issues hamper direct comparisons and harmonisation, while restricting assessment products. To assist in the classification of marine litter in future, a photo library of litter items was produced. Finally, the WGML generated guidance documents and SOPs for sampling, data reporting and QA/QC, which included defined terminology.

The activities towards microplastic in ICES DOME included recommendations for sampling of microplastic in different environmental matrices (sediments, water, biota), identification and classification of microplastic materials, QA/QC, and creating an overview of existing microplastic datasets from WGML members. During the meeting ICES WGML tested the submission procedure for microplastic data to the ICES Data Centre.

# 1 Administrative details

**Working Group name**

Working Group on Marine Litter (WGML)

**Year of Appointment within current cycle**

2018

**Reporting year within current cycle (1, 2 or 3)**

1

**Chair(s)**

Thomas Maes, UK

Andy Booth, Norway

Francois Galgani, France

**Meeting dates**

23–27 April 2018

**Meeting venue**

ICES HQ, Copenhagen, Denmark

# 2 Terms of Reference

| ToR | Description | Background | Science Plan topics addressed | Duration | Expected Deliverables |
|---|---|---|---|---|---|
| a | Respond to requests for external and internal advice (e.g. EU, Regional Seas Conventions, ICES Data Centre/Secretariat) as required | Science or Advisory Requirements. | 1,2,9,11, 12, 13, 25, 26, 27, 28, 31 | Y1-3 | Advice and review document as required |
| b | Review and report on developments in MSFD, other EU directives and international frameworks regarding marine litter. | Follow-up on future needs is key to constructively guiding and supporting the development process for monitoring, threshold development and impact assessment. | 1,2,9,11, 12, 13, 25, 26, 27, 28, 31 | Y1-3 | Annual reporting |
| c | Review and propose guidance for seafloor | The aim is to provide guidance in solving | 1,2,9,11, 12, 13, 25, 26, 27, 28, 31 | Y1-3 | Annual reporting consisting of |

| | | | | | |
|---|---|---|---|---|---|
| | litter and microplastic monitoring and assessment to support expected ICES data needs based on the review in ToRa | problems for sampling, data comparability and ICES data submissions. | | | guidelines and review of Standard Operating Procedures (SOP), scientific publication |
| d | Propose a possible strategy or road map for ICES to follow with respect to seafloor litter and microplastic research and monitoring | Required for standardisation of monitoring and subsequent assessments | 1,2,9,11, 12, 13, 25, 26, 27, 28, 31 | Y3 | Seafloor litter monitoring and research strategy for attention of SCICOM, scientific publication |
| e | Interact with exisiting bodies, projects and organisations e.g. OSPAR, HELCOM, GESAMP, JPI Oceans to develop and report on international developments in marine litter research and monitoring | To avoid duplication of effort and improve international coordination and communication | 1,2,9,11, 12, 13, 25, 26, 27, 28, 31 | Y1-3 | Annual reporting |
| f | Report new developments in quality assurance in marine litter monitoring in Europe, and provide information on other proficiency testing schemes with relevance to WGML. | Availability of high quality proficiency testing is vital to produce reliable results. | 1,2,9,11, 12, 13, 25, 26, 27, 28, 31 | Y1-3 | Annual reporting, guidance for proficiency testing, ICES Cooperative Research Report (CRR) or Techniques in Marine Environmental Sciences (TIMES) |

# 3 Summary of Work plan

| | |
|---|---|
| Year 1 | Respond to requests under ToR a, e & f<br>Begin review paper to start to address ToRs c & d;<br>Gather information on network of experts for topic to address ToR b, c & e<br>Develop and set out matrix of knowledge gaps for remaining ToRs;<br>Progress work towards completion of the remaining ToRs<br>It will be important to revise current practices and activities in relation to seafloor litter and microplastic monitoring and assessment to take stock of different approaches in the light of international requirements and to make future recommendations for ICES e.g. sampling methods, protocol updates, monitoring programme guidelines, analytical methods, assessment methods, gear comparisons, data statistical power of monitoring programmes and QA/QC<br>Produce Interim Report |
| Year 2 | Respond to requests under ToR a<br>Progress work towards completion of the remaining ToRs<br>Continue review paper activity to address ToRs c & d<br>Further develop matrix of knowledge gaps in relation to national and international knowledge and produce network map and advise documents as required<br>Produce Interim Report |
| Year 3 | Respond to requests under ToR a<br>Finalise review papers ready for submission for ToRs c and d; finalise matrices and interpret output to address other ToRs<br>Produce Final Report |

# 4 List of Outcomes and Achievements of the WG in this delivery period

### General

- WGML mapped seafloor litter/microplastic monitoring approaches & issues amongst group members (Annex 3 & 4).
- WGML discussed and selected the best channels to distribute key information produced by the group (Annex 5).
- WGML provided an overview of national and international drivers and linkages (Annex 5).
- WGML established a network folder to collect relevant publications and documents.
- WGML started developing a combined road map on seafloor litter and microplastic for the next 1/5/10 years showing interactions with relevant project, organisations and institutes, key events and descision points (Annex 5).
- WGML discussed QA/QC existing schemes and potential for WGML monitoring: no existing scheme for seafloor litter monitoring yet, possibly in future for microplastics via an extension of Quasimeme and JPI Oceans Baseman (Annex 6).
- WGML suggested checks and developed data submission guidelines for DATRAS and DOME (Annex 7).

### Seafloor Litter

- WGML created simple overviews of seafloor litter data in the ICES database DATRAS (surveys/areas/trawls/data availability) (Annex 3a, 4 & 8) and summarised general observations on the data:
    - Good database already on litter at the seafloor in DATRAS following international guidelines (started in 2012).
    - For the North Sea most data are related to IBTS and mostly performed with GOV gear.
    - For the Baltic Sea most data are related to BITS and mostly performed with TVS and TVL gears
    - For the western waters, most data are related to the surveys coordinated by the IBTSWG and mostly performed by otter trawls (GOV, BAK)
    - North Sea and Western areas are also covered by the beam trawls that might have better seafloor litter catchability
    - In general, coverage by year and country is quite good, but some data gaps exist.
- WGML defined terminology and questions (e.g. fragments, tangled, weights, habitats, …), unclarities, critical issues, differences in sampling and data outputs. A summary of the current monitoring issues with seafloor litter data is provided in Annex 9a.
- WGML provided a summary of the current statistical and sampling issues for seafloor litter and WGML discussions in Annex 9b.
- WGML outlined common grounds and agreed best ways forward on questions from ICES WGML members on data collection and seafloor litter classification taken up into the monitoring guidelines/photoguide.
- WGML developed additional seafloor litter sampling guidelines, SOPs (Annex 9c) and photoguides (Annex 9d).
- WGML defined additional QA/QC improvements for next year: Ringtest, video training, interactive fora, data logging app, submission format training.
- WGML discussed potential data and assessment options:
    - regional assessments, country sampling differences, trawl comparability, mesh sizes, inter/intra variability, power, **weight**, **presence/absence**.
- WGML discussed and summarised (Annex 10) what could be done in terms of an overall assessment of seafloor litter levels from the 14 surveys available.
- WGML defined current data issues with users/submitters/receivers and identified ways forward (Annex 7)
    - minimum required/missing data/incorrect/wing-door spread/-9-0
- WGML tested datasets intended for DOME with ICES Data Centre. DOME is open for Microplastics/non-DATRAS Seafloor litter submissions (ERF3.2 or Simplified Format).

### Microplastics

- WGML attempted to map available microplastic data in DATRAS/DOME: no microplastic data are in the ICES databases. By survey design, only macroplastic litter can be found in DATRAS surveys. Data on microplastic can be submitted to DOME, however no data have been successfully submitted. The format for data submission is being discussed with ICES data experts.
- WGML developed outlines for microplastic sampling, analysis and QA/QC guidelines, including upcoming proficiency schemes. OSPAR Candidate Indicator Doc used as guiding doc (Annex 11)
- WGML established overview of monitoring of microplastic in sediments, biota or water which is performed regularly by some countries (Finland, Netherlands, United Kingdom), but start dates varied (Annex 3b).
    - Finland is the best candidate, pilot monitoring carried out at fixed open sea stations since 2013, will be implemented to the national monitoring program from 2018
    - Many countries have ongoing research programmes covering the North Sea and the Baltic Sea that are establishing methods and baselines for future microplastic monitoring (Annex 3b).
    - There are many research activities concerning microplastic in various matrices across Europe, with more data relevant for monitoring expected to come in the future (Annex 3c).
- During the meeting, ICES WGML attempted to submit existing microplastic data to the ICES Data Centre for evaluation and testing of the DOME data system.

## 5 Progress report on ToRs and workplan

### Progress by ToR

**ToR a:** The group did not receive requests for external and internal advice (e.g. EU, Regional Seas Conventions, ICES Data Centre/Secretariat)

**ToR b:** WGML took into account advice from EU directives and international frameworks regarding marine litter and fed this information into the roadmap. More detailed information can be found in Annex 5.

**ToR c:** WGML group members reviewed existing data in the ICES database to propose guidance for seafloor litter and microplastic monitoring to support expected ICES data needs and assessment outputs. An overview of the seafloor litter data in DATRAS and how these differ by countries can be found in Annex 8. The group produced guidance documents for sampling, including a photo guide, and data submissions. This information is presented in Annexes 7 & 9.

**ToR d:** WGML integrated key dates with respect to seafloor litter and microplastic monitoring meetings, project outcomes and initiatives into the roadmap of TOR b. More detailed information can be found in Annex 5.

**ToR e:** WGML reviewed OSPAR, HELCOM and JPI Oceans outputs to take into account international developments in marine litter research and monitoring. The group used the OSPAR marine litter indicator documents, assessments and developments to guide discussions and needs. Recommendations for monitoring, data submissions and future assessments were given in Annex 7, 9 & 10.

**ToR f:** WGML discussed potential quality assurance and quality control options for marine litter monitoring in Europe. A QA/QC Framework for microplastic monitoring and analysis is given in Annex 12.

#### Cooperation with other WGs

- WGBEC: To evaluate the results of marine litter monitoring and research activities, especially microparticles (plastic/non plastic) and associated chemicals.
- MCWG: The marine chemistry working group focuses its works on the status and fate of pollutants in marine ecosystems and chemical oceanography. Related to litter and microplastics, the marine chemistry working groups is interested in the presence of chemical pollutants sorbed on plastics, the leaching of plastic additives to the environment and the quality assessment and quality control of analytical methods applied for microplastic determination. Therefore, MCWG expressed its interest in the outcome of the Working Group on Marine Litter in its last meeting in Vigo, March 2018.
- WGMS*:* Microplastics are of emerging concern and may be a vector for contaminant transfer to sediments, or from sediments to biota

Some other potential overlaps with WGs were highlighted, and WGML recommendations and reports will be taken forward by members who sit on both groups. These include WGZE, WGEEL, IBTSWG, WGBEAM, WGBIFS.

#### Science Highlights

- Large amounts of seafloor litter data available;
- Good spatial coverage for seafloor litter data since 2012;
- Seafloor litter assessments already possible using presence/absence and weight;
- Microplastic monitoring starting across Europe;
- Available microplastic techniques from a monitoring perspective;
- First examples of MP monitoring programme present across ICES WGML Members.

## 6 Revisions to the work plan and justification

Potential revision to ToR b). To be confirmed at a later stage.

# 7 Next meetings

Year 2018

23–27 April ICES HQ, Copenhagen, Denmark

Interim report by 31 May 2018 to HAPISG

Collaboration with OSPAR & HELCOM

**Year 2019**

DATE PICES HQ, Vancouver, Canada

Interim report by 31 May 2019 to HAPISG

Collaboration with PICES

**Year 2020**

DATE CIESM HQ, Monaco

Final report by 31 May 2020 to SCICOM

Collaboration with CIESM

## Annex 1: List of participants

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|---|---|---|---|
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## Annex 2: Recommendations

| Recommendation | Adressed to |
|---|---|
| 1. Collect, count, and report litter data according to the two guidance documents produced by WGML-2018.<br>a) Distribution of the manual on sampling, identification and registration of sea floor litter caught in bottom trawl surveys.<br>b) Distribution of the document on suggestions for quality assurance/quality control measures for studies on micro litter. | IBTSWG, WGBIFS, WGBEAM, WGBEC, MCWG, WGMS, WGZE, WGEEL |
| 2. Improve quality assurance of the ongoing marine litter data submissions (see Annex 6 and 7). It is recommended to implement ringtest, video training, interactive fora, data logging app, submission format training. | ICES Data Centre |
| 3. Implement litter size reporting for the seafloor litter as dimensions L-W-D in parallel with LTSZC | ICES Data Centre |
| 4. Follow Litter Data Collection Guidelines by WGML (Annex 9c).<br>a) Seafloor litter data requested via DATRAS<br>b) All microplastic data requested via DOME<br>c) Other litter data requested via DOME | IBTSWG, WGBIFS, WGBEAM, WGBEC, MCWG, WGMS, WGZE, WGEEL, Relevant national data submitters |
| 5. Contact ICES Data Centre with data reporting issues (accessions@ices.dk) | IBTSWG, WGBIFS, WGBEAM, WGBEC, MCWG, WGMS, WGZE, WGEEL, data submitters |
| 6. Improve the descriptions in C-TS-REV of categories A5 and A6, since not all monofilaments are fishing lines. For A5, it is suggested to use “monofilaments”, for A6 “entangled filaments” (see Annex 9a). | ICES Data Centre |
| 7. National submitters to correct historic data (see Annex 9b) | IBTSWG, WGBIFS, WGBEAM |

# Annex 3: Monitoring overviews WGML members: seafloor litter, micro-plastic and country specific marine litter monitoring programmes

### Seafloor litter monitoring

There are multiple seafloor monitoring programmes in place, see the details in Annex 3a.

The established data submission routine for the seafloor routine is to DATRAS (ICES database on trawl surveys).

DATRAS collects litter data from the bottom trawl surveys that have established data submissions in DATRAS. Currently, there are 14 bottom trawl surveys in DATRAS, and 12 of them started submitting litter data, covering majority of coastal areas in the North-east Atlantic, the North Sea, the Baltic Sea, Rockall, and Porcupine Bank (see Figure 3.1).

For the North Sea, most data are related to IBTS and delivered by Denmark, France, Germany, Netherlands, Norway, Sweden and England and Scotland. These data are collected from fishing trawls performed with the same type of gear: GOV (http://www.ices.dk/sites/pub/Publication%20Reports/ICES%20Survey%20Protocols%20(SISP)/SISP1-IBTSVIII.pdf).

The other part of the North Sea data is related to beam trawl surveys coordinated by WGBEAM, amongst others by Belgium, Netherlands, England and Germany. For the Baltic Sea, data are delivered by Denmark, Estonia, Germany, Latvia, Lithuania, Poland, Russia and Sweden and are related mainly to BITS. In the Baltic Sea, the gears TVS and TVL are mostly used. Even if the coverage by year and country is quite good, some data gaps are still remaining.

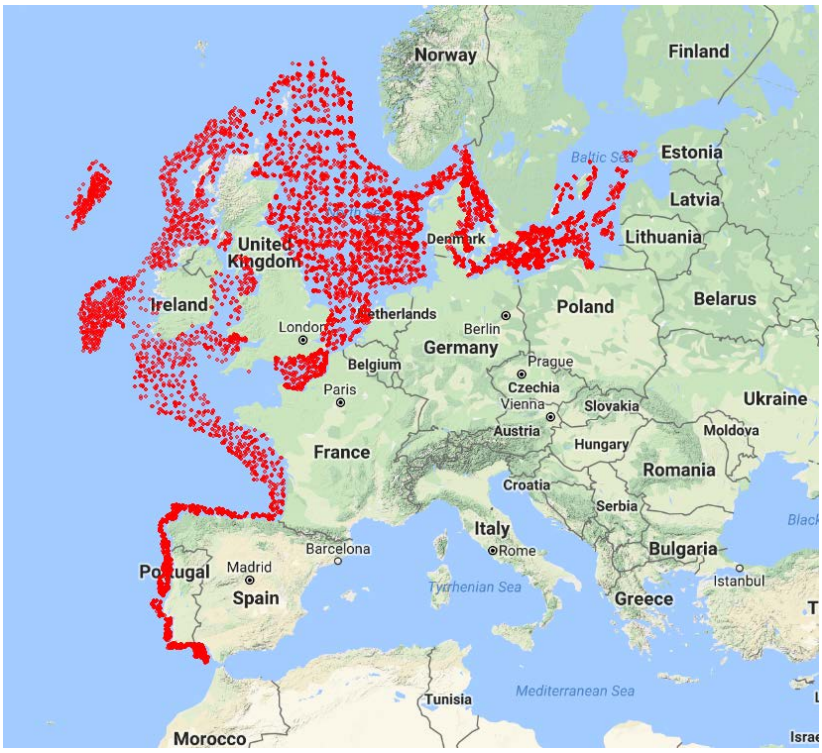


**Figure 3.1. Area distribution of the data submitted to DATRAS, spring 2018.**

DATRAS data collection process is roughly shown in Figure 3.2, where trawl and litter data are submitted separately to DATRAS, and based on combined data from these submissions, 2 litter data products are published on DATRAS web portal. Data are covered by ICES Data Policy:

http://ices.dk/marine-data/guidelines-and-policy/Pages/ICES-data-policy.aspx

DATRAS Litter submission format is simplified (only 1 LT record), because haul-related information is collected from the HH haul records in the trawl submission. This, however, means that LT records presently cannot be submitted to DATRAS at the same time as the rest of the survey records.

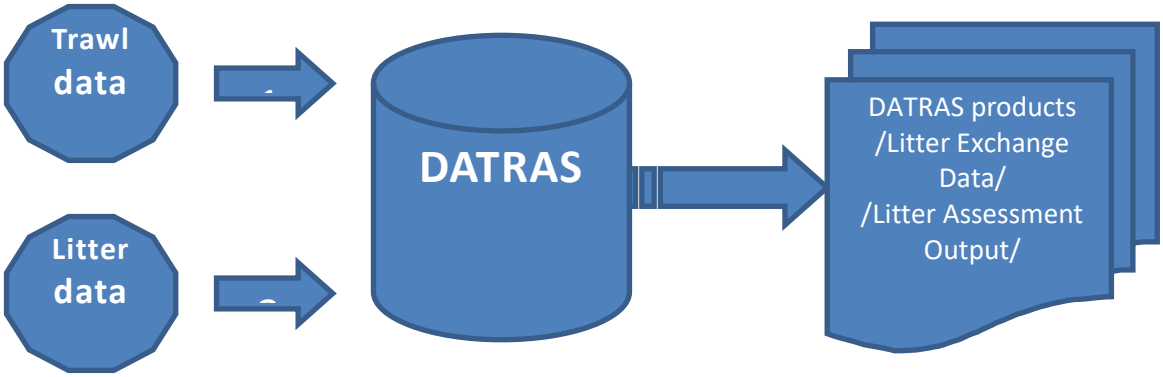


**Figure 3.2. DATRAS data collection process.**

Litter data extractions can be done in several formats:

1. Litter Exchange Data = (HH and LT) – continuously updated
2. Litter Assessment Output (OSPAR) = (merged HH, LT, and GIS-info) – updated once a year
3. Web services – available for specific download and extractions

Additional information on the products can be found on DATRAS Documents page.

Belgium, France and Germany collect additional data on marine litter at the seafloor using fishery trawls on a monitoring basis. These additional data are not related to the fisheries surveys and are therefore cannot be included in DATRAS. These additional data are supposed to be stored in ICES DOME, because it is related to ecological or biological monitoring. At the moment, DOME is testing a first trial format for those submissions.

### Microplastic monitoring

Preliminary monitoring of micro litter in sediments, fish or water is performed by some countries (Finland, Netherlands, Sweden and United Kingdom) on a regular basis until now. Many countries have ongoing research programmes covering the North Sea and the Baltic Sea aiming at micro litter monitoring in the future (compare „MP Data Overview Table“). For example micro litter sampling conducted by the Swedish University of Agricultural Science, Institute of Marine Research is done during the DCF NS-IBTS survey in Q1 in Skagerrak and Kattegat. Midwater Ring trawl (MIK) net meso-litter sampling (mesh-size 1.6 mm) is conducted by all countries participating in the Q1 IBTS. Since 2017, these data are gathered by Bastian Huwer (DTU aqua). Although there are lots of activities concerning microplastic on a research basis in various matrices all over Europe, there are more data for monitoring expected to come in the future. Monitoring data on microplastic will be submitted to DOME in the future. At the moment, the format for these submissions is discussed with ICES data experts. Please find more details in the annexes: „Trawl survey litter submission status 2004–2018“ and „MP Data Overview Table“. Submission of potential meso litter data from MIK trawls to DOME was not discussed or proposed at the meeting.

## Annex 3a: Seafloor litter monitoring programmes overview WGML members

### Trawl survey litter submission status 20-04-2018

**Number of hauls***

| Country | Area | Gear | Survey | Data location | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DE | Baltic | TVS | BITS q1 | Datras | 0 | 55 | 60 | 59 | 60 | 60 | 0 | | | | | | |
| DK | Baltic | TVL and TVS | BITS q1 | Datras | 0 | 0 | 54 | 53 | | 50 | 54 | 56 | | | | | |
| DK | Baltic | TVL and TVS | BITS q1 | Datras | 0 | 0 | 0 | 49 | 49 | 48 | 49 | 48 | | | | | |
| LT | Baltic | TVS | BITS q1 | Datras | 6 | 5 | 5 | 0 | 0 | 0 | 0 | | | | | | |
| LV | Baltic | TVL | BITS q1 | Datras | 25 | 28 | 30 | 0 | 0 | 0 | 0 | | | | | | |
| PL | Baltic | TVL | BITS q1 | Datras | 0 | 81 | 49 | 0 | 0 | 0 | 0 | | | | | | |
| SE | Baltic | TVL | BITS q1 | Datras | 0 | 51 | 47 | 49 | 45 | 50 | 52 | | | | | | |
| DE | Baltic | TVS | BITS q4 | Datras | | 53 | 58 | 48 | 55 | 44 | 51 | | | | | | |
| DK | Baltic | TVL and TVS | BITS q4 | Datras | | 0 | 0 | 53 | 48 | 47 | 49 | 49 | | | | | |
| DK | Baltic | TVL and TVS | BITS q4 | Datras | | 0 | 43 | 16 | 51 | 54 | 52 | 52 | | | | | |
| EE | Baltic | TVS | BITS q4 | Datras | | 10 | 10 | 9 | 0 | 0 | 0 | | | | | | |
| LT | Baltic | TVS | BITS q4 | Datras | | 6 | 6 | 5 | 4 | 0 | 0 | | | | | | |
| LV | Baltic | TVL | BITS q4 | Datras | | 21 | 14 | 14 | 0 | 0 | 0 | | | | | | |
| PL | Baltic | TVL | BITS q4 | Datras | | 56 | 51 | 32 | 0 | 0 | 0 | | | | | | |
| RU | Baltic | ? | BITS q4 | Datras | 0 | 15 | 0 | | | | | | | | | | |
| SE | Baltic | TVL | BITS q4 | Datras | | 29 | 31 | 29 | 29 | 25 | 30 | | | | | | |
| DE | NS | BT7 | BTS q3 | Datras | | 39 | 53 | 60 | 17 | 38 | 32 | 10 | | | | | |
| GB-ENG | NS | BT4A and BT4AI | BTS q3 | Datras | | 193 | 201 | 74 | 0 | 0 | 0 | | | | | | |
| NL | NS | BT8 | BTS q3 | Datras | | 128 | 72 | 76 | 71 | 69 | 72 | | | | | | |
| BE | NS | BT4A | BTS q3 | Datras | | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| BE | NS | BT8 | Environment monitoring | Dome | | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GB-ENG | NS | BT4A and BT4AI | BTS q4 | Datras | | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| FR | Channel | GOV | EVHOE q4 | Datras | | 0 | 161 | 150 | 147 | 128 | 108 | | | | | | |
| FR | Western waters | GOV | FR-CGFS q4 | Datras | | 0 | 75 | 76 | 0 | 0 | 0 | | | | | | |
| IE | ? | ? | IE-IGFS | Datras | | 149 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| DE | NS | GOV | NS-IBTS q1 | Datras | 0 | 58 | 36 | 0 | 0 | 0 | 0 | | | | | | |
| DK | NS | GOV | NS-IBTS q1 | Datras | 49 | 43 | 41 | 46 | 36 | 39 | 0 | | | | | | |
| FR | NS | GOV | NS-IBTS q1 | Datras | 0 | 0 | 67 | 83 | 74 | 66 | 59 | | | | | | |
| GB-SCO | NS | GOV | NS-IBTS q1 | Datras | 0 | 61 | 60 | 57 | 44 | 57 | 57 | | | | | | |
| NL | NS | GOV | NS-IBTS q1 | Datras | 56 | 55 | 53 | 45 | 56 | 59 | 0 | | | | | | |
| NO | NS | GOV | NS-IBTS q1 | Datras | 18 | 23 | 20 | 17 | 22 | 23 | 0 | | | | | | |
| SE | Skagger-rak/Kategat | GOV | NS-IBTS q1 | Datras | 47 | 47 | 46 | 47 | 48 | 46 | 46 | | | | | | |
| DE | NS | GOV | NS-IBTS q3 | Datras | | 7 | 25 | 15 | 21 | 12 | 22 | 18 | | | | | |
| DK | NS | GOV | NS-IBTS q3 | Datras | | 50 | 59 | 59 | 51 | 51 | 0 | | | | | | |
| GB-ENG | NS | GOV | NS-IBTS q3 | Datras | | 77 | 76 | 67 | 74 | 74 | 75 | | | | | | |
| GB-SCO | NS | GOV | NS-IBTS q3 | Datras | | 79 | 99 | 94 | 87 | 90 | 87 | | | | | | |
| NO | NS | GOV | NS-IBTS q3 | Datras | | 50 | 39 | 11 | 16 | 14 | 0 | | | | | | |
| SE | Skagger-rak/Kategat | GOV | NS-IBTS q3 | Datras | | 53 | 45 | 46 | 45 | 45 | 47 | | | | | | |
| PT | ? | ? | PT-IBTS q3/4 | Datras | | 0 | 88 | 91 | 82 | 93 | | 86 | 87 | 93 | 88 | 97 | 88 |
| GB-SCO | Rockall | GOV | ROCKALL q3 | Datras | | 42 | 48 | 43 | 48 | 31 | 36 | | | | | | |
| ES | ? | BAK | SP-ARSA q1/4 | Datras | | | | | | 40 | 70 | | | | | | |
| ES | ? | BAK | SP-ARSA q1/4 | Datras | 0 | 0 | 0 | 0 | 45 | 43 | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ES | ? | BAK | SP-NORTH | Datras | | | | | | | 112 | | | | | | |
| ES | ? | BAK | SP-NORTH | Datras | | 112 | 112 | 92 | 115 | 114 | | | | | | | |
| ES | Porcupine | PORB | SP-PORC q3 | Datras | | 0 | 81 | 80 | 79 | 80 | 79 | | | | | | |
| GB-SCO | NE Atlantic | GOV | SWC-IBTS q1 | Datras | 0 | 64 | 65 | 64 | 63 | 70 | 64 | | | | | | |
| GB-SCO | NE Atlantic | GOV | SWC-IBTS q4 | Datras | | 0 | 61 | 60 | 0 | 26 | 69 | | | | | | |

*** total number of hauls reported by the submitting country, including hauls with '0' litter**

## Annex 3b: Microplastic monitoring programmes overview WGML members

### Microplastic Monitoring Programmes Overview WGML Members

| | | | | | Environmental Compartment | | | | | | Microplastic Size Ranges Studied | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | Institute | Area Covered | Survey | Year | Sediment | Water | Bio-ta | Other (e.g. beach, air) | Sampling Equip-ment/Method | Species (for biota sam-pling) | <100 µm | 100-300 µm | 300-1000 µm | 1000-5000 µm | <5000 µm* | Is data available? | Can be upload-ed to ICES DOME? |
| NO | NIVA | Norwegian Coast | | | | | x | | | | | | | | | ? | ? |
| NO | NIVA | Norwegian Coast | | | x | | | | | | | | | | | ? | ? |
| NO | NGI | Norwegian Sea Continental Shelf | | | x | | | | | | | | | | | ? | ? |
| NO | UniResearch | Bergen Fjord | | ? | x | | | | | | | | | | x | ? | ? |
| UK | CEFAS | Northwest European Seas | CSEMP | 2017 | x | | | | Box cores (75 g; 15 x 5 g) | | x | x | x | x | x | Available in 2018 | Y |
| UK | CEFAS | Northwest European Seas | CSEMP | 2017 | | | x | | | Bivalves, crustaceans & fish (multi species) | x | x | x | x | x | Available in 2018 | Y |
| UK | CEFAS | Northwest European Seas | Fisheries Surveys | 2011 | | x | | | High Speed Manta Trawl | | | | x | x | x | Y | Y* |
| UK/France/Belgium/Netherlands | MICRO | Eastern Channel | Environmental Surveys | 2012 | x | | | | Box cores/Van Veen | | | | | | x | Y | Y |
| UK | CEFAS | Sewage Treatment Plant | Case Study | 2013 | x | x | | sludge | subsampling/Van Veen | | x | x | x | x | x | N | N |
| DK | Aurhus Uni | West Coast of Denmark and North Sea | n/a | 2015 | x | | | | Grab sample | | | | | | | Y | ? |
| DK | DTU | Danish Waters, North Sea, Baltic Sea | n/a | 2016 | | | x | | | Fish | | | | | | Y | ? |
| NE | RWS | North Sea & | National Monitor- | 2017 - | x | | | | Box core or shovel | | | x | x | x | x | Availble | Y |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Wadden Sea | ing Program | onwards | | | | | (inter-tidel zone) | | | | | | | 2018 | |
| DE | AWI/BSH/Thuenen | | Pangea? | | | | | | | | | | | | | | |
| FI | SYKE | Baltic Sea (Gulf of Finland/Bothnia) | National Monitoring Program | 2017 - onwards | x | | | | Sediment - GEMAX corer | | | | | | x (100 - 5000 µm) | Availble 2018/2019 | Y |
| FI | SYKE | Baltic Sea (Gulf of Finland/Bothnia) | *Pilot monitoring at fixed stations<br>**National Monitoring Program | *2013-2017<br>**2018 - onwards | | x | | | Water – manta trawl | | | | | | 300 - 5000 µm | ? | ? |
| FI | SYKE | Baltic Sea (Gulf of Finland/Bothnia) | Pilot monitoring at fixed stations | 2016-2017 | | x (column) | | | Multi-net | | | | | | 100 - 5000 µm | Available 2018/2019 | ? |
| FI | SYKE | Baltic Sea (Gulf of Finland/Bothnia) | Additional coastal sampling points | 2017 | x | x | x | x (beach) | Grab sample/Water by pump | Fish | | | | | 100 - 5000 µm | Available 2018/2019 | Y |
| FI | SYKE | Baltic Sea | n/a | 2016 | | | x | | | Fish | | | | | 100 - 5000 µm | Y | Y |
| BE | ILVO | North Sea | Biological (benthos) monitoring | 2013-2014 (3 time points) | | | x | | | Shrimp | | | | | x | Y | Y |
| BE | ILVO | North Sea | Contaminant Survey | 2013 | | | x | | | Mussels | | | | | x | Y | Y |
| BE | ILVO | North Sea | Biological (benthos) monitoring | 2013-2014 (3 time points) | | | x | | | Fish | | | | | x | Y | Y |
| BE | ILVO | North Sea | Biological (benthos) monitoring | 2018 - onwards | | | x | | | To Be Decided | x | x | x | x | x | Will be available 2018/2019 | Y |
| SE | Swedish University of Agricultural Science | Skagerrak and Kattegat | IBTS | 2015 - onwards | | x | | | MIK trawl | | | | | | Would need to go in and pull out data only for microplastic /currently goes above) | | |
| All | Q1 IBTS countries | North Sea | Q1 IBTS | 2015 - onwards | | X | | | MIK trawl | | | | | | | | |

## Annex 3c: Country specific monitoring programmes overview WGML members

### 1. SWEDEN

Seafloor litter monitoring in Sweden conducted by the Swedish University of Agricultural Science, Institute of Marine Research.

Sampling of sea floor litter is done during the DCF NS-IBTS survey in Q1 and Q3 in Skagerrak and Kattegatt. It is also done in Q1 and Q4 during the DCF BITS survey in the Baltic. Sampling of sea floor litter is also done closer to the coast in Skagerrak and Kattegat in a national programme every Q3. Litter sampled within DCF surveys is registered on board and litter sampled in the national programme is registered in the lab.

- Today analysis and report of seafloor litter is per year, per km$^2$ and for specific areas within Skagerrak/Kattegat and the Baltic. The results includes

- Number of stations sampled
- Number of stations without litter
- Graphs of mean weight of litter per km$^2$ per litter category A-plastic, B-metal etc.
- Graphs of mean number of litter items per km$^2$ per litter category, A-plastic, B-metal etc.

Seafloor litter data from IBTS and BITS are uploaded to DATRAS. Seafloor litter data from IBTS, BITS and from coastal trawling in Skagerrak and Kattegat are also sent to the Swedish Agency for Marine and Water Management. Results from analysis of IBTS, BITS and coastal trawling data are reported to the Swedish Agency for Marine and Water Management.

The quality control is based on documents in the DATRAS Litter reporting format xls file and information in BITS and IBTS manuals.

Data from sea floor litter sampling within IBTS and BITS have been reported to DATRAS since 2012. The national sea floor litter sampling started in 2015.

Micro litter sampling within DCF conducted by the Swedish University of Agricultural Science, Institute of Marine Research is done during the DCF NS-IBTS survey in Q1 in Skagerrak and Kattegat. This is done during the MIK-trawling, which is directed to the sampling of herring larvae. Litter is registered on board and data is sent to and analysed by Bastian Huwer at DTU Aqua.

### 2. BELGIUM

#### Belgian litter and microplastic monitoring and research (Lisa Devriese – VLIZ; Bavo De Witte – ILVO)

#### Litter monitoring

Routine macrolitter monitoring on the seafloor by Belgium is done within 2 different sampling surveys by ILVO. Litter is recorded within the bottom trawl survey, making use of a 4m beam trawl with 40 mm mesh size at the cod end. This monitoring campaign

includes 5 stations within the Belgian part of the North Sea, as well as 57 stations at other parts of the Southern North Sea. Litter is also collected within environmental monitoring campaigns at the Belgian part of the North Sea, which are held twice a year. Within environmental monitoring, 8m bottom trawl is used with 20 mm mesh size at the cod end. Data from 2012 onwards will be made public available within the ICES databases (DATRAS and DOME).

Other macrolitter monitoring in Belgium includes beach litter (OD Nature/RBINS), plastics in Fulmar stomachs (INBO) and plastics in marine mammals (OD Nature/RBINS).

#### Microplastic monitoring and research

Currently, there is no routine monitoring of microplastics in the marine environment for Belgium. Different research groups were involved with microplastic analysis in water, sediment and biota within different research projects. So analytical methods are in use at ILVO, UGhent, VLIZ, UAntwerpen and ULG. A detailed overview was presented at WGML, together with recommendations on QA/QC of the analytical methods.

#### Identified needs

VLIZ and ILVO gave an overview of most important needs on macrolitter and microplastic monitoring.

Macrolitter and microplastic needs for environmental monitoring and research:

- Gathering international knowledge and developing international methods and technologies to sample, identify and quantify the smallest fraction of microplastics and nanoplastics.
- Preparing an extensive long-term monitoring programme (marine & freshwater environment) to identify the sources, the presence, behaviour and effects of litter and microplastics.
- The development of a risk assessment framework and the necessary techniques / models to quantitatively assess the risks for humans and the environment.
- Linked ecological and socio-economic studies to evaluate the impact of policy measures concerning litter or microplastics.
- Funding to support marine litter monitoring (seafloor, beach, birds etc) and microplastic monitoring (incl. development of harmonized techniques).

## 3. GERMANY

Ulrike Kammann, Germany

### German National monitoring of marine litter at the seafloor

Germany is contributing to diverse programmes concerning marine litter at the seafloor. Among these are IBTS in the North Sea, BITS in the Baltic Sea and monitoring alongside the chemical and biological effects monitoring of fish under MSFD (all performed by the Thünen Institute). Ulrike Kammann (Thünen Institute, Germany) presented part of the German data of marine litter in fishery trawls generated together with environmental monitoring. The study was recently published: (Kammann *et al.* (2018) Marine litter at the seafloor - abundance and composition in the North Sea and the Baltic Sea. Mar Pollut Bull 127:774-780). This kind of litter monitoring is performed for more than 20 years with similar gears and since 2011 it follows the IBTS protocol and MSFD requirements.

Some examples of the results were that plastic represents 80% of the total litter in both, North Sea and western Baltic Sea, which is in accordance with other studies. Diversity of litter material increases in near-shore regions and quantitative differences in litter items/km^2 were recognised between regions. However, as different gears were used in North Sea and Baltic Sea they may have influenced the absolute litter catch.

Special problems/questions addressed were:

1 ) Low absolute numbers of litter items in the fishery hols (0, 1 or 2) cause high statistical variation in results.

2 ) How broad is the net? Is there a data bias due to different calculation principles?

3 ) Where are the dolly ropes? At least IBTS has no such category.

4 ) Do we underestimate seafloor litter because of overlapping trawling tracks?

*5 )* We propose a photo guide for marine litter for e.g. for training. A first example is available under:

*https://www.thuenen.de/en/fi/fields-of-activity/marine-environment/marine-litter/marine-litter-gallery*

6 ) Can we compare results from different ships or net types? Do we need an intercomparison between ships or can use existing data on that?

7 ) How should we handle mixed category items?

Germany expressed its wish to deliver data from this ongoing environmental monitoring programme to ICES DOME. German data from BITS and IBTS are already available via ICES DATRAS.

## 4. NORWAY

### Norwegian litter and microplastic monitoring and research

#### Litter monitoring

Norway records macrolitter on the seafloor from bottom trawls conducted by the Institute for Marine Research (IMR, Jennifer Devine, jennifer.devine@hi.no). For IBTS Q1 and Q3 surveys, data are then uploaded into the ICES DATRAS database and following the protocol laid out in the IBTS manual (record to category, take weight and area for each piece of litter unless they are obviously from the same object). For all other surveys, because they are not coordinated by ICES, the data are held in national database. IMR has it's own set of litter codes for those surveys, that doesn't conform to the C-TS or C-TS-REV formats. The non-ICES coordinated surveys register very simple litter categories: metal, glass, plastic.

There has been some sampling for microplastics. Bjørn Einar Grøsvik is the contact person: bjoern.einar.groesvik@hi.no

Other macrolitter monitoring in Norway, including Svalbard and Jan Mayen, includes beach litter (MOSJ program) and litter in sediments (MAREANO program). Few data on plastics in Fulmar stomachs from Svalbard are available for selected years (Norwegian Polar Institute) and for plastics in fish and mussels (Norwegian Institute for Water Research).

#### Microplastic monitoring and research

Norway does not currently have any form of governmental monitoring program on microplastics, as no standardized methods for microplastics analysis are developed and available yet. Nevertheless, a number of mapping projects are ongoing with the aim to provide information on the amount of microplastics in different types of environment, and to provide reference values for bigger particles.

In 2017/2018, the Norwegian Environment Agency (Miljødirektoratet) issued the following studies to map microplastics in different environmental matrices:

1. Testing of methodology for measuring microplastics in blue mussels (*Mytilus* spp.) and marine sediments, and recommedations for future monitoring of microplastics - MEMI (Norwegian Institute for Water Research)
2. Microplastics in offshore sediments on the Norwegian continental shelf DNVGL and Norwegian Geographical I (Norges Geotekniske Institutt & DNVGL)
3. Microplastics in sewage (Norwegian Institute for Water Research)
4. Microplastics in blue mussels from seven sampling stations along the Norwegian coastline (Norwegian Institute for Water Research)
5. Microplastics in sediments from Lake Mjøsa (planned)

In addition to the above, different research groups are involved with microplastics analysis in water, sediment, sea ice and biota within different research projects, including the JPI-Oceans projects (BASEMAN, PLASTOX, Weather-Mic, EPHEMARE). Analytical methods are implemented at SINTEF Ocean, NILU and NIVA. Several institutes are involved in national and international research projects on environmental microplastics

analysis and ecosystem impacts, including Akvaplan-niva, IMR, NIVA, Nofima, NORUT, Norwegian Polar Institute, and SINTEF Ocean. Microplastics researchers with a Nordic/arctic perspective collaborate within the Fram Centre for Climate and the Environment.

### Identified needs

Macrolitter and microplastic needs for environmental monitoring and research:

- Gathering knowledge and developing standardized/harmonized methods and technologies to sample, identify and quantify the smallest fraction of plastic litter (microplastics and nanoplastics).
- suitable monitoring programs for marine and freshwater environments to identify sources, distribution, and transport pathways, as well as ecosystem effects of microplastics.
- development of risk assessment frameworks and associated techniques to quantitatively assess the risks for humans and the environment.
- Linked ecological and socio-economic studies to evaluate the impact of policy measures concerning litter or microplastics.
- Funding to support marine litter and microplastics monitoring and research

## 5. NETHERLANDS

### Litter monitoring

Routine macrolitter monitoring on the seafloor by the Netherlands is done in the first Quarter of the year during the IBTS using the GOV and following the international IBTS survey manual including the description of how to collect the seafloor litter data. This monitoring has been done since 2013 and is yearly reported to Rijkswaterstaat (van Hal & de Vries 2013, van der Sluis & van Hal, 2014, van Hal 2015, 2016, 2017). The monitoring has developed in time, first year seperation was made between the litter from the net and litter from the codend. The years after counting improved, were multiple items of the same subcategorie (Fishing line and Syntetic rope) were registered as a single item in 2013 and 2014. Later these were all counted seperately.

In the third Quarter macrolitter monitoring on the seafloor is done during the Dutch Beam Trawl Survey (BTS) covering a large part of the North Sea up to 58.5N. This survey is done with an 8m beam trawl having 40 mm mesh size. Seafloor litter is collected since 2012 on this survey.

On an irregular basis seafloor litter is collected during other survey activities performed by Wageningen Marine Research, most of this are inshore surveys. These data are held in a national database.

van der Sluis MT, van Hal R. 2014. Collecting marine litter during regular fish surveys. Report number C065/14, IMARES, IJmuiden.

van Hal R. 2015. Sea floor litter monitored using catches of the International Bottom Trawl Survey. Rapport / IMARES Wageningen UR C083/15, IMARES, IJmuiden.

van Hal R, de Vries M. 2013. Pilot: collecting Marine litter during regular fish surveys. IMARES, Ijmuiden

van Hal, Ralf 2017. Sea floor litter monitoring : International Bottom Trawl Survey 2016 Den Helder: Wageningen Marine Research, (Wageningen Marine Research rapport C021/17) - 60

van Hal, Ralf 2017. Sea floor litter monitoring IJmuiden : Wageningen Marine Research, (Wageningen Marine Research report C054/17) - 57

#### Monitoring microplastics in the Netherlands

Within the national monitoring program for chemical contaminants in marine sediments, the Dutch Ministry for Infrastructureand the Environment - Rijkswaterstaat (RWS) started a study on the occurrence of microplastics in the Wadden Sea, North Sea and Zeeuwse Delta.

The monitoring is conducted from 2017 until (at least) 2020. The first year, 2017, focusses on method development.

The project is divided in two parts: 1) the development of an accurate and robust analytical method, 2) the application and optimization of the analytical method for the RWS monitoring.

Part 1) for the development of the analytical method 24 samples of 1 l wet sediment have been collected in 2017 from the Dutch Wadden Sea and North Sea. The sediments are from 4 locations (Noordwijk2, Vlissingen, Doovebalg-west and Bocht van Watum); and sampled in triplicate with boxcore or shovel (from tidal mud flats).

The method of analysis complies with the OSPAR recommendations.

Required amount of sediment: 50-200 g wet weight.
Extraction: zinc chloride (density 1.6 g/ml).
Filtration: optimal filter.
Cleanup of the filtrate with necessary agents.
Analysis: microscopy of filter
Reporting limit: 100 um + size-classes (max. length): 100-300, 300-1000, 1000-5000 um.
Shapes: sphere, fiber, film/foil, pellet
Color: transparent/translucid, grey, white, black, blue, green, orange, yellow, red
Validation: sufficient part of the samples (for false positives) by second technician, random chosen, complete with FTIR.
Quality control: Blank extraction-analysis per measuring series. Extraction and analysis of a reference material (150 um) to simple blank sediment, per measuring series.

#### End product

Part 1) Report of the micro-plastic analytical method + measurement uncertainty. Photo attachment of representative micro plastic fractions (shape and size). Evaluation on the OSPAR approach and determination of points for improvement and recommendations for final method.

Data reporting and end products: a. sample code b. Sample description (from detailed metadata provided by RWS). c. amount of material per sample for analysis (gram dry weight) d. number of particles per size class + form class, as specified above. e. Showing FTIR analysis (composition plastics in some samples). f. if applicable an explanation: special observations in the extraction and analysis of the specific sample. g. the file name (s) of one or more pictures of the micro plastics from this monster. h. quality control, based on blank and std addition. i. method of prescription. Including: extraction methods, analytical methods, quality assurance + measurement uncertainty of the method.

Part 2) Optimization and application of the method for the multiannual monitoring of microplastics.

#### Planned monitoring program

In 2018, 13 sediment samples will be collected. For the North Sea and coastal zone locations: TERSLG235, TERSLG100, TERSLG10, ROTTMPT50, Noordwk20, Noordwk70, Goere6, WAlCRN2 and WALCRN20. In addition four locations in the Wadden Sea (in overlap with the 2017 program).

In 2019, 12 sediment samples will be collected. For the Zeeland Delta locations: DREISR, ROGGPND, VEERHVMZD, haringvliet, WILHMNDGGPT, MARLGOT, TERNZ-BIWPT2, SCHAARVODDL. In addition four locations in the Wadden Sea (in overlap with the 2017 program). In addition four locations in the Wadden Sea (in overlap with the 2017 program).

In total in the period 2018 to 2020, 31 samples from different locations will be collected (given the potential changes in the multiannual planning of the chemistry program). Results and methods improvements will be reported as mentioned above.

## 6. FINLAND

#### Seafloor macrolitter

Bottom trawling is not conducted on Finnish seafloors. The Finnish Environment Institute (SYKE) has carried out one small pilot study at four sites in Helsinki by scuba diving following UNEP method for underwater litter survey. Each site was monitored by visually observing litter items from three 15 m long transects. One transect covered approx. 30 m2, one site 90 m2 and the whole survey 360 m2. The survey was published in Finnish as a report in 2014.

#### Microlitter

The Finnish Environment Institute (SYKE) took first microlitter samples from the surface waters in 2013. The sampling is conducted using a manta trawl equipped with a 330 µm net and a flow meter. Sampling has been carried out during monitoring cruises at different seasons; during these cruises, altogether 39 offshore sampling sites have been visited, of which 15 are presently considered as future monitoring sites for surface microlitter. These fifteen stations are located in the Gulf of Finland, the Bothnian Sea and the Bothnian Bay, and are nowadays sampled annually in May during national COMBINE II monitoring cruise together with e.g. zooplankton and benthos sampling. Samples taken

before 2018 represent pilot monitoring, where different methods for sampling and sample processing have been tested at fixed sampling stations.

Microlitter sampling from water column has been carried out with a multinet equipped with 100 μm mesh size from the same sites as for surface sampling in Gulf of Finland in September 2016 and Bothnian Sea in January 2017. In 2017, SYKE also started taking sediment samples targeted to microplastic monitoring. The sediment is collected from the same stations using a Gemax corer, which produces two replicate samples. The topmost 5 cm of these cores are used for analyses.

Smaller scale mapping of microplastic abundance from water, sediment, shoreline and biota (fish, >500 speciemens of mainly perch, roach, threee-spined sticklebacks) has also been done for research purposes on coastal areas around Finland in summer 2017. In addition, research has been also conducted on the microplastic load of offshore fish: common Baltic pelagic fish species (herring, sprat and three-spined stickleback) have been studied in 2016. The dataset includes approx. 600 open sea fish individuals.

The analyzing methods have mainly been visual, or relying to the hot needle test or the use of soldering iron. Currently there is ongoing effort to establish new analytical methods for microplastic identification (including Nile Red staining), especially to be able to reach the smaller size classes of particles (< 100 μm).

## 7. DENMARK

### Monitoring of microplastic

Long term monitoring of microlitter in the Danish environment is not currently carried out. However, there have been a number of case studies of microplastic litter conducted by different institutes in Denmark.

Contents of microplastic particles were investigated in sediment sampled in the North Sea in 2015 by Aarhus University as a national monitoring activity funded by the Danish EPA . This study looked at microplastic the size range of 20–5000 μm from 10 stations. Samples were collected using HAPS bottom corer with a diameter of 13.5 cm corresponding to a surface area of 0.0143 $m^2$. Microplastic were visually identified based on their relatively homogenous texture and structure using a stereo microscope (20–50x magnification). Later this study has been followed by a parallel study on 10 sediment samples collected in the Inner Danish waters.

Reference

Strand, J. & Tairova, Z. 2016. Microplastic particles in North Sea sediments 2015. Aarhus University, DCE – Danish Centre for Environment and Energy, 20 pp. Scientific Report from DCE – Danish Centre for Environment and Energy No. 178. http://dce2.au.dk/pub/SR178.pdf

As a national monitoring activity funded by the Danish EPA studies on microplastic in the stomachs of herring and cod from the North Sea and Baltic Sea was carried out by DTU in 2016. Two specific fish species, cod and herring were examined. The aim was to analyse the stomach contents of 100 fish from each species caught in coastal and offshore waters of the North Sea and the Baltic Sea with the focus on particles > 100 μm in size and using the sampling already planned as part of DTU Aqua fish monitoring activities

(International Bottom Trawl Survey). Microplastic samples were identified using a combination of visual identification and the hot needle technique. Sub-samples were also taken for polymer identification using Ramen spectroscopy. Another more case-oriented study showed no increase in marine microplastic concentration in herring from the Baltic Sea over the last three decades.

References

Robin Lenz *et al.* (2016). Analysis of microplastic in the stomachs of herring and cod from the North Sea and Baltic Sea. Report from DTU aqua. http://naturstyrelsen.dk/media/194047/microplastreportnst_dtuaqua.pdf

Beer *et al.* (2018). No increase in marine microplastic concentration over the last three decades – A case study from the Baltic Sea. Science of The Total Environment Volume 621, 15 April 2018, Pages 1272-1279

#### Research on microplastic

Various research projects on sources, detection methods, occurrence, fate and impact of microplastic in the environment is at the moment going on at the different Danish universities.

To mention some projects that Aarhus University is involved in:

- Research project on sources, occurrence and fate of plastic debris in a Danish coastal fjord (Roskilde Fjord) covering studies on water column, sediment and mussels. Cooperation between Aarhus University, Roskilde University and Plastic Change. Funded by the VELUX foundation.
- Research project (SIMAG) on microplastic in sediments in West Greenland and in a gradient from a more local urban area towards mores pristine waters. Focus on particle sizes >100 μm where polymer composition has been verified with μFT-IR. The dominant polymer groups in the sediment were found to be polyesters, acrylates, rubber and PVC. The SUMAG project also included studies on beach litter and fulmars in Greenland. Funded by the Danish EPA
- Synthesis project which aims to gather knowledge about potential framework for risk screening of microplastic, detection methods and the fate of microplastic in Denmark. The project also intends to facilitate networking and knowledge exchange between research groups at different Danish universities and relevant stakeholders. Funded by the VELUX foundation.
- Method development projects to improve identification methods of microplastic using μFTIR images for mapping microplastic. This includes work with on developments of more automated methods for the processing of data produced by μFTIR imaging of microplastic. Collection of relevant μFT-IR as well as ATR generated samples of different types of environmental plastic will also feed into developments of high quality reference libraries. Collaboration with e.g. Ålborg University, The technical University in Denmark and Gothenburg in Sweden and SYKE in Finland.

**8. England, Wales and N-Ireland**

Since 1992, the Centre for Environment, Fisheries and Aquaculture Science (Cefas), a UK Government organisation, has been collecting seafloor litter data on environmental and fisheries stock assessment surveys. Such research provides spatial and temporal trend assessments of the abundance of seafloor litter within North West European seas and acts as a baseline against which litter reduction mitigation measures can be assessed.

We recently published an assessment of 25 years of seafloor litter data (1992–2017), gathered during 39 scientific surveys at 2461 stations in the coastal seas of North West Europe. We divided the analysis in two main parts: an analysis of the trends of the major litter categories and plastic sub-categories during the 1992–2017 period (presence/absence) and a spatial analysis in 2011 (number of items), the last year in which all surveys took place, thus providing a comparison of the inshore (within 12 nm of land) and offshore (>12 nm) regions of the Celtic and Greater North Seas.

https://www.sciencedirect.com/science/article/pii/S0048969718306442

**The highlights of the study:**

- Widespread distribution of litter items on the seabed, up to 1835 pieces $km^{-2}$
- Over the 25-year period, 63% of the trawls contained at least one plastic litter item.
- No significant temporal trend in total number of litter items $km^{-2}$
- Significant trends in plastic bags (down) and fishing debris (up)
- Potential influence of behavioural changes on litter abundance?

Since 2012, the UK has implemented a seafloor litter monitoring programme to fulfil international drivers and requirements e.g. OSPAR, MSFD. The data is gathered on board of trawling surveys by trained staff, QA/QCed and submitted to ICES Datras on a yearly basis. The data, together with those of other countries, has been used in the intermediate OSPAR common indicator assessment for seafloor litter: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/marine-litter/composition-and-spatial-distribution-litter-seafloor/

In relation to microplastics, the UK has published the results of several case studies to look at the presence of microplastics in the water and sediments.

Microplastic contamination was determined in sediments of the Southern North Sea and floating at the sea surface of North West Europe. Floating concentrations ranged between 0 and 1.5 microplastic/$m^3$, whereas microplastic concentrations in sediments ranged between 0 and 3146 particles/kg dry weight sediment. In sediments, mainly fibers and spheres were found, whereas at the sea surface fragments were dominant. At the sea surface, concentrations of microplastics are lower and more variable than in sediments, meaning that larger sample sizes and water volumes are required to find detectable concentrations. We have calculated the widths of the confidence intervals (CI) for different sample sizes, to give a first indication of the necessary sample size for a microplastic survey at the water surface. Higher concentrations of floating microplastics were found near estuaries. In sediments, estuaries and areas with a high organic carbon content were likely hotspots. Standardization of monitoring methods within marine regions is recommended to compare and assess microplastics pollution over time.

https://www.frontiersin.org/articles/10.3389/fmars.2017.00135/full

Cefas presented a new approach for analysis of microplastics in environmental samples, based on selective fluorescent staining using Nile Red (NR), followed by density-based extraction and filtration. The dye adsorbs onto plastic surfaces and renders them fluorescent when irradiated with blue light. Fluorescence emission is detected using simple photography through an orange filter. Image-analysis allows fluorescent particles to be identified and counted. Magnified images can be recorded and tiled to cover the whole filter area, allowing particles down to a few micrometres to be detected. The solvatochromic nature of Nile Red also offers the possibility of plastic categorisation based on surface polarity characteristics of identified particles. This article details the development of this staining method and its initial cross-validation by comparison with infrared (IR) microscopy. Microplastics of different sizes could be detected and counted in marine sediment samples. The fluorescence staining identified the same particles as those found by scanning a filter area with IR-microscopy.

http://www.nature.com/articles/srep44501.pdf

In 2017, the UK has setup a specific monitoring programme, mainly to look at microplastics in sediments, but also to investigate the potential for microplastic monitoring in biota. The first year we have focussed on the method development, sample collection and collaborations with other international experts to fine-tune the approach together with OSPAR. We will follow the procedure as outlined in the OSPAR Microplastic Candidate Indicator (Annex 11). We have now started the analysis of sediment samples and are testing methods for the analysis of biota.

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## Annex 4: Overview DATRAS data by trawl and quarter

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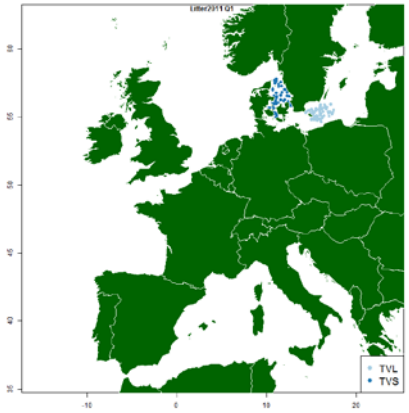


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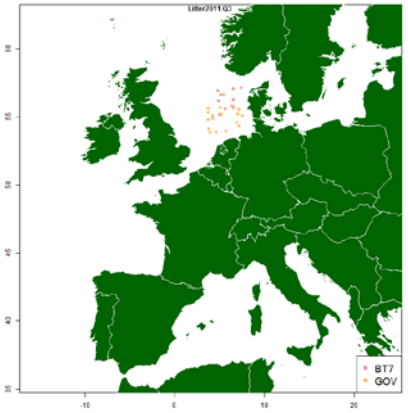


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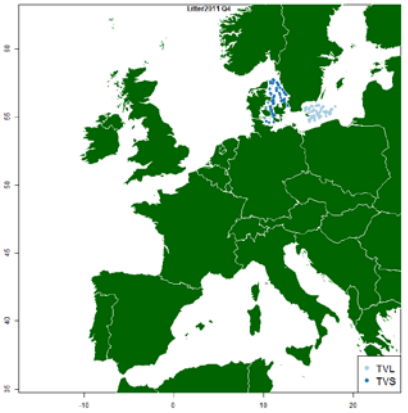

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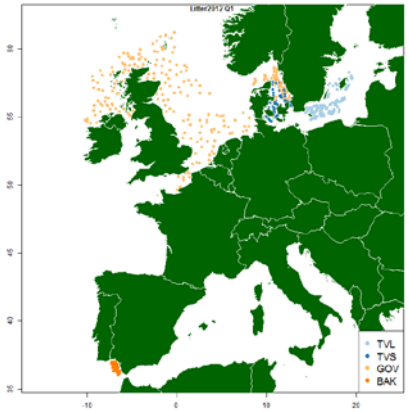


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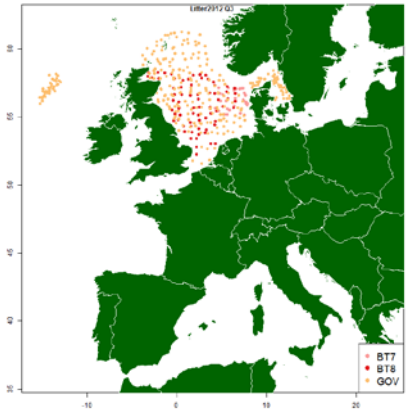


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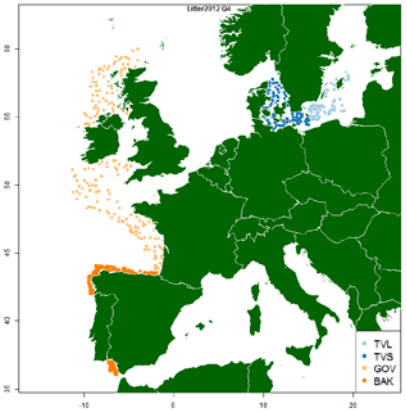


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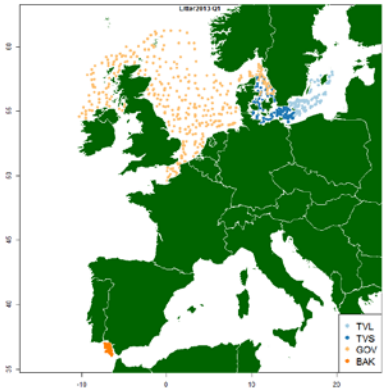


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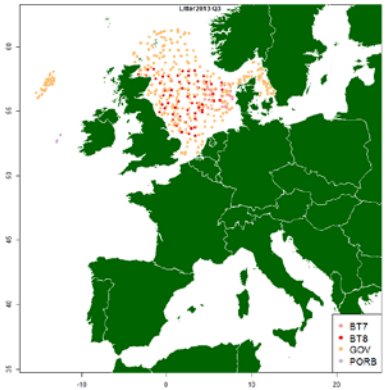


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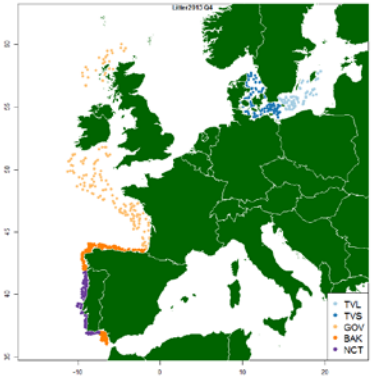

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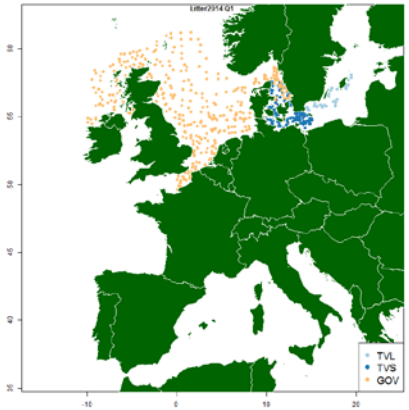


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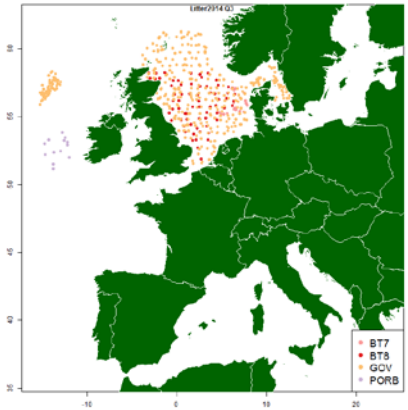


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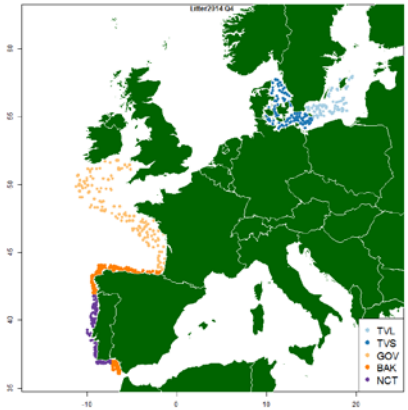


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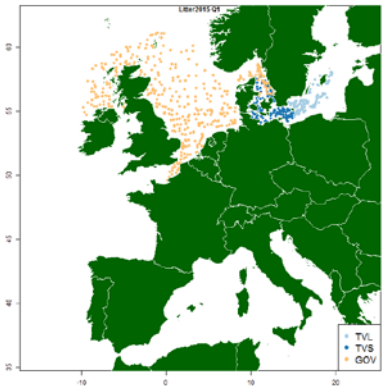


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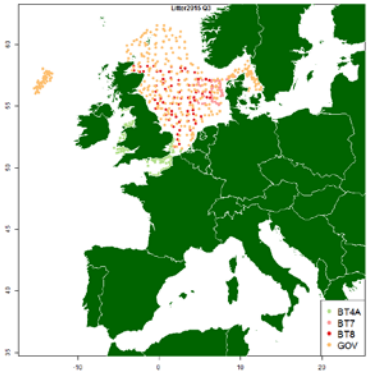


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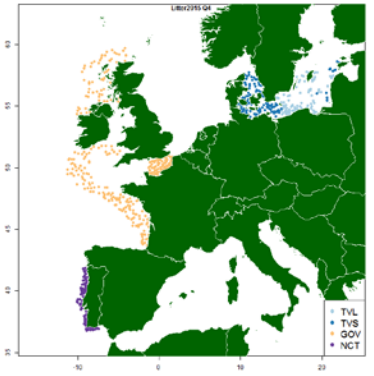


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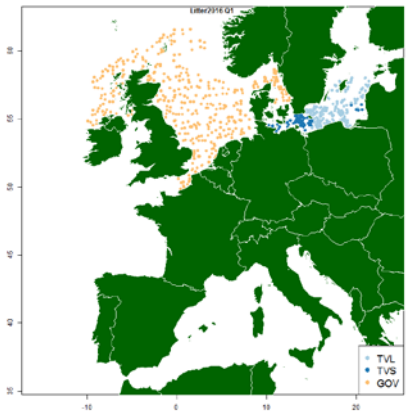


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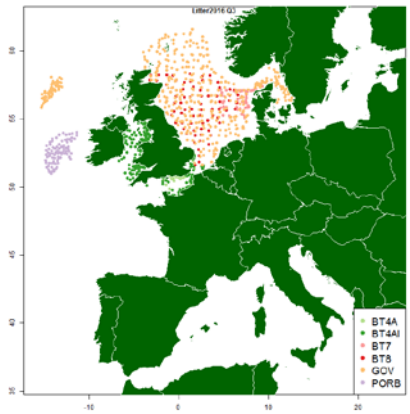


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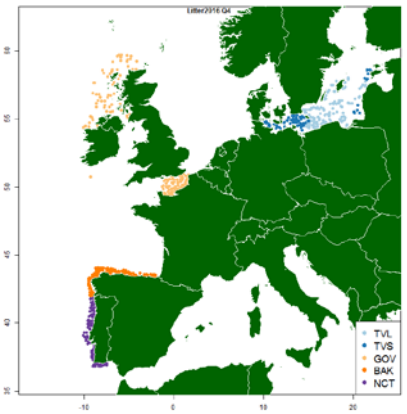


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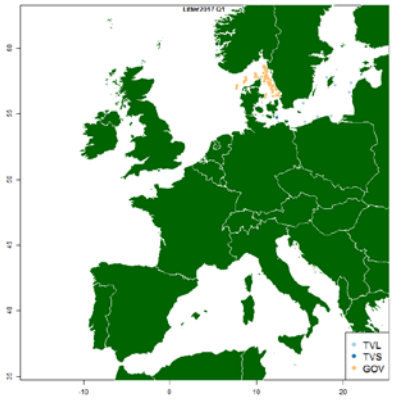


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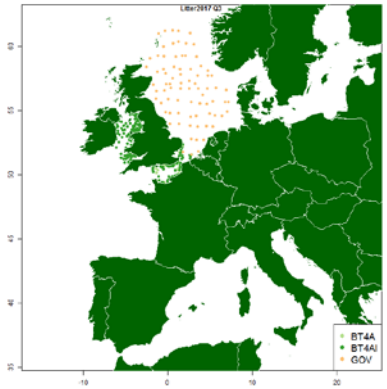


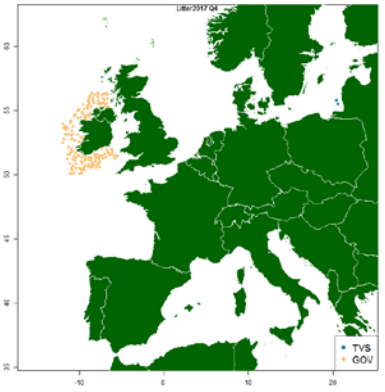


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## Annex 5: International roadmap and drivers

**International/National needs, drivers and timeline/roadmap**

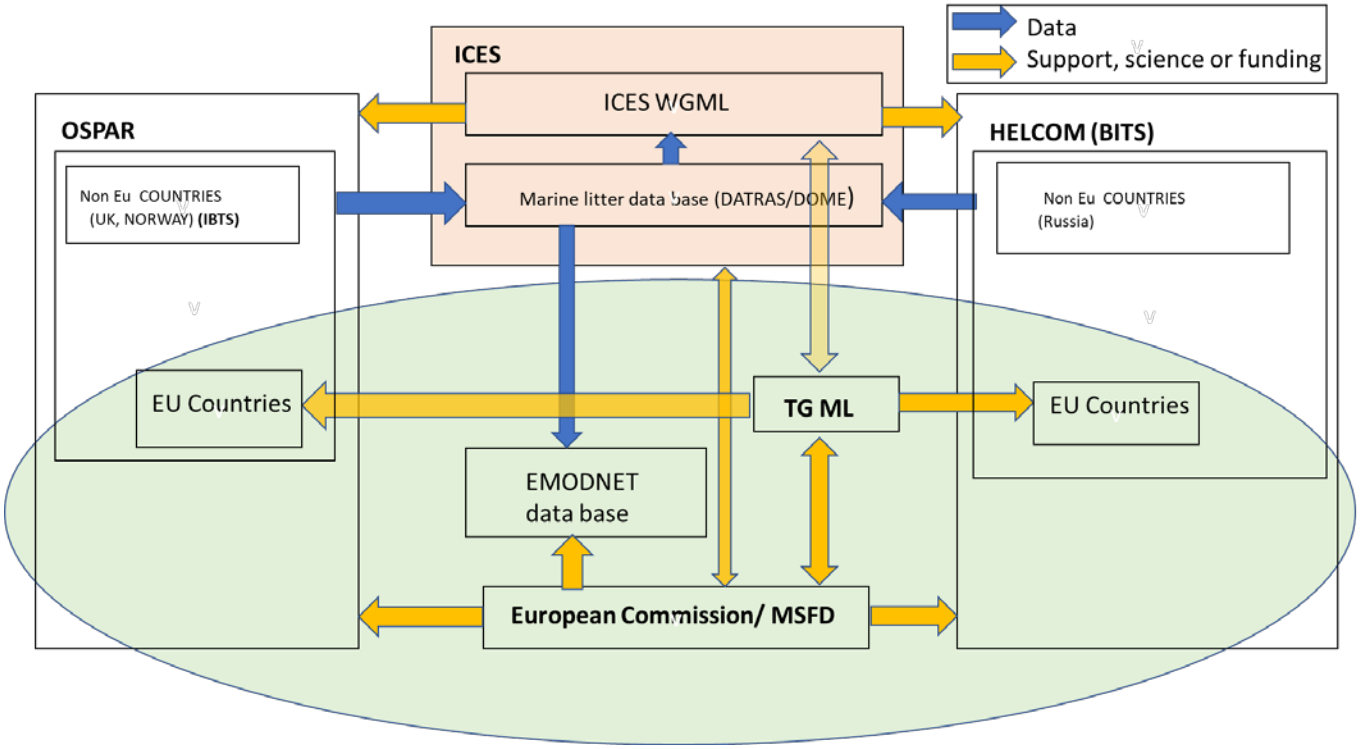



**Figure 1. Overview of drivers and linkages.**

| Key | | | |
|---|---|---|---|
| | OSPAR | | EU |
| | GESAMP | | Conferences |
| | Important International Meet- | | JPI Oceans |


**Figure 2. ICES WGML roadmap.**

Many initiatives have been launched at international fora (e.g. G7 and G20, the United Nations, the MARPOL Convention, EU TG Marine Litter) and regional sea conventions (e.g. OSPAR, HELCOM) and actions against marine litter are also included in the International Ocean Governance Agenda for the future of our oceans. Based on their published reports or action plans, WGML selected a list with drivers (Table 1) and defines their supporting role for these events/targets.

ICES WGML:

- Advice and guidance
- Assessments with DATA & DOME
- Focus on scientific issues around data collection, data submissions, sample analysis, data assessments and QA/QC

**Table 1. Selected drivers and deadlines.**

| | **Driver** | **Year** |
|---|---|---|
| EIHA | EIHA [8-12 April] location tbc. | April 2018 |
| GESAMP | Second full GESAMP workshop WG40 | June 2018 |
| MSFD | Deadline for submission of proposals: June 2018. The purpose of this call for proposals is to support the next 6-year cycle of MSFD implementation. | June 2018 |
| EU TGML D10 | Next EU TGML D10 meeting: 26-28 the June 2018 | June 2018 |
| ICG-ML | ICG-ML meeting: 2018 12-14 June Berlin | June 2018 |
| PAME II | Arctic counsel: PAME II-2018 meeting 1-4 October 2018 | October 2018 |
| MICRO conference + JPI Oceans final conference | 19-23 November 2018 in Lanzarote | November 2018 |
| ICG-ML | ICG-ML meeting: 2018 6-8 November Edinburgh | November 2018 |
| MSFD | Updates of the initial assessment, determination of GES and environmental targets due to be reported in October 2018 | 2018 |
| GESAMP | Joint publication by GESAMP, IOC and UN Environment with a target of date of December 2018. | December 2018 |
| JPI-Oceans | New JPI-Oceans microplastic call will be launched | End of 2018 |
| WFD | Review of the WFD by 2019 | 2019 |
| OSPAR | OSPAR final assessment | 2020 |
| EU action plan for circular economy | Aspirational target of 30% reduction in marine litter by 2020 (= an aspirational target of reducing marine litter by 30% by 2020 for the ten most common types of litter found on beaches, as well as for fishing gear found at sea , with the list adapted to each of the four marine regions in the EU) | 2020 |
| MSFD | Updating the programmes of measures due to be reported in March 2022 | 2022 |
| SDG 14 | Including marine debris' and states that a significant reduction must be achieved by 2025. | 2025 |
| Waste Proposal | Higher recycling target for plastics (55% by 2025), to be defined for 2030 | 2030 |

## G7 and G20

G7 Action Plan to combat Marine Litter (G7, 2015)

**Overarching Principles**

The G7 countries

- Commit to the improvement of countries' systems as a key goal of the action plan, to prevent, reduce and remove marine litter, including the below listed priority actions.
- Recognize that support through international development assistance and investments are important to combat marine litter and encourage both.
- Support development and implementation of national or regional action plans to reduce waste entering inland and coastal waters and ultimately becoming marine litter, as well as to remove existing waste.
- Share best practices, especially with developing countries, and encourage a similar call to action in other international fora.
- Recognize that, where available, the use of existing platforms and tools for cooperation will reduce duplication and take advantage of progress made (e.g. the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA), the Global Partnership on Marine Litter (GPML) and the Regional Seas Conventions and Action Plans) and therefore support their use.
- Promote individual and corporate behaviour change through public awareness and education to address marine litter.
- Recognize that prevention is key to long-term success in addressing and combating marine litter and that industries and consumers have an important role to play in reducing waste.
- Recognize that the need for removal actions is important, due to the vast amounts of litter already in the marine environment.
- Support the use of a broad range of policy toolkits and available instruments, including economic incentives, market-based instruments, and public private partnerships to support implementation of actions to effectively combat marine litter.

G20 Action Plan on Marine Litter (G20, Germany, 2017)

The G20 maintains that the tools to reduce marine litter have to be as diverse as the challenge of marine litter itself. There is no 'one size fits all' solution. We **reiterate the need to:**

- address pollution from land based sources,
- address pollution from sea based sources, including key waste items from the fishing and aquaculture industry as well as from the shipping sector,
- address financial resources for cost-effectiveness analyses as well as measures for marine litter prevention or reduction,
- put in place effective actions e.g. to facilitate the implementation of the polluter pays approach, e.g. 'extended producer responsibility' or deposit schemes - already in place in some G20 countries as appropriate and develop new sources of

funding for effective waste management systems, as well as stimulate innovation;
- address education and outreach, and
- address additional research requirements.

#### UN Environment Assembly (UNEA3)

The resolutions and decisions called for accelerated action and strengthened partnerships to, inter alia: combat the spread of marine plastic litter and microplastics; eliminate exposure to lead paint and promote sound management of used lead-acid batteries; improve air quality globally; address water pollution; manage soil pollution; and control pollution in areas affected by terrorist operations and armed conflict.

#### UN – Decade of Ocean Science (2021–2030) – SDG14

Drivers:

- SDG14 includes marine debris' and states that a significant reduction must be achieved by 2025.

#### The Global Partnership on Marine Litter

The Global Partnership on Marine Litter (GPML) was launched in June 2012 at Rio + 20 in Brazil. The GPML, besides being supportive of the Global Partnership on Waste Management, seeks to protect human health and the global environment by the reduction and management of marine litter as its main goal, through several specific objectives.

#### EU TGML

Review of Guidance for the Monitoring of Marine Litter:

While the TG Marine Litter Guidance on the Monitoring of Marine Litter is being widely used and has led to a considerable improvement of harmonization, further progress and research results require a review of the guidance. That review will be performed in 2017/2018 by the TG Marine Litter, in close collaboration with Member States experts, research projects and scientific experts on specific topics.

MSFD Marine Litter Item Category Masterlist:

The monitoring of marine macro litter is based on its identification according to a list of commonly found items. The harmonization of this list is crucial to a comparable assessment of macro litter and has been referenced in the Commission Decision 2017/848/EU. The list is currently being revised within the TG Marine Litter, in close collaboration with Member State experts, the EEA and Regional Sea Conventions.

#### Interactions

- EU TGML D10 meeting 26-28 June 2018
- Review of Guidance for the Monitoring of Marine Litter 2017-2018
- MSFD Marine Litter Item Category Masterlist

### EU – Plastic Strategy

Opportunities and challenges linked to plastics are increasingly global and addressing them will significantly contribute to achieving the 2030 Sustainable Development Goals.

**Drivers**:

- Major aim to reduce marine litter
- Consideration of recyclability/biodegradability and bio- based plastics
- Vision/actions on microplastics
- Strategy for most-found items

### EU – Marine Strategy Framework Directive (MSFD)

The main goal of the Marine Directive is to achieve Good Environmental Status of EU marine waters by 2020. The Directive defines Good Environmental Status (GES) as: "The environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive". For Descriptor 10, the Good Environmental Status (by 2020) is defined as: "the properties and quantities of marine litter do not cause harm to the coastal and marine environment".

Further work has to be carried out on the harmonization of a number of methods which have not yet been fully developed (such as e.g. those for microplastics and floating litter) and the specification of protocols in the light of national experiences and considerations, the possible establishment of a network for microplastic measurements, and further discussions and advise on a database with litter information from MS states which can serve as a baseline for marine litter.

The MSFD is now entering the second 6-year cycle of implementation, with updates of the initial assessment, determination of GES and environmental targets due to be reported in October 2018, followed by updating of monitoring programmes due to be reported in October 2020, and updating the programmes of measures due to be reported in March 2022.

Deadline for submission of proposals: June 2018. The purpose of the open call for proposals is to support the next 6-year cycle of MSFD implementation. The proposals should have practical outcomes which clearly contribute to the implementation of the MSFD. The successful implementation of the proposals should directly contribute to regional or subregional cooperation needs of Member States' competent authorities in their implementation of the Directive. The proposals can contribute directly to the efforts of the regional organisations, such as the Regional Sea Conventions (RSCs), as long as these are directly linked to MSFD implementation requirements. The proposals should support those (sub)regions where Member States have jointly identified certain shortcomings and are committed to address them together in a coherent manner

**Drivers**:

- Updating of monitoring programmes due to be reported in October 2020
- Updating the programmes of measures due to be reported in March 2022
- Next cycle starting 2020

### EU – Water Framework Directive (WFD)

In the context of the Water Framework Directive Member States must report on the presence of litter/microplastics, if they are taking measures to address it.

**Drivers**:

Review of the WFD by 2019.

### OSPAR

OSPAR currently assesses beach litter, seabed litter and plastic particles in Fulmars stomachs indicators, as part of its monitoring and assessment programme. These allow the abundance, trends and composition of marine litter in the OSPAR Maritime Area to be determined for different marine compartments (floating, seafloor and coast).

OSPAR is currently also working to develop new indicators, including ingestion of plastic particles by turtles and microplastics in sediments. The turtle indicator is being developed by the INDICT project and will cover the Bay of Biscay and Iberian Coast, (as well as the western Mediterranean). The microplastics indicator will address levels in marine sediments and will cover the whole OSPAR Maritime Area.

After the OSPAR intermediate assessment (2017), OSPAR will publish a final assessment by 2020.

In 2014 OSPAR agreed to develop a Regional Action Plan for Marine Litter along with an implementation plan, in order to achieve its objective to significantly reduce amounts of marine litter. The RAP focuses on both sea-based and land-based sources of litter, as well as considering removal actions and education and outreach. It will be implemented over the period 2014–2021.

The OSPAR objective and this RAP are supportive of the Rio+20 global commitment to "take action to, by 2025, based on collected scientific data, achieve significant reductions in marine debris to prevent harm to the coastal and marine environment" in the "The Future We Want" and with the 2013 UNGA resolution A/RES/68/70 in which States noted concern on marine debris.

**Drivers:**

- OSPAR microplastic indicator
- OSPAR final assessment by 2020
- OSPAR litter expert group (ICG-ML): Develop and agree regionally coordinated SMART reduction/operational targets linked to relevant actions as contained in this implementation plan, starting from 2015, including those linked to sources
- Next ICG-ML: 12-14 June 2018 Berlin
- Next ICG-ML: 6-8 November 2018 Edinburgh

### OECD – workshop on Managing Contaminants of Emerging Concern in Surface Waters:

Scientific developments and cost-effective policy responses, 5 February 2018:

https://www.oecd.org/water/Summary%20Note%20-%20OECD%20Workshop%20on%20CECs.pdf

"Key messages of the workshop will inform an OECD report on policies to manage CECs. Draft versions of the report, including preliminary policy recommendations, will be circulated for comment to delegates of the JM and WPBWE and workshop participants. The final report will be released at the end of 2018."

### GESAMP

Joint publication by GESAMP, IOC and UN Environment on monitoring harmonisation and standardisation with a target of date of December 2018.

### HELCOM – Lisa Bredahl Nerdal

Marine litter monitoring issues goes under State&Conservation group and the implementation of the Regional Action Plan under PRESSURE group. When these groups meets marine litter is part of the agenda.

The upcoming PRESSURE meeting will be on 8-12 October 2018 and the S&C meeting on 14-18 May 2018.

Below the outcomes of the last meetings for further details:

PRESSURE 8-2018

S&C 7-2017

Ministerial Meeting 2018

# Annex 6: QA/QC Framework for microplastic monitoring and analysis

### Microplastic assessment – overview

Within microplastic assessment, multiple decisions have to be made: a broad range of analytical methods are available, giving a different degree of information but also cost-effectiveness. Choices have to be made regarding monitoring or research scheme and sampling procedure. Within each step, quality assessment and quality control are essential and should be taken into account throughout the entire procedure.

### Type of monitoring and research, objectives and matrix

To set up the microplastic assessment, best fit for purpose, researcher should be aware of which type of monitoring and research is requested: if it is important to determine a status or condition, to identify trends or reach specific research goals will influence the way forward. This will also be strongly dependent on the objectives of the assessment. Different objectives can be identified, which will define the degree of information wanted, e.g. if detailed polymer information is necessary or not.

Identified objectives may be:

- Identification of abundance
- Identification of occurrence
- Identification of sources
- Identification of pathways
- Identification of food chain
- Set Ecological Quality Standard

Marine matrices that can be analyzed to achieve these goals are water, sediments and/or biota. Performance criteria for microplastic analysis may be put forward in order to select the best sampling and analysis approach.

### Monitoring or sampling scheme

After identifying goals and objectives, researchers should decide on the monitoring/sampling scheme. It is important to consider what the best selected sample will be: should the researcher sample surface water or deeper water, top layer sediment, mixed sediments or different layers, the entire organism or the edible part of an organism, … Spatial and temporal variability of the monitoring scheme should be considered. Whereas a study may want to identify small temporal changes, other studies may put their focus on spatial variability. Both natural as well as analytical variability should be taken into account in order to meet the requested statistical power to meet good sensitivity and to determine the amount of replicate samples and subsamples. Use of pilot studies to estimate variability is hereby essential. The presence of quality controlled international data on microplastic occurrence within the ICES databases may play an important role in estimating variability and performing power analysis.

### Sampling and transport

Depending on the depicted matrix, different sampling techniques can be selected. Nets and pump for water analysis, corers, grabs or shovels for sediment analysis, different fishing techniques or manual sampling for biota sampling, …

Due to the omnipresence of microplastics in the environment, stringent background reduction measures should be taken during sampling, subsampling and transport. Possible background reduction measures may be:

- Avoid the use of plastic material within the sampling procedure, the division into subsamples and the use of sampling containers or sampling packaging.
- Precleaning of all materials used during sampling and transport is mandatory. Filtered water can be used. Use of solvents such as ethanol may even perform better since solvents reduce surface tension and enhance cleaning efficiency.
- In case of water sampling by a net, the net should be thoroughly cleaned before sampling. When multiple tracks are planned close to each other, the use of 2 nets can be advisable.
- All containers should be sealed as much as possible during and directly after sampling.
- Train all persons involved in sampling with special focus on QA/QC measures.
- If a plastic material cannot be avoided during the sampling procedure, a subsample of the plastic used can be taken, e.g. to recheck by FTIR (e.g. net material).
- Record the color of clothes as well as the color of the research vessel.
- Where possible, field blanks can be taken in order to take into account background contamination at the sampling site.
- To estimate airborne contamination during handling, filters can be set for the time of sampling to estimate this effect.

### Laboratory analysis

After sample transport and sample storage, samples are analyzed in the lab. Harmonization of methods is important, although research/monitoring goals and cost-effectiveness are important to take into account in selecting the method best fit for the purpose. Multiple research papers have described analytical methods, dealing with different extraction techniques, density separation, digestion media and filtration steps. A thorough comparison of methods is beyond the scope of this report. It is, however, important to notice that users should be aware of the limitations of their methods. E.g. within density separation, the selected salt will define the efficiency of the separation process but also affect the analysis cost. For biota analysis, different digestion media have different impacts on the matrix as well as the plastic itself. The optimum combination is therefore case-dependent. To determine the amount of microplastics, difference can be made between microscope counting, use of dye methods to enlarge microplastic visibility, identification of plastics by microFTIR or FTIR or other, advanced techniques. Also here, difference in research goals and cost-effectiveness determine the best choice.

Independent of the method selected, stringent background reduction measures should be taken. Possible background reduction measures may be:

- Preclean labware
- Filter all solutions that are added to the sample
- Cover all glassware
- Use clean air room if possible
- Check air contamination by tapes or exposing filters
- Frequently clean the place were analysis is performed
- Forbid synthetic clothes within the analysis lab
- Minimize the amount of people allowed in the analysis lab
- Dust filters may be applied to reduce air contamination
- Avoid plastic labware
- Minimize transfer steps

#### Analytical method QA/QC

To assess the quality of the analytical procedure, multiple QA/QC steps should be taken into account. Advisable procedures are:

- Use of procedure blanks. Since background contamination is a large issue within microplastic analysis, laboratories should apply procedure blanks in order to estimate background contamination impact. Procedure blanks include the whole procedure. Procedure blanks may make use of a microplastic-free sample, e.g. filtered water for seawater analysis or fish filet for biota analysis. Otherwise, he procedure can run without matrix.
- Use of spiked samples. As positive control samples, spiked samples may be used. Microplastics are commercially available or laboratories may use custom-build microplastics. The use of different shapes and sizes is advisable. The amount of spiked microplastics may be determined by prior counting the added amount of microplastics or by weighing when spiked microplastics are uniform.
- Microplastic specificity. Even when the polymer type is not routinely determined, it is advisable to check to what extent the procedure allows to identify microplastics from other materials and which types of microplastic can be identified. (Micro)FTIR can hereby be of help.
- Quantification limit. Since background contamination is difficult or even impossible to exclude to 100%, values near background contamination levels can be questionable to report. It is therefore advisable to apply a limit of quantification, e.g. as three times the standard deviation of the procedure blanks.
- Procedure validation. To know the strengths and limitations of a method, method validation is advisable. Making use of procedure blanks and spiked samples, the determination of accuracy, precision, limit of quantification, specificity and robustness is advisable. Each microplastic method has also a lower size limit. The determination of this lower size limit can be an essential part of the validation procedure.

- Proficiency testing schemes and reference materials. By our knowledge, no proficiency testing schemes exist for microplastic analysis, neither are reference materials with known microplastic content available. However, efforts are being done to have proficiency schemes in the near future. WGML strongly advice laboratories to participate in these schemes in order to increase harmonization and quality control.

# Annex 7a: Seafloor Litter Data Submission Guidelines

## 7.1 Summary

This guideline has been developed and revised for data suppliers submitting seafloor litter data originating from bottom trawls during fishery surveys (DATRAS) and environmental (DOME) surveys in the Northeast Atlantic covering 2012-to date (historical data should be delivered following these guidelines as closely as possible).

DATRAS is a database of trawl surveys with an online access to standard data products. DATRAS has been developed to collate and document the survey data, assure data quality, standardise data formats and calculations, and ease data handling and availability. With the possibility for instant remote access, the data from DATRAS are used for stock assessments and fish community studies by the ICES community and public users.

DOME is a data portal for marine biological communities as well as contaminants and biological effects in marine environments data. A large portion of the data held in DOME are monitoring data submitted for the OSPAR CEMP and HELCOM COMBINE monitoring programmes and therefore follow specific monitoring programme guidelines. While these programmes have key components that are monitored yearly at defined stations, components that are under development are also included.

## 7.2 Fisheries trawl survey litter data reporting to DATRAS

### 7.2.1 Introduction

Fisheries litter trawl survey data output is generated by combining the haul related information (HH) with the litter data record (LT). Therefore, it is important that litter data can be connected to the parent HH records submitted previously.

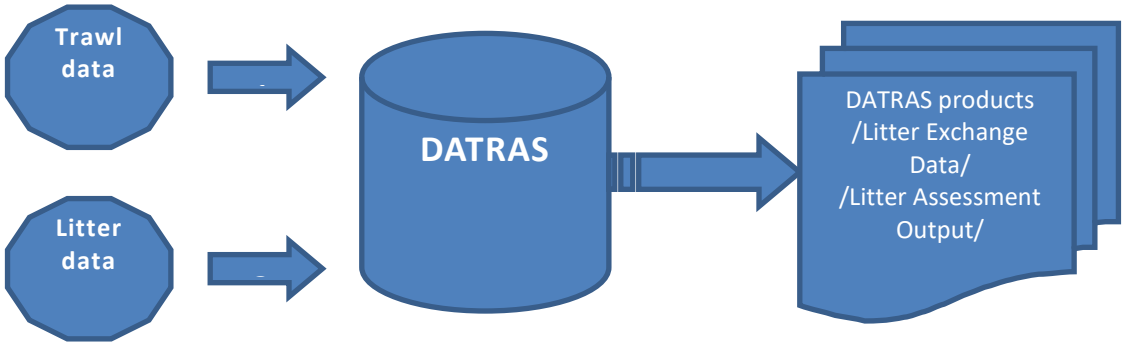



**Figure 7.1. DATRAS data collection process.**

### 7.2.2 Submission process

At present, DATRAS Litter data submission process is made in several steps:

1 ) Submission of Trawl Biology data (HH/HL/(CA)) – by national submitter

2 ) Update DATRAS Data Warehouse – by ICES Data Centre

3 ) Submission of Litter data (LT) – by national submitter

In the future, it is planned to simplify the submission process, where the submitters would not have to wait for the data warehouse update to submit the litter records.

### 7.2.3 Litter data formatting

For successful data upload, data files for DATRAS should follow certain formatting rules (Table 7.a.1).

Detailed information about litter format for each of the data fields can be found here: http://ices.dk/marine-data/Documents/DATRAS/Litter_Format_DATRAS.xls and in Table 7.a.2.

**Table 7.a.1. Data formatting and reporting rules (checklist).**

| **Rule** | |
|---|---|
| DATRAS Litter submission files should contain only 1 type of records – LT (Litter) | |
| The files should use extension csv (or txt) | |
| Each of the submitted files must contain unique key fields: survey, country, ship, gear, year, and quarter. Submissions with these key values will overwrite the previously submitted data, which also means that partial data submissions are not allowed. | |
| Reported key fields must have previously submitted 'parent' HH records. | |
| Each record should be reported in a separate row, while fields within a record should be separated by commas. Objects belonging to the same subcategory A1 etc. and size might be reported on the same row. | |
| Remove header lines before submitting your files | |
| Fields should be reported in a specific order identified in http://datsu.ices.dk/web/selRep.aspx?Dataset=122 | |
| Empty fields are not allowed. Report -9 instead | |
| For numbers requiring decimals, report with decimal points, not decimal commas | |
| Codes can be found in the respective code lists in ICES vocabulary at vocab.ices .dk. If additional codes are required, contact accessions@ices.dk | |
| Hauls with 0 litter must be reported. For reporting zero litter catches, report LTREF = RECO-LT, PARAM = LT-TOT, UnitItem = items/haul, LT_Items = 0 | |
| Litter categories in hauls with litter should only be based on the LTREF = C-TS-REV | |
| Litter size categories should be reported on CEFAS litter size categories. | |
| The field LT_Items should be used for reporting the number of litter items of the same type/category. Preferably, items should be weighed individually. If the items are weighed together, the total weight for (multiple) items of the same litter type/category should be reported in the LT_Weight field. More details about counting and weighing litter can be found in Seafloor Litter Data Collection Guidelines (WGML, Annex 9c, 2018). | |
| Field LTPRP allows simultaneous reporting of several codes, which should be separated with ~. No other fields allow the reporting of multiple codes | |
| Submit data online at https://datras.ices.dk/Data%20submission/Default.aspx by following the instructions on the screen for the dataset "Litter data from DATRAS trawl surveys" | |
| Contact accessions@ices.dk for log-in or any additional information | |

**Table 7.a.2. DATRAS Litter Reporting Format.**

| FID | FieldName | DataType | Mandatory | CodeList | Comment |
|---|---|---|---|---|---|
| 1 | RecordType | char(2) | Y | | For litter records the value is always LT |
| 2 | Quarter | int(1) | Y | | Report the survey target quarter, as in HH |
| 3 | Country | char(3) | Y | TS_Country | |
| 4 | Ship | char(4) | Y | TS_Ship | |
| 5 | Gear | char(6) | Y | Gear | |
| 6 | Survey | char(20) | Y | Datasets | |
| 7 | Reserved1 | char(10) | N | | Report -9 |
| 8 | Reserved2 | char(10) | N | | Report -9 |
| 9 | StNo | char(6) | Y | | Report StNo as in the trawl data submission |
| 10 | HaulNo | int(6) | Y | | Report HaulNo as in the trawl data submission |
| 11 | Year | char(4) | Y | | YYYY |
| 12 | LTREF | char(10) | Y | LTREF | |
| 13 | PARAM | char(20) | Y | ** | **Parameter code depends on the LTREF, check www.vocab.ices.dk for more information |
| 14 | LTSZC | char(4) | N | LTSZC | |
| 15 | UnitWgt | char(15) | Y/N* | TS_LT_UnitWgt | *Both weight and number of litter items must be reported from 2019. It is also recommended that size is reported unless the object is entangled. |
| 16 | LT_Weight | decimal4(10) | Y/N* | | *Both weight and number of litter items must be reported from 2019. It is also recommended that size is reported unless the object is entangled. |
| 17 | UnitItem | char(15) | Y/N* | TS_LT_UnitItem | *Both weight and number of litter items must be reported from 2019. It is also recommended that size is reported unless the object is entangled. |
| 18 | LT_Items | int(10) | Y/N* | | *Both weight and number of litter items must be reported from 2019. It is also recommended that size is reported unless the object is entangled. |
| 19 | LTSRC | char(5) | N | LTSRC | |
| 20 | TYPPL | char(5) | N | TYPPL | |
| 21 | LTPRP | char(20) | N | LTPRP | |

### 7.2.4 Submission status

Detailed overviews of the submission status can be found here: https://datras.ices.dk/Data_products/Submission_Status.aspx

Select "Litter data from DATRAS trawl surveys" , start/stop year and quarter

## 7.3. Environmental trawl survey litter data reporting format (DOME)

### 7.3.1 Submission overview

Data are reported according to the Environmental Reporting Format version 3.2 or the Simplified Reporting Format in order to be quality controlled and entered into the database. Submissions of data may be made at any time, however, for OSPAR and HELCOM yearly assessments, data must be submitted by 1 September.

The files must be screened for errors before submission via DATSU (data checking program), which includes checks defined by the Regional Sea Conventions and ICES Expert Groups. Each submission receives an accession number which enables the status to be followed and summaries made. Once accepted into the database, files can be found at http://dome.ices.dk/browse/. Filter for "%LT_2".

Environmental trawl survey litter data follow the same procedures as microlitter submissions. See Annex 7b.

### 7.3.2 Submission Status

No specific data submission status tool has been created yet, but the required information can be found via http://www.ices.dk/marine-data/tools/Pages/Submission%20status.aspx

## Annex 7b: Microlitter Data Submission Guidelines

Microlitter data can be reported to the ICES DOME database as well as all other types and sizes of litter data. "Litter" includes macro-, meso- and microlitter monitoring data.

Formats:

The format required for reporting microlitter data is based on the Environment Reporting Format version 3.2.5. This format can be submitted in two versions, the original hierarchical structure of the ERF3.2 format, or the Simplified Format version. Both versions can be downloaded at http://www.ices.dk/marine-data/Documents/ENV/Environment_Formats.zip.

For existing data flows, where monitoring data are already reported using the ERF3.2 hierarchical format, one can simply add microplastic data to existing files by adding records with microlitter parameters under the appropriate sample matrix.

For new data flows, the most convenient for the user is the Excel-based Simplified Format. The format, examples and instructions can be downloaded at http://www.ices.dk/marine-data/Documents/ENV/Environment_Formats.zip.

The Simplified Formats were developed to meet the needs of those data submitters who have no possibility to use the ERF3.2 hierarchical format or who have only Excel-stored data. One advantage of the Simplified Format is that multiple years can be reported in one file whereas ERF3.2 hierarchical format requires one year/one file.

The "Simplified Format for litter" is used for macro-, meso- and microlitter on the seafloor (MATRX=SF), in the water column (MATRX=WC), on the water surface (MATRX=SW) or on a beach (MATRX=BE) (note that these formats/database are not for OSPAR beach data). This format allows for reporting information in fields such as litter reference lists (LTREF), type of plastic (TYPPL), size (LTSZC) and other properties (LTPRP) of the litter.

For microlitter data which need to be linked to the specific sample matrix that was analysed in biota, sediment or water bottle data (for example, in the stomach of a fish (MATRX=ST) or in a specific grain size fraction (ex. MATRX=SED1000) in sediment), report the microlitter parameters together with the other sample parameters in the "Simplified Format for Contaminants&Microlitter". This means that the fields for general litter above, LTREF, TYPPL, LTSZC, and LTPRP, are not available but parameter codes can be created by the Data Centre to include any combination of these litter field options if necessary. For example, if one knows the type of microplastic that was found in the stomach, a code can be created to reflect this information which would otherwise be reported in field TYPPL.

Codes needed to report data can be found at vocab.ices.dk. Microlitter codes can be found in the parameter code list (PARAM) where litter codes begin with "LT". Microlitter codes can be found from LT239 onward. Contact accessions@ices.dk for new codes.

See the Simplified Format Instructions for more information. Help may also be found in the DOME FAQ Document available at http://www.ices.dk/marine-data/Documents/ENV/DOME%20Frequently%20asked%20questions.docx.

## Annex 8: All DATRAS data by country (data reporting and boxplots)

**The tables below show when only main categories are reported (plastic, metal etc.) and not sub categories such as plastic bottles, plastic bags etc. indicating a different approach to monitoring.**

**Countries reporting Param A by year (All data from assessment sheets).**

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|
| DEN | 20 | 40 | 35 | 39 | 32 | 0 |
| EST | 0 | 0 | 0 | 0 | 0 | 0 |
| GFR | 0 | 0 | 0 | 0 | 0 | 0 |
| LAT | 0 | 0 | 0 | 0 | 0 | 0 |
| LTU | 0 | 0 | 0 | 0 | 0 | 0 |
| POL | 0 | 0 | 0 | 0 | 0 | 1 |
| SWE | 0 | 0 | 0 | 0 | 1 | 0 |
| ENG | 0 | 0 | 0 | 0 | 0 | 0 |
| NED | 0 | 0 | 0 | 0 | 0 | 0 |
| FRA | 0 | 0 | 0 | 1 | 0 | 0 |
| NOR | 0 | 0 | 0 | 0 | 0 | 0 |
| SCO | 0 | 0 | 0 | 0 | 0 | 0 |
| SPA | 0 | 24 | 53 | 23 | 0 | 0 |

**Countries reporting Param B by year.**

| | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| DEN | 5 | 10 | 18 | 10 | 4 |
| EST | 0 | 0 | 0 | 0 | 0 |
| GFR | 0 | 0 | 0 | 0 | 0 |
| LAT | 0 | 0 | 0 | 0 | 0 |
| LTU | 0 | 0 | 0 | 0 | 0 |
| POL | 0 | 0 | 0 | 0 | 0 |
| SWE | 0 | 0 | 0 | 0 | 0 |
| ENG | 0 | 0 | 0 | 0 | 0 |
| NED | 0 | 0 | 0 | 0 | 0 |
| FRA | 0 | 12 | 0 | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| NOR | 0 | 0 | 0 | 0 | 0 |
| SCO | 0 | 0 | 0 | 0 | 0 |
| SPA | 0 | 16 | 24 | 13 | 0 |

**Countries reporting Param C by year.**

| | 2013 | 2014 |
|---|---|---|
| DEN | 0 | 0 |
| EST | 0 | 0 |
| GFR | 0 | 0 |
| LAT | 0 | 0 |
| LTU | 0 | 0 |
| POL | 0 | 0 |
| SWE | 0 | 0 |
| ENG | 0 | 0 |
| NED | 0 | 0 |
| FRA | 0 | 0 |
| NOR | 0 | 0 |
| SCO | 0 | 0 |
| SPA | 2 | 1 |

**Countries reporting Param D by year.**

| | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| DEN | 7 | 2 | 11 | 15 | 6 |
| EST | 0 | 0 | 0 | 0 | 0 |
| GFR | 0 | 0 | 0 | 0 | 0 |
| LAT | 0 | 0 | 0 | 0 | 0 |
| LTU | 0 | 0 | 0 | 0 | 0 |
| POL | 0 | 0 | 0 | 0 | 0 |
| SWE | 0 | 0 | 0 | 0 | 0 |
| ENG | 0 | 0 | 0 | 0 | 0 |
| NED | 0 | 0 | 0 | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| FRA | 0 | 2 | 0 | 0 | 0 |
| NOR | 0 | 0 | 0 | 0 | 0 |
| SCO | 0 | 0 | 0 | 0 | 0 |
| SPA | 0 | 6 | 22 | 11 | 0 |

**Countries reporting Param E by year.**

| | 2012 | 2013 | 2014 |
|---|---|---|---|
| DEN | 0 | 0 | 0 |
| EST | 0 | 0 | 0 |
| GFR | 0 | 0 | 0 |
| LAT | 0 | 0 | 0 |
| LTU | 0 | 0 | 0 |
| POL | 0 | 0 | 0 |
| SWE | 0 | 0 | 0 |
| ENG | 0 | 0 | 0 |
| NED | 0 | 0 | 0 |
| FRA | 0 | 0 | 2 |
| NOR | 0 | 0 | 0 |
| SCO | 0 | 0 | 0 |
| SPA | 7 | 27 | 0 |

**Countries reporting Param F by year.**

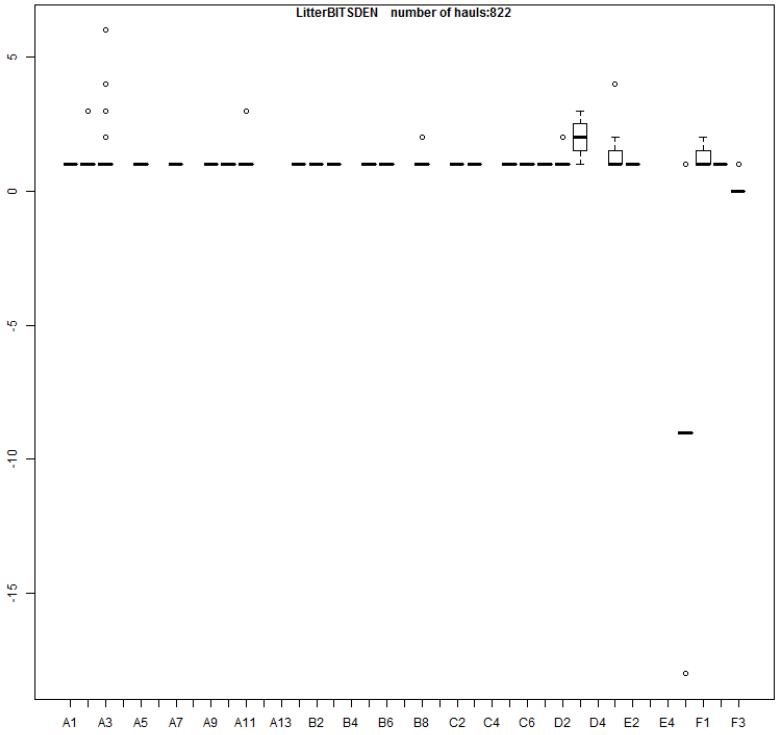
| | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| DEN | 8 | 23 | 16 | 17 | 4 |
| EST | 0 | 0 | 0 | 0 | 0 |
| GFR | 0 | 0 | 0 | 0 | 0 |
| LAT | 0 | 0 | 0 | 0 | 0 |
| LTU | 0 | 0 | 0 | 0 | 0 |
| POL | 0 | 0 | 0 | 0 | 0 |
| SWE | 0 | 0 | 0 | 0 | 0 |
| ENG | 0 | 0 | 0 | 0 | 0 |

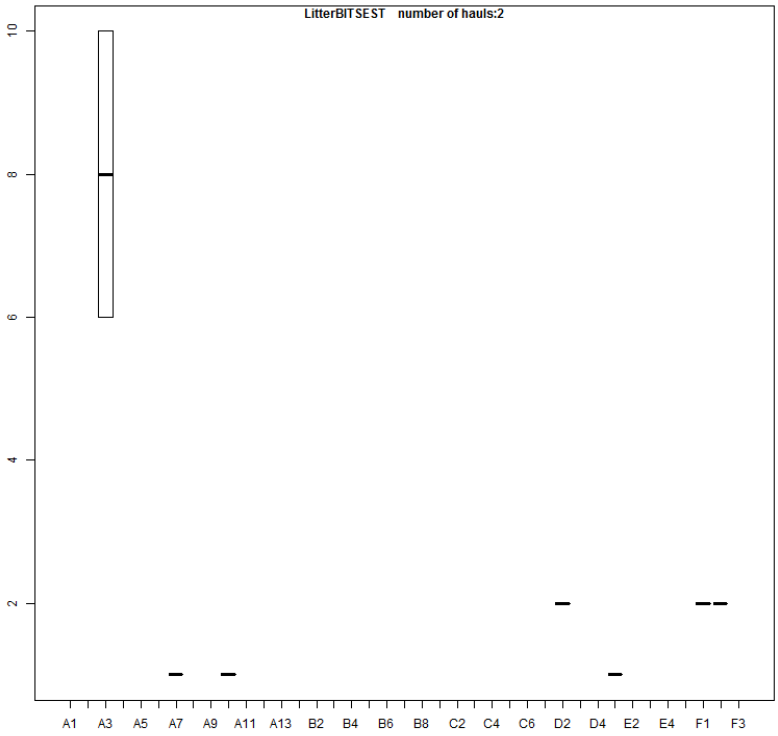
| | | | | | |
|---|---|---|---|---|---|
| NED | 0 | 0 | 0 | 0 | 0 |
| FRA | 0 | 5 | 0 | 0 | 0 |
| NOR | 0 | 0 | 0 | 0 | 0 |
| SCO | 0 | 0 | 0 | 0 | 0 |
| SPA | 0 | 0 | 2 | 0 | 0 |

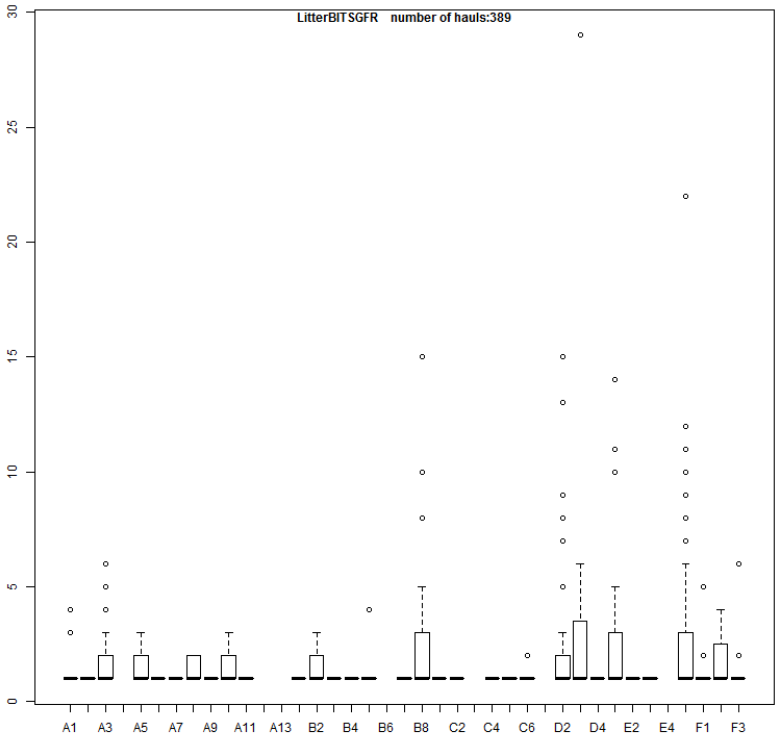
The boxplots below show for each country–survey combination the reported litter by subcategory (x-axis) and number of items per haul (y-axis). Minus values result from reporting -9 in some cases. Zero catches in DATRAS are only reported for the total haul, not by subcategory. Thus the boxplot only presents when items were present in a haul.

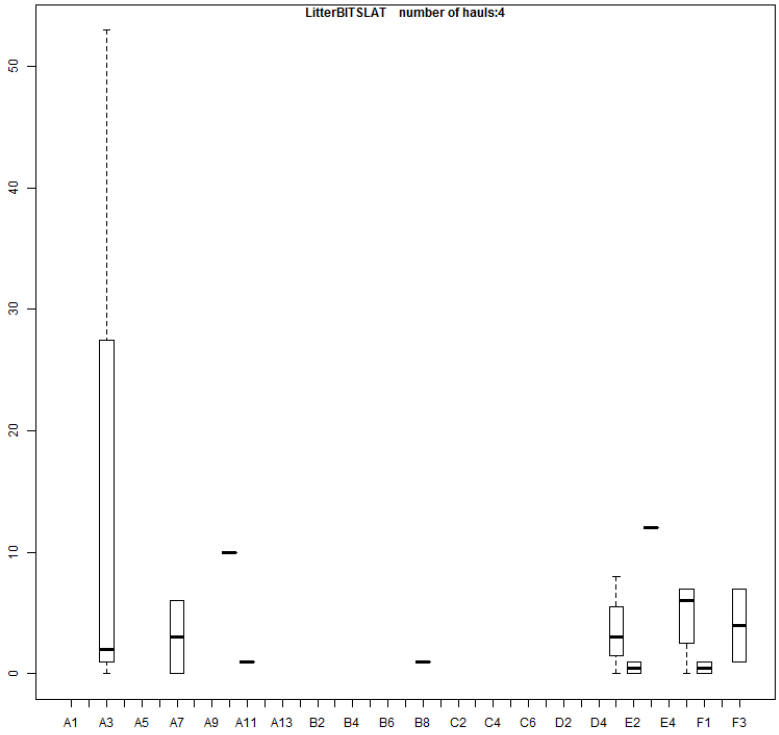
The Danish BITS example below shows the data of 822 hauls. As most boxplots are located on 1, most of the times an items is found, it was a single item of that subcategory in a haul. Multiple plastic bags (A3), up to 6, have been recorded in a single haul. If pieces of glass (D3) were caught it were often 2 or 3 pieces. A worry is the lack of entangled fishing line (A6) and the recording of only single fishing line (A5) and synthetic rope (A7). These last two subcategories are often caught in high numbers per trawl (see some of the other boxplots below). As never more than a single piece of rope was caught in 822 hauls, the question rises if ropes are actually counted as individual items or are these only recoded as present. In the last case, it means these data can't be used in the estimation of numbers per km2, the Danish BITS data can only be used in present-absence analysis. This worry rises from many of the other boxplots as well.

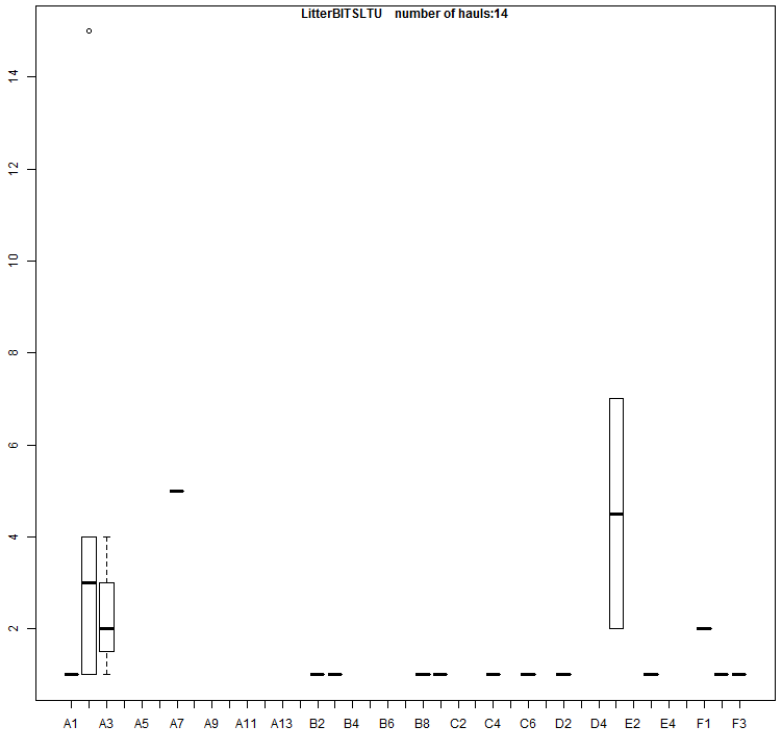
Some countries (like the Netherlands) started counting A5 and A7 only later in the time series, this is not visible from these boxplots. But this is tried to be reconstructed by validating the litter data by year.

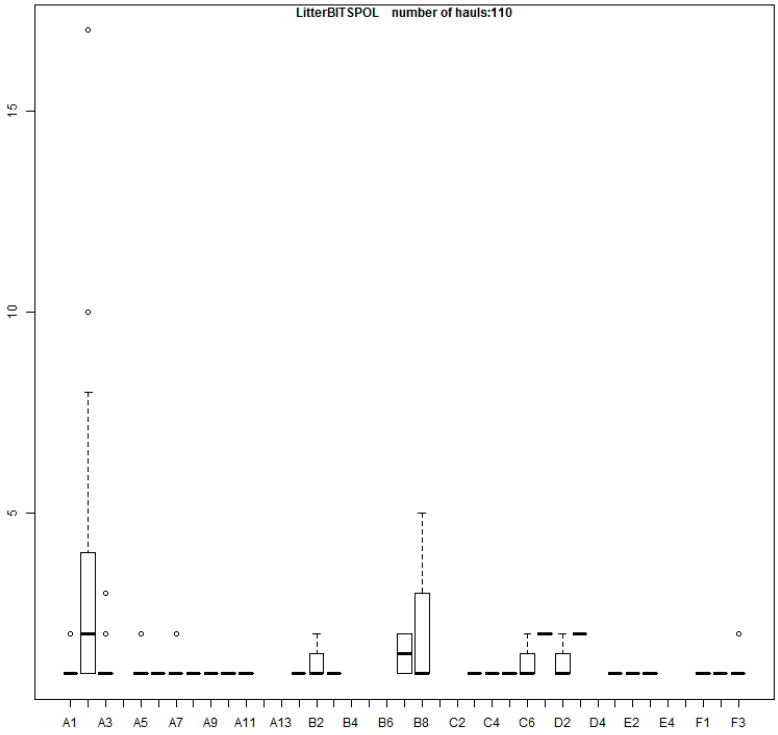

LitterBITSDEN number of hauls:822
5
0
-5
-10
-15
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

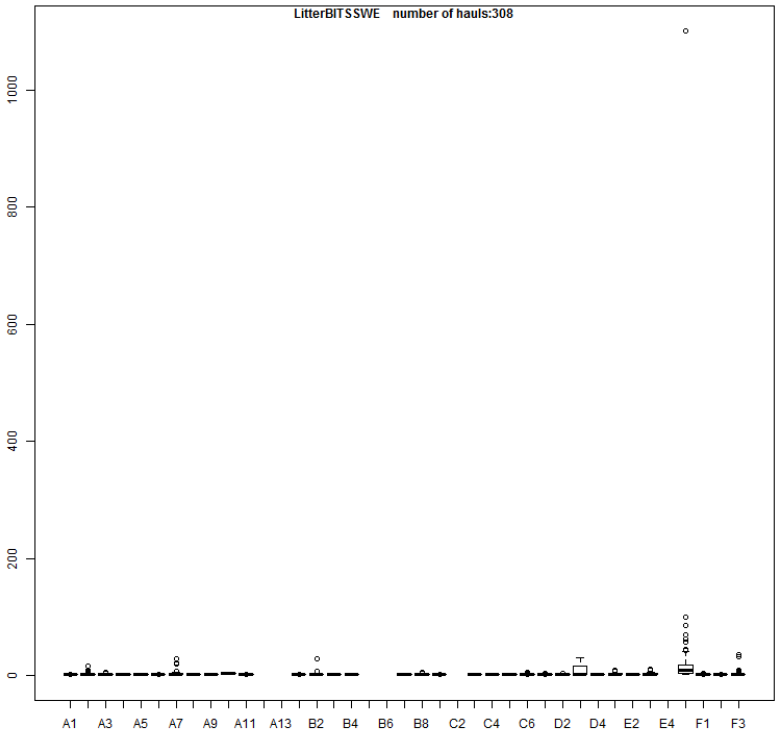

LitterBITSEST number of hauls:2
10
8
6
4
2
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

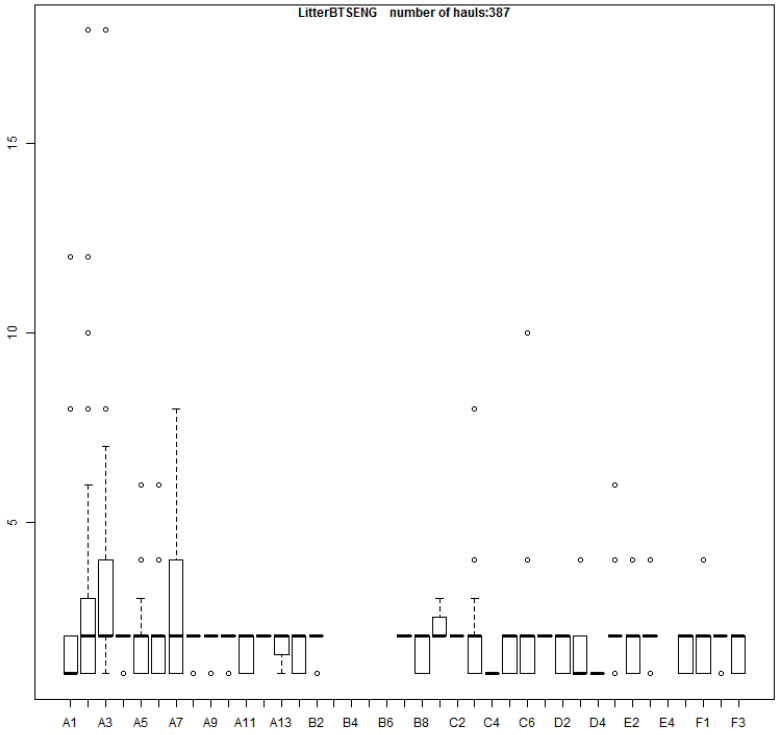

LitterBITSGFR number of hauls:389
0
5
10
15
20
25
30
A1
A3
A5
A7
A9
A11
A13
B2
B4
B6
B8
C2
C4
C6
D2
D4
E2
E4
F1
F3

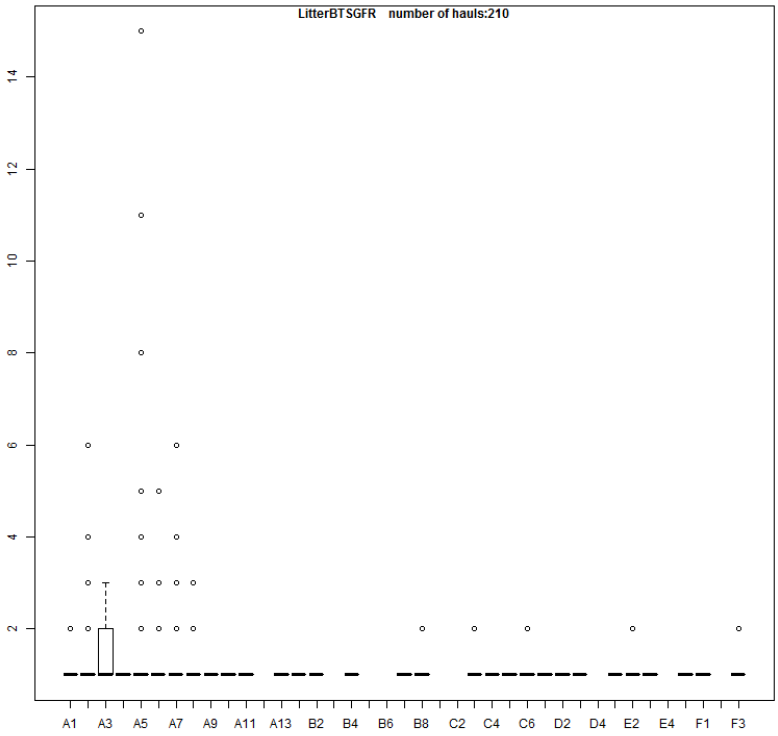

LitterBITSLAT number of hauls:4
0
10
20
30
40
50
A1
A3
A5
A7
A9
A11
A13
B2
B4
B6
B8
C2
C4
C6
D2
D4
E2
E4
F1
F3

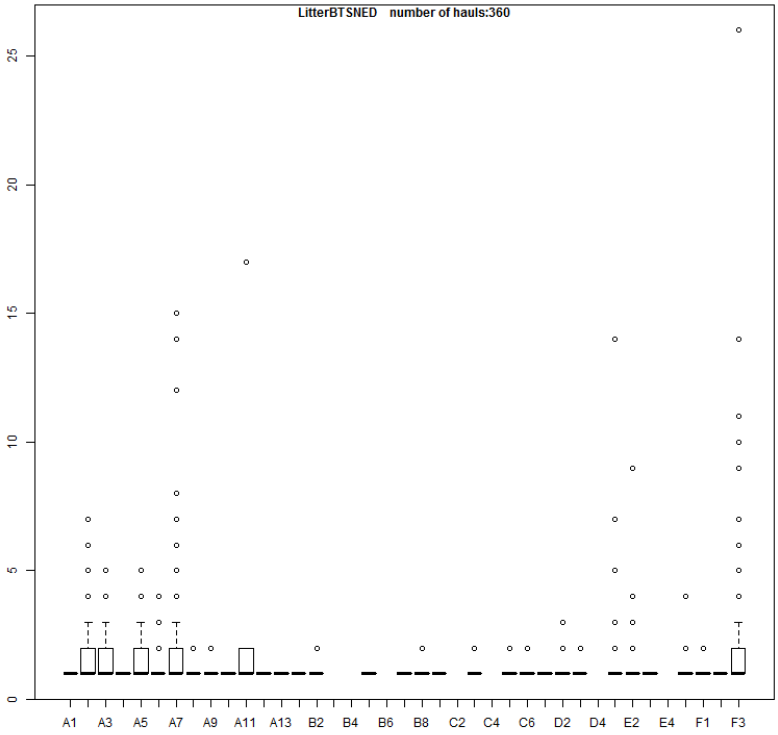

LitterBITSLTU number of hauls:14
2
4
6
8
10
12
14
A1
A3
A5
A7
A9
A11
A13
B2
B4
B6
B8
C2
C4
C6
D2
D4
E2
E4
F1
F3

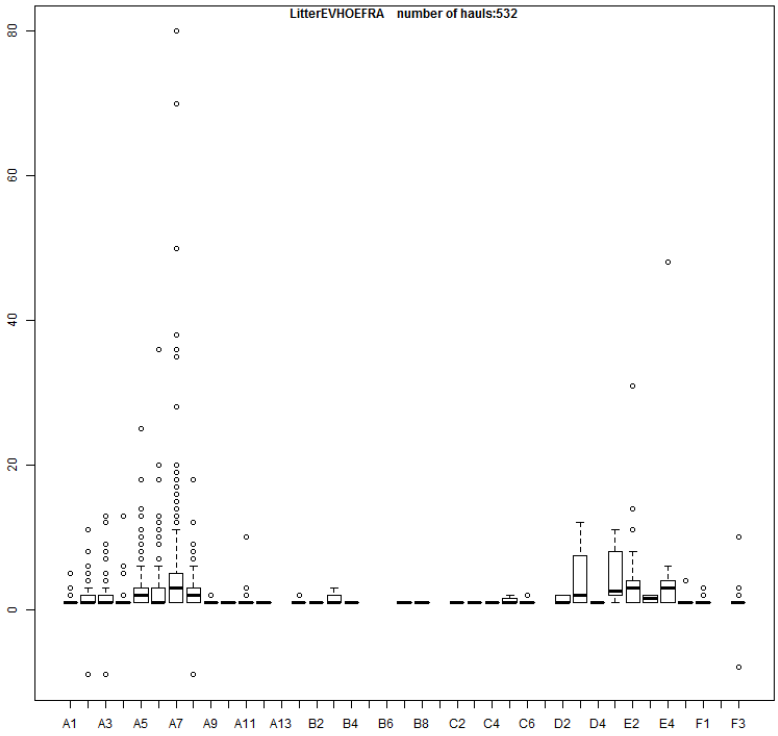

LitterBITSPOL number of hauls:110
5
10
15
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

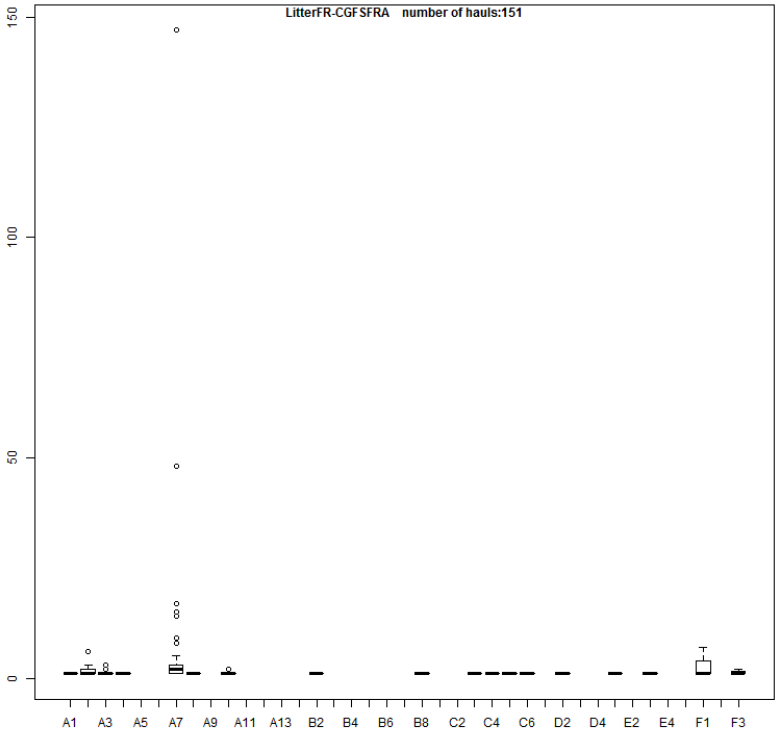

LitterBITSSWE number of hauls:308
0
200
400
600
800
1000
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

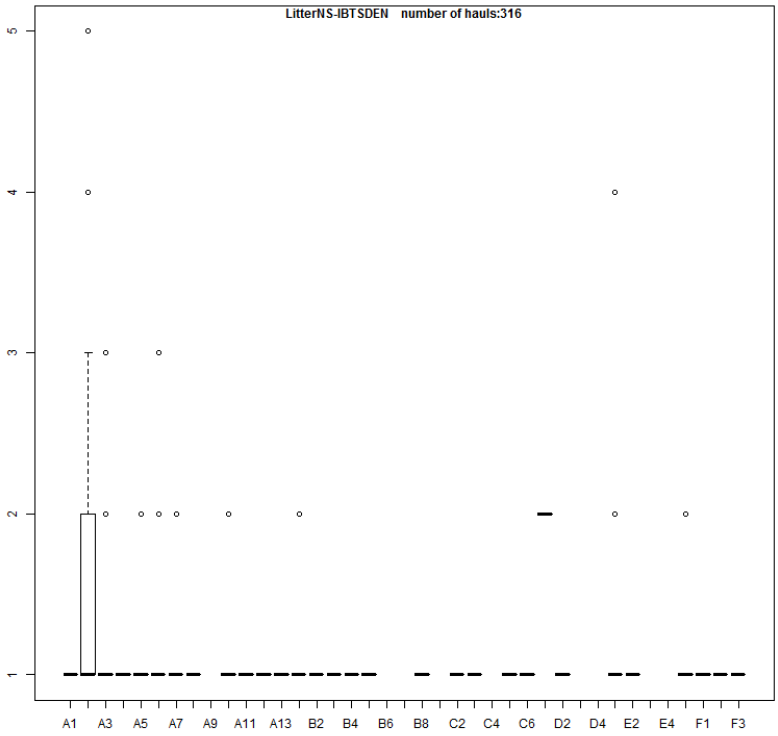

LitterBTSENG number of hauls:387
5
10
15
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

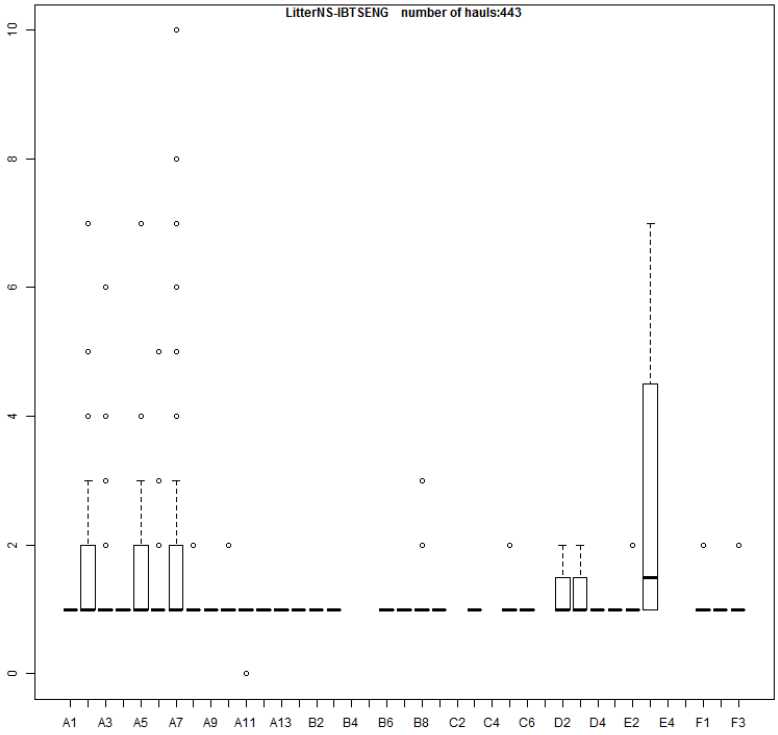

LitterBTSGFR number of hauls:210
2
4
6
8
10
12
14
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

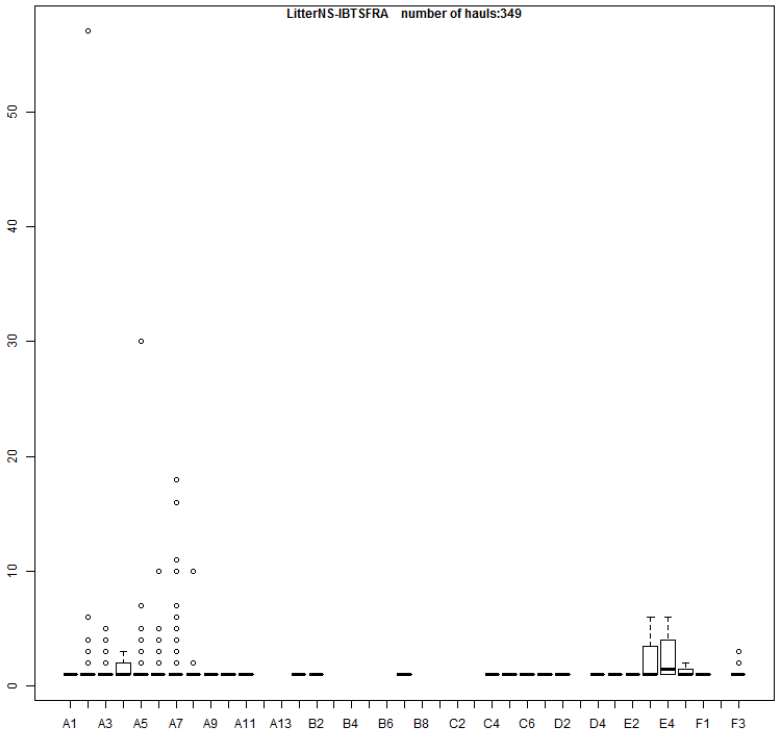

LitterBTSNED number of hauls:360
0
5
10
15
20
25
A1
A3
A5
A7
A9
A11
A13
B2
B4
B6
B8
C2
C4
C6
D2
D4
E2
E4
F1
F3

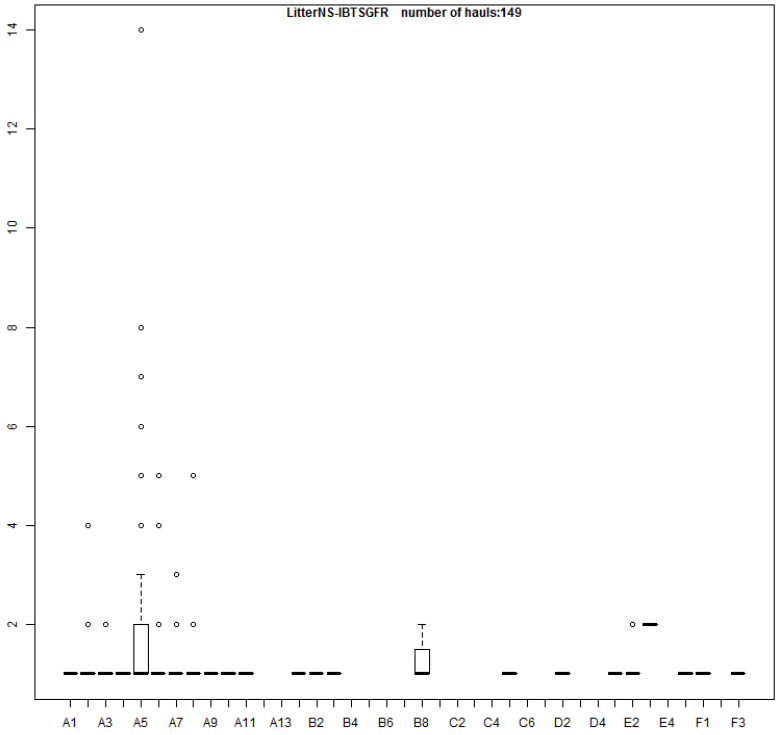

LitterEVHOEFRA number of hauls:532
0
20
40
60
80
A1
A3
A5
A7
A9
A11
A13
B2
B4
B6
B8
C2
C4
C6
D2
D4
E2
E4
F1
F3

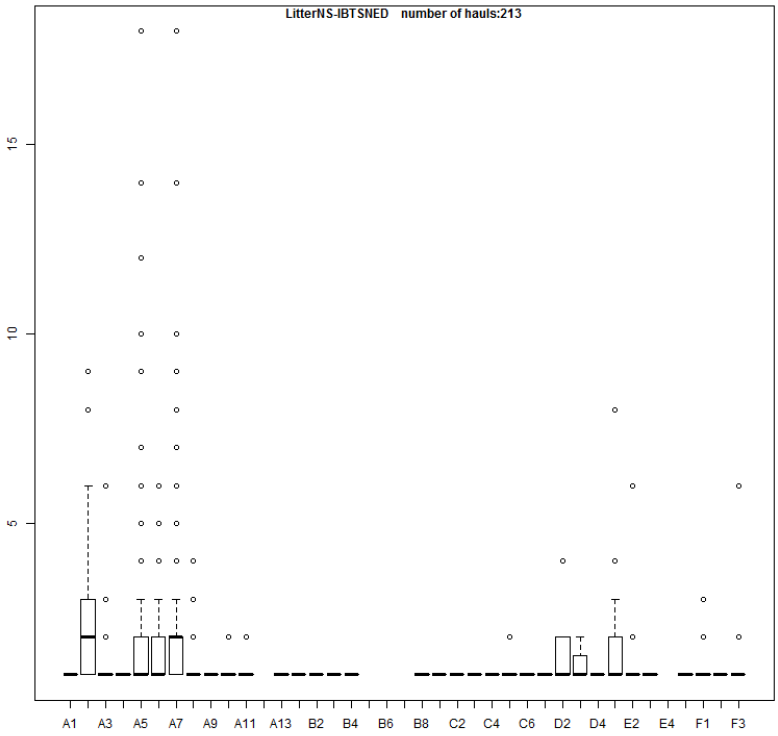

LitterFR-CGFSFRA number of hauls:151
0
50
100
150
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

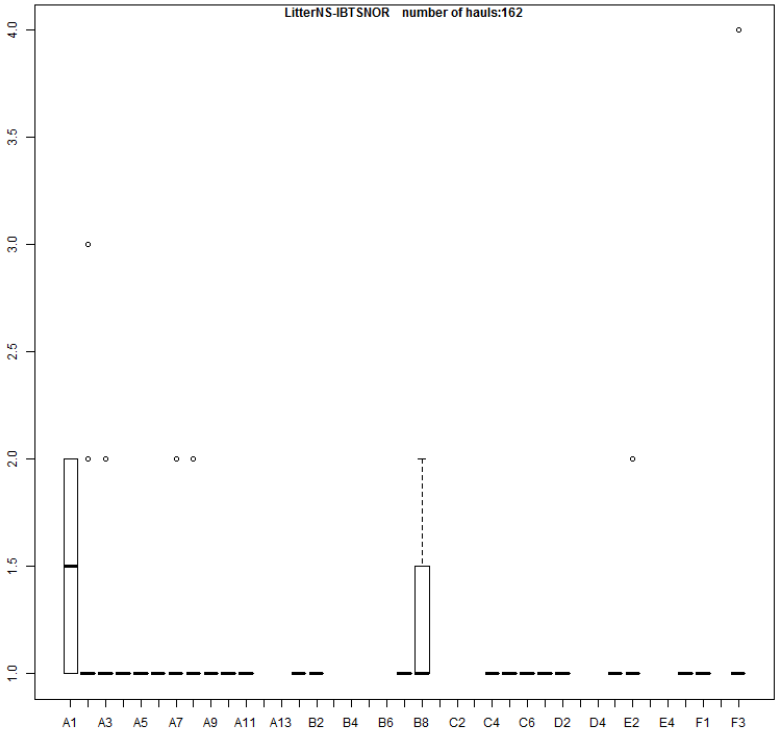

LitterNS-IBTSDEN number of hauls:316
1
2
3
4
5
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

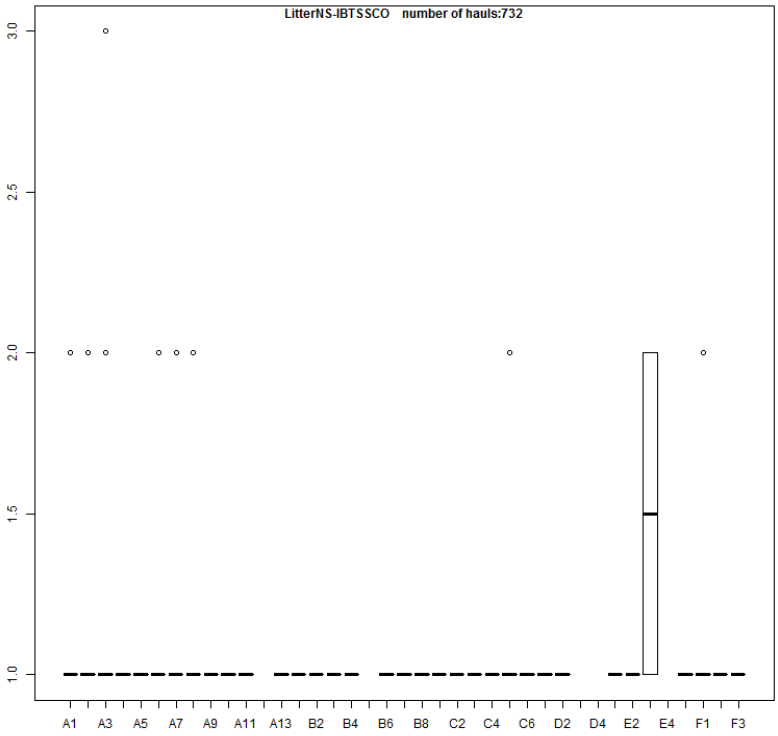

LitterNS-IBTSENG number of hauls:443
0
2
4
6
8
10
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

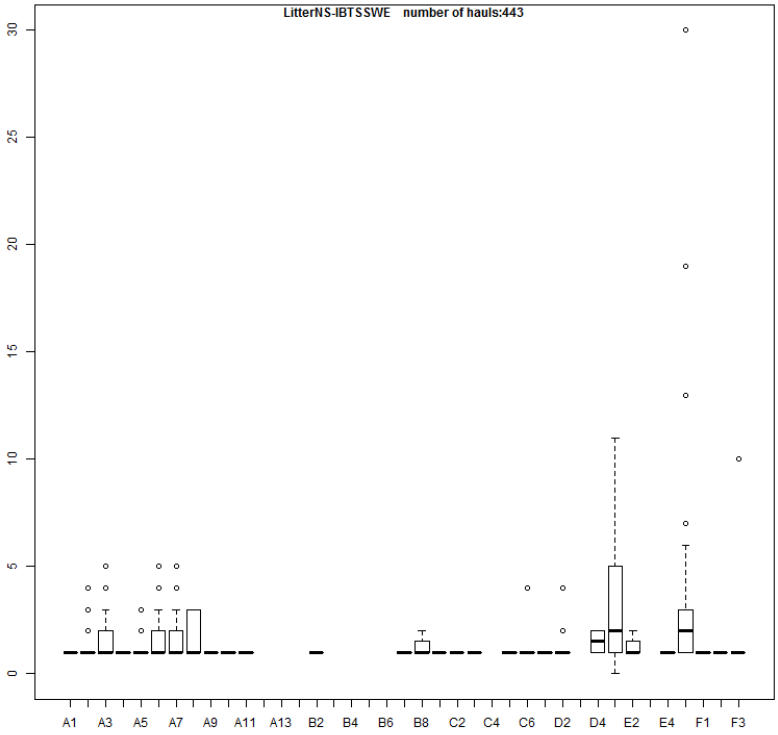

LitterNS-IBTSFRA number of hauls:349
0
10
20
30
40
50
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

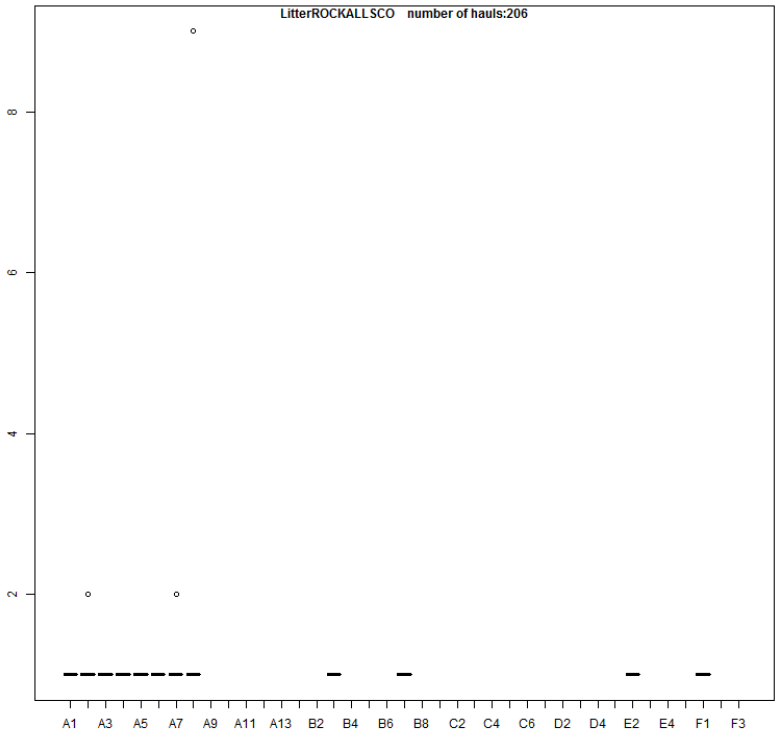

LitterNS-IBTSGFR number of hauls:149
2
4
6
8
10
12
14
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

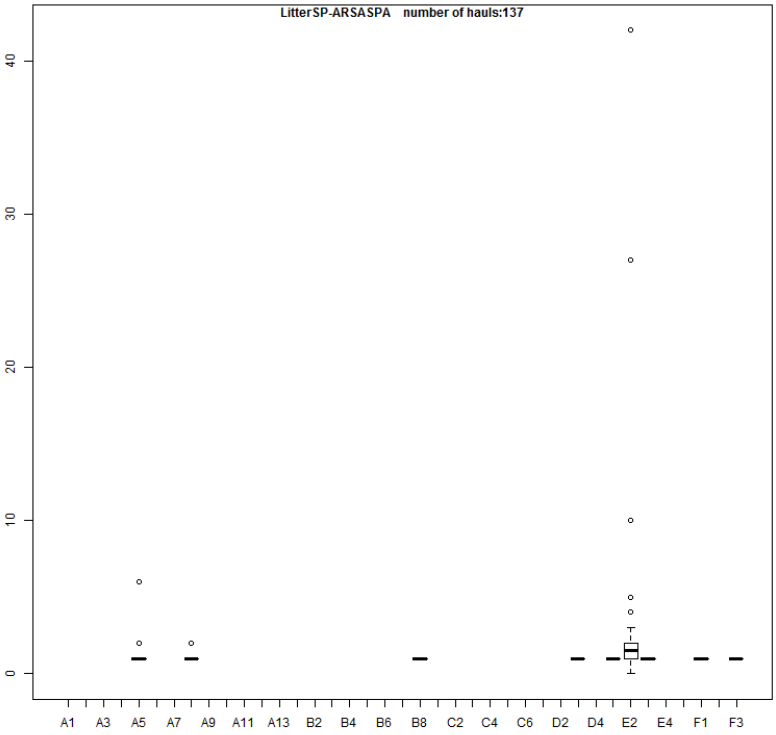

LitterNS-IBTSNED number of hauls:213
5
10
15
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

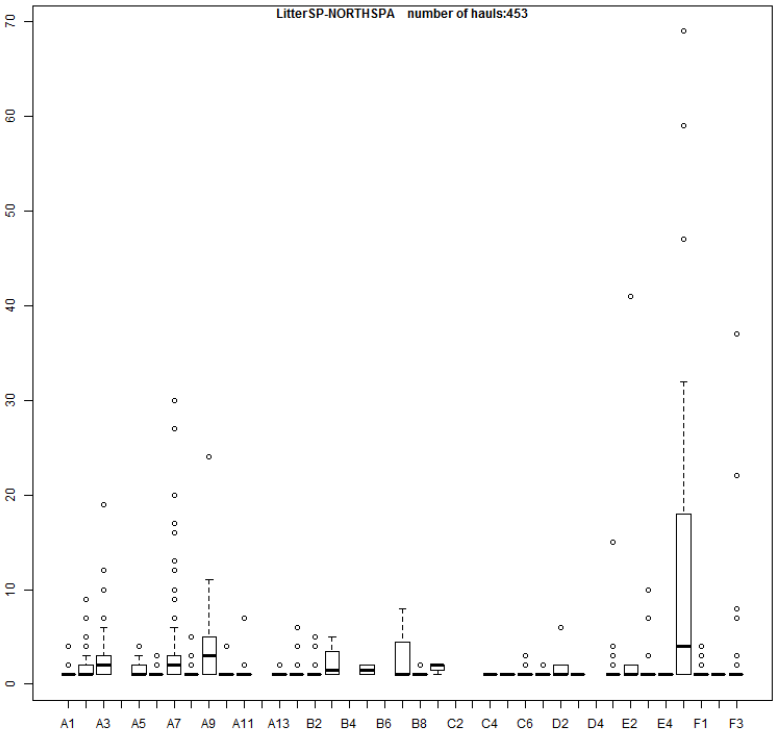

LitterNS-IBTSNOR number of hauls:162
4.0
3.5
3.0
2.5
2.0
1.5
1.0
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

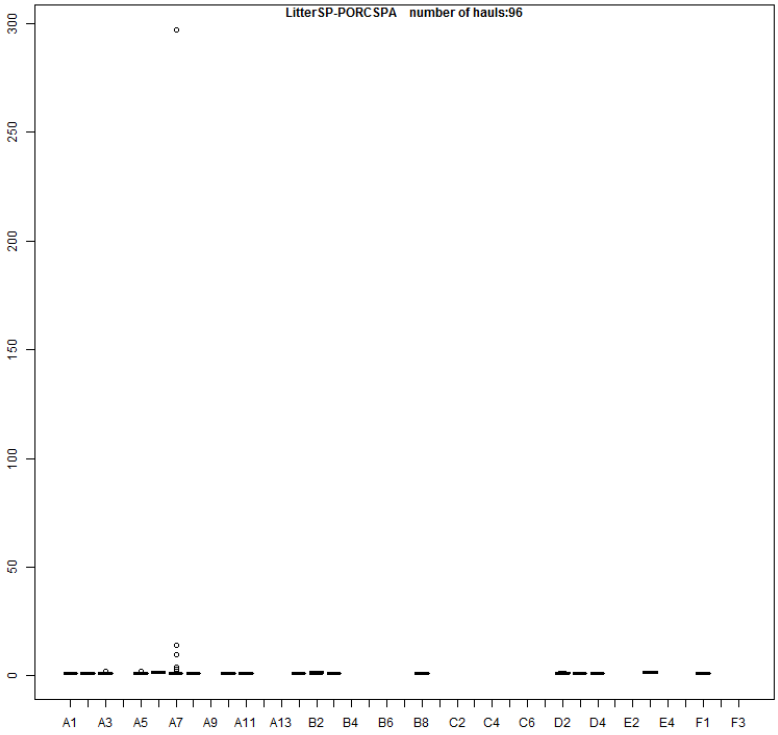

LitterNS-IBTSSCO number of hauls:732
3.0
2.5
2.0
1.5
1.0
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

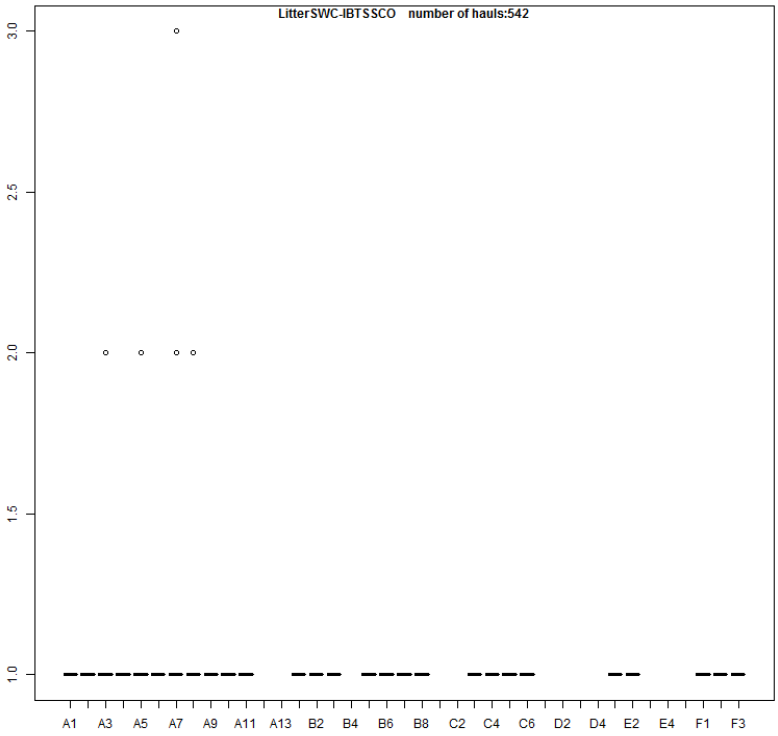

LitterNS-IBTSSWE number of hauls:443
0
5
10
15
20
25
30
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3


LitterROCKALLSCO number of hauls:206
2
4
6
8
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3


LitterSP-ARSASPA number of hauls:137
0
10
20
30
40
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3


LitterSP-NORTHSPA number of hauls:453
0
10
20
30
40
50
60
70
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3


LitterSP-PORCSPA number of hauls:96
300
250
200
150
100
50
0
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3


LitterSWC-IBTSSCO number of hauls:542
3.0
2.5
2.0
1.5
1.0
A1 A3 A5 A7 A9 A11 A13 B2 B4 B6 B8 C2 C4 C6 D2 D4 E2 E4 F1 F3

# Annex 9a: Discussion notes in preparation of the seafloor litter data collection guidelines

An overview has been made on available datasets on marine litter within different European countries, including following information: country, area, gear, survey and data location. Summarizing table is given in addendum.

Secondly, current monitoring and sampling was discussed, bringing forward different issues that monitoring people are faced with during sampling. These issues are summarized within 10 questions in the table beneath. For each question, different documents were consulted and checked what is described:

- Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area, Edition 1.0, Ospar commission
- A guidance document within the common implementation strategy for the Marine Strategy Framework Directive, JRC scientific and policy reports, MSFD Technical subgroup on marine litter, 2013.
- Manual for the international Bottom Trawl Surveys, Revision VIII, Series of ICES survey protocols SISP 1-IBTS VIII
- UNEP/IOC Guidelines on Survey and monitoring of marine litter, Regional seas reports and studies no. 186 – IOC Technical series No. 83.

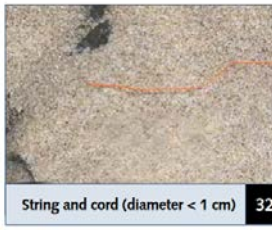
It was concluded by WGML that most documents did not provide an answer on the issues stated. Only within the beach litter monitoring, detailed information was given on some issues related to counting of litter and weighing of litter. For each question, WGML stated their advice (see Table below).

There were also issues related to the categorization of litter items. E.g. among countries, different definitions of "monofilament" are used. Issues related to categorization can be solved by having a photo guide which can be actively used during monitoring. The start-up of this photo-guide is given in addendum. For categories A5-A6, a change of names is proposed since not all monofilaments are fishing lines. For A5, it is suggested to use "monofilaments", for A6 "entangled filaments".

To assist monitoring and to reduce differences in litter counting between countries or even between people of the same country, a ring test is advisable and will be set up. Within this ring test, pictures of marine litter samples will be send around. Participants may categorize and count the litter and results can be used for intercomparison and harmonization of monitoring.

**Table 9.a.1. Overview of issues related to current monitoring and sampling of litter.**

| Question | Beach litter | Others | Advice |
|---|---|---|---|
| Mixed category –<br><br>In which category should we have to put the item? | • On the survey forms, each item is given a unique OSPAR identification number.<br>• Pieces of plastic that are not recognisable as an item should be counted as a plastic/polystyrene piece according to its size.<br>• Pieces of plastic that are recognisable as a small plastic bag (number 3 on the survey form) should be registered as such<br>• They have 123 categories for 100 meter strech survey!<br>• Many categories have the size of the item in the category<br><br>For the 1000 m survey the measure objects > 50 cm and have 24 categories. | - | If they are two or more objects who got entangled > count all recognisable items<br><br>If its an item made up from different materials > count as one item and classify according to the dominant (visual) material type |
| Counting- what do to with many pieces from the same original item? | All pieces of litter that are recognisable as<br><br>part of the same item should be counted as one item. For example pieces of a glass bottle (same colour). Page 13.<br><br>However all pieces of strings and cords should be counted although they might be from the same rope page 14. | - | Pieces of litter (eg plastic, glass) that are recognisable as originating from the same item should be registered as one.<br><br>All pieces of string and cord (monofilaments) should be counted. Often a piece of string or cord is found with smaller, detached pieces lying nearby that were obviously part of the original item. All separate monofilaments should be counted individually, even if they originate from the same larger item. |

| | | | |
|---|---|---|---|
| |  A piece of string, counted as such: 1 x numbe 32 on the survey form | | Pieces of plastic that are recognisable as an item should be registered as that item (e.g bottle neck). |
| Weighing-<br>Do we have to weigh? | They do not weigh items. | - | Mandatory: Number of items in a category.<br><br>Mandatory: Weight.<br><br>Recommended: Size<br>• Predefined surface categories A-F OR measure W x L x D.<br><br>See Annex 9c for more details. |
| Weighing-<br>Do we need to weigh wet or dry? | They do not weigh items. | - | Wet weight |
| Weighing-<br>Do we need to remove fouling? | They do not weigh items. | - | No, treat as found |
| Size-<br>Do we measure size piece by piece or grouping by category? | They have many categories for specific objects.<br>Ropes have different categories depending on diameter of the rope.<br>They have different categories for different sizes of plastic pieces. | - | by item and according to size class A-F<br><br>e.g. 16 similar subcategory items in three size classes = 12 items size A, 2 items size C & 2 items size F |
| Size – how to calculate the area of a 3D-object | They have many categories for specific objects.<br>Ropes have different categories depending on diameter of the rope. | - | Size: measure W x L x D |

| | | | |
|---|---|---|---|
| Volume-<br>Is it important to introduce volume? | They have many categories for specific objects.<br>Ropes have different categories depending on diameter of the rope. | - | Can be calculated from WxLxD |
| Content – is the content of a container also considered litter (e.g. chemicals?) | They have categories for cosmetic bottles, engine oil containers and paint tins. | - | No |
| Do we need category – "other fishing plastics" | They have octopus pots and crab/lobster pots besides nets and fishing line. | - | No |

The group described national/international needs, linkages and drivers for seafloor litter monitoring, its data and subsequent assessments in order to determine linkages:

- Drivers for monitoring are NAP/ MSFD/ RSCs (OSPAR) and UN ENV/ G7 and G20 global actions plans ( platform & monitoring)
- Technical Constraints / monitoring guidances are MSFD guidelines, and UN interagencise GESAMP ( UN env related) protocols
- ICES/WGML to translate /transpose focus on NE Atlantic available data and constraints (OSPAR for montoring and ICES for supporting science). ICES/ WGML will also try to later harmonize with existing monitoring plans in North Pacific ( PICES relates) and the Mediterranean ( CIESM of related programmes)

## Annex 9b: Current Data Issues Seafloor Data and statistical and sampling issues for seafloor litter monitoring

This overview is not complete yet. It was a first quick trail of finding descrapencies in data reporting. It is requested to National data submitters or those collecting the data to extend this overview.

**NOR**

NS-IBTS:

- No zero hauls reported
- Never more than 1 A5
- Only 4 times A7 more than 1 item (all four cases only 2 ropes)

**NED**

NS-IBTS

- 2013 limited counting (no individual ropes)

BTS

- Limited counting 2012-2015 (rarely ropes counted individually)

**DEN**

BITS

- Not counted items in most years
- Only counted in 2016

NS-IBTS

- Only in a small number of case more than one A5, A6, A7. Never more than 2.

**FRA**

NS-IBTS

- 2012-2014 nothing counted
- 2015 and 2016 items counted

CGFS

- 2015 not counting individual items.

**SCO**

NS-IBTS

- Only very rarely 2 or 3 items per category.
- Likely not been counting consistent

SWC-IBTS

- Not been counting individual items

#### Restrictions and limitations:

**Will the sample give an unbiased estimate of the population litter per km² in a defined region?** If not, we could try to remove the problems or to redefine what we mean by our population estimate (see below).

**There may be more sampling in some areas of the region than others**. This will bias your sampling estimate towards the value in the areas that have been more heavily sampled. If the sampling design cannot be changed then we could create a stratified estimator for the heavily and lightly sampled areas. We would then weigh this by area.

**The sample points are from fishing surveys and so they will avoid areas with lots of obstacles (e.g. rocks, wrecks) that could snag fishing gear.** These rocky areas may have more/less litter than sandy areas. I don't know an easy solution to this other than to redefine your estimator as: "litter per km² from fishable grounds (trawl specific)".

**When analysing the data for trends, confidence intervals we have always assumed independence of our data.** For example, it might be that data in a type of habitat or in a similar region are more similar than those in different ones. We could check spatial correlation using a semi-variogram plot. We could also check habitats if such data was available. If such correlations are present, we can get around them by modelling them during the analysis (or removing them by explicitly modelling habitat, for example).

#### Different methods of litter collection:

**Comparing litter over time or space is problematic if different gears have been used to collect the litter.** We could come up with conversion factors for the litter by examining counts from nearby areas that have been collected with different gears. However, we would need to make sure both the mean as well as the variance is correctly dealt with by the convergence factor (which might be tricky). An equivalent method to the conversion factor is to include litter collection method as a factor when modelling the data. We can then standardise outputs to a chosen gear. Also, if a whole region is sampled with one gear type and another region with another type then gear and regions are confounded. So we would need to have both gear types in the same region to estimate a gear effect. Another problem with a conversion factor is that 0 counts get converted to 0 counts. So, the way to do it is to model the data and effectively change the mean level in a (say) Negative Binomial distribution.

**Standardising data to litter per km²**. This seems to be common practice, but there are statistical problems with it (similar to those when using conversion factors). For example, if you have counts of 0, 1, 2 and 3 in the raw data from a 0.1km² haul, and then you multiply these data by 10 then you end up with data that is 0, 10, 20, 30. This is clearly not what you would have in a real survey of area 1km². Similarly, if you have presence absence data on 0.1km² and then you multiply this by 10, you get some silly results – for example, if you had a real survey of 1 km² then you would get far fewer 0s than from a 0.1km² survey. As above, the answer is to model data on the original scale and then to

use the area swept (or haul duration as a proxy) as an explanatory variable (an offset in technical terms). You can then get outputs from your model for standard haul areas.

#### Assessment outputs:

**What does our data really tell us in terms of actual temporal patterns of litter?** That is, has the litter from our 2017 survey actually been dropped in 2016-17? Anecdotal evidence suggests that this is not the case and we have a time-lag for litter items. But what is this time-lag, what happens to old litter, what proportion of our counts are old litter and what proportion are new litter. We should probably do some ageing of captured litter to help us with this. If the litter is swept out of our regions then maybe we don't need to worry about it. If it is in the region, but buried in the sediment then we should probably know about it.

#### Sampling concerns:

**Is there a problem if the same piece of seabed is sampled from year to year?** The advantage is that this may give us 'new' litter. The disadvantage is that there may be less litter here than in other places. However, if litter moves about a lot then this whole thing may not be an issue – that is, an area may not stay clean for very long.

**The time of year may influence the amount of litter found**. WGML member presentations showed that more litter was found in different seasons.

#### Future work:

Once all the above have been sorted out (!) then **we should be looking at our surveys and deciding what we want to use them for.** For example, do we want to measure litter levels in a particular year with a certain precision or do we want to detect an X% trend (whatever, trend might mean)?

# Annex 9c: Seafloor Litter Data Collection Guidelines

The following guidelines are predominately addressed to those (crew, researchers etc.) who carry out the sampling of seafloor litter on board during statutory fish task surveys (e.g. International Bottom Trawl Survey, Beam Trawl Survey etc.)

## Methodology

### 1. Sampling location

Seafloor litter should be collected at every station where a fish haul is planned during the cruise.

### 2. Collection of litter

#### 2.1 From the net

This point is particularly important to relay to any persons handling the net on deck that may not be directly involved in seafloor litter monitoring (e.g. crew members).

Where possible, as much litter should be removed from the net and placed in a bucket or container (whatever is appropriate for the amount of litter caught). This will minimise the chances of transporting litter from station to station. The accessibility of reaching all parts of the net will be ship- and net-dependent, but as much litter as possible should be removed.

#### 2.2. From the catch

Any litter from the catch should be collected and placed in a bucket or container (as above, whatever is appropriate for the amount of litter caught).

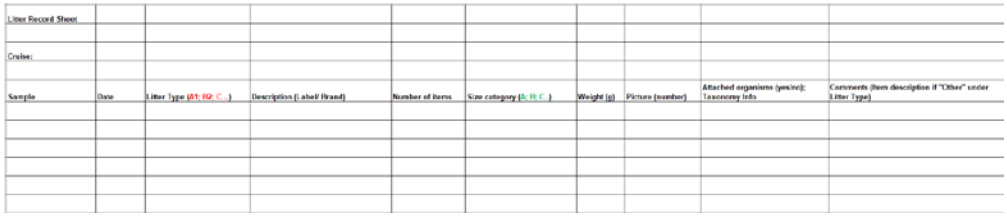
**NB.** For litter obviously originating from the ship (e.g. paint fragments and pieces of net that tie up the codend), these should be manually removed and separated from the rest of the litter so as to not record it (i.e. discard it as soon as possible to avoid the misrecoding of litter items).

### 3. Identification and recording of litter items

Identification of litter should be done using both Table 9.c.1 and the accompanying **photoguide**, which has been developed in order to facilitate the identification and categorisation of seafloor litter (see additional pdf). Figure 9.c.1 shows an example of the seafloor litter recoding sheet. The table has been revised to include A5 monofilaments (formerly A5 plastic fishing line (monofilament) and A6 Entangled filaments (formerly A6-plastic fishing line (entangled). A more detailed description of how to fill each column is outlined below.

**Table 9.c.1. Overview of litter categories (A-F) and their respective subcategories used for sorting and recording seafloor litter (C-TS-REV). The overview also includes the list of size categories that may be used during recording.**

| **Litter overview** | | | |
|---|---|---|---|
| | | | |
| **A: Plastic** | **B: Metals** | | **Related size category** |
| **A1.** Bottle | **B1.** Cans (food) | | **A:** <5*5 cm= 25 $cm^2$ |
| **A2.** Sheet | **B2.** Cans (beverage) | | **B:** <10*10 cm= 100 $cm^2$ |
| **A3.** Bag | **B3.** Fishing related | | **C:** <20*20 cm= 400 $cm^2$ |
| **A4.** Caps/ lids | **B4.** Drums | | **D:** <50*50 cm= 2500 $cm^2$ |
| **A5.** Monofilament | **B5.** Appliances | | **E:** <100*100 cm= 10000 $cm^2$= 1 $m^2$ |
| **A6.** Entangled filaments | **B6.** Car parts | | **F:** >100*100 cm = 10000 cm2= 1 m2 |
| **A7.** Synthetic rope | **B7.** Cables | | |
| **A8.** Fishing net | **B8.** Other | | |
| **A9.** Cable ties | | | |
| **A10.** Strapping band | | | |
| **A11.** Crates and containers | | | |
| **A12.** Diapers | | | |
| **A13.** Sanitary towel/tampon | | | |
| **A14.** Other | | | |
| | | | |
| **C: Rubber** | **D: Glass/ Ceramics** | **E: Natural products** | **F: Miscellaneous** |
| **C1.** Boots | **D1.** Jar | **E1.** Wood (processed) | **F1.** Clothing/ rags |
| **C2.** Balloons | **D2.** Bottle | **E2.** Rope | **F2.** Shoes |
| **C3.** Bobbins (fishing) | **D3.** Piece | **E3.** Paper/ cardboard | **F3.** Other |
| **C4.** Tyre | **D4.** Other | **E4.** Pallets | |
| **C5.** Glove | | **E5.** Other | |
| **C6.** Other | | | |


Litter Record Sheet

Cruise:

| Sample | Date | Litter Type (A1; B2; C...) | Description (Label/ Brand) | Number of items | Size category (A; B; C...) | Weight (g) | Picture (number) | Attached organisms (yes/no); Taxonomy info | Comments (Item description if "Other" under Litter Type) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

**Figure 1. Example of litter recording sheet to be filled out during seafloor litter collection**

### 3.1. Sample number

Sample number should be a code that links to haul information (e.g. station or haul number).

### 3.2. Litter Type

Table 9.c.1 and the photoguide should be used to fill Litter Type.

### 3.3. Description

This is not mandatory but may be useful to differentiate between similar litter items.

### 3.4. Number of items

The counting of items is mandatory. Count all recognisable items.

If, during a haul, there are several pieces that clearly originate from the same item, these should be counted as one.

### 3.5. Size category and weight

From 2019, it will be mandatory to report both weight and number of litter items. It is also recommended that size is reported unless the object is entangled.

#### 3.5.1. Size

Size can be recorded in two ways:

- According to the related size categories (A-F) as per Table 9.c.1.
- By taking the W x L x D measurements
- Several objects may be reported per row if they belong to the same size

NB, size should be recorded per object.

#### 3.5.2. Weight

If weight is the preferred parameter, the following should be done:

- Items should not be left to dry. Ideally, weighing should be done as soon after the haul as possible
- Any fouling should NOT be removed. Item should be weighed as found. An indication of the degree of biofouling can be made in the comment section.
- Preferably, items should be weighed individually. If the items are weighed together, the total weight for (multiple) items of the same litter type/category and size should be reported.

### 3.6. Picture number

The picture number relates to the photo number on the camera used to photograph the litter item(s). The recording of the picture is optional. However, this may be useful for future reference and as a backup if the surveyor is unsure on how best to categorise the item.

### 3.7. Attached organisms

Any organisms attached to the litter item should not be removed (as stated in 3.5.2). The recording of organism is optional.

### 4. Additional useful information and FAQ

Items composed of mixed categories – in which categories to put these and how to count them:

- If an item is made up of two or more objects that have become entangled, and all items are recognisable, all items should be accounted for separately. E.g.

- If the item is made up of different materials, the item should be counted as 1 and classified according to the (visually) dominant material

Is the content of a container also considered litter (e.g. chemicals)?

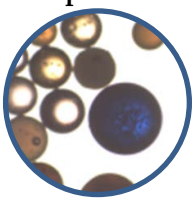
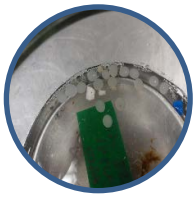
- No, only the physical container is considered a litter item.

## Annex 9d: Seafloor and Microplastic Photo Guidelines

### PHOTOGUIDE SEAFLOOR LITTER CATEGORIES

ICES WGML 2018
Seafloor Litter Photc

### PHOTOGUIDE MICROLITTER CATEGORIES

| Spheres | Fragments/Foam | Film/Foil | Fibres | Pellets |
|---|---|---|---|---|
|  |  |  |  |  |
| round, smooth, evenly shaped, spherical, hard, smaller than pellets | irregular, angular; sharp or smooth edges; three-dimensional; soft or hard | flat, thin, two-dimensional, flexible or rigid | long or short, thin, fibrous; flat or cylindrical; single filament or multiple filaments entangled; can be clumped together | spherical, cylindrical, disc or ovoid; hard; larger than spheres, diameter > 1 mm |

## Annex 10: Progress on an overall assessment

These are what we think we could do in terms of an overall assessment of litter levels from the seafloor surveys.

We have litter data from 14 surveys. Whilst we haven't done an extensive investigation of these data, we have noted the following problems with the data.

- Some countries record weights and counts, some record only counts and some record only weights. For example, in most of the IBTS survey, DEN records weights only. For the initial observations in the EVHOE survey, FRA records weights only. We have created a new count variable for where the count is zero but where there is a positive weight. In such instances, count is recorded as "1". We have, however, also retained the original count variable.
- Most surveys record weights. The surveys where no weight values are given are shown in Table 1.
- There are 40 cases where no weight or count value is recorded. These are mainly (39) for the BITS survey but there is 1 for the BTS survey. These values need to be checked. They do seem to have a recording for litter type – so it may be that they have simply forgotten to put down the weight or count.
- Our view is that not a single survey counts litter items properly. We have not considered this separately by year, but over all the years surveyed. The last column of Table 1 gives the proportion of 1 counts out of the positive counts recorded. It also gives the expected number of 1 counts as a percentage of positive counts that you would expect if the counts followed a Poisson distribution (a reasonable assumption of litter items are distributed fairly randomly – though the situation might well be worse if the items had some other distribution to reflect clustering of litter items). We can see that the proportion of 1s recorded is much higher than you would expect. Thus, the data on counts cannot be relied upon. One thought is that perhaps we should abandon any attempt to count litter items – we haven't managed it yet so it is clearly a difficult thing to operationalise. Instead, we could rely on weight and on presence/absence data.
- The count variable (LT_Items) is sometimes recorded as -9 and sometimes as 0 if there is a zero count. This should be standardised.
- There are 10 different gear types. We know that different gear types have different abilities to catch litter. The problem is that the gear types can be confounded with country or region effects.
- Some surveys record weight as Kg and some as grams (see Table 1). For my single file, I have converted all weights to Kg. However, this is an extra level of complication and I think that the original files should all be converted to Kg and data input people should be told to use only Kg.
- The NMarea (whether a haul is within 12 NM of the country) and the region (OSPAR/MSFD region) are not reliable at present. This needs to be fixed in the original data files.

- The weights and counts should be checked for potential outliers. The two highest weight values recorded at present are 46 318 Kg in the EVHOE survey and 1330 Kg in the FR-CGFS survey. The two highest count values are 1100 in the BITS survey and 297 in the SP-PORC survey.
- The surveys PT-IBTS and IE-IGFS need to be put into the same column format as the other surveys and to have their own data files.

**Table 1. Summary of differences between the surveys.**

| Survey | Gear type | Weight unit | No Weight recorded | No Weight or Count recorded | % +ve counts=1 and expected number (.) under Poisson assumption |
|---|---|---|---|---|---|
| BITS | TVL, TVS | Kg | 42 | 39 | 75 (16) |
| BTS | BT4A, BT4AI, BT7, BT8 | Kg | 825 | 1 | 98 (55) |
| EVHOE | GOV | g | 1 | 0 | 52 (14) |
| SPPORC | PORB | g | 0 | 0 | 85 (10) |
| SWCIBTS | GOV | Kg | 30 | 0 | 99.7 (58) |
| FRCGFS | GOV | g | 0 | 0 | 73 (17) |
| NSIBTS | GOV | Kg | 162 | 0 | 91 (51) |
| ROCKALL | GOV | Kg | 0 | 0 | 98 (55) |
| SPARSA | BAK | g | 0 | 0 | 93 (48) |
| SPNORTH | BAK | g | 0 | 0 | 67 (27) |
| PTIBTS | NCT | Kg | 0 | 0 | No counts |
| IEIGFS | GOV | Kg | 0 | 0 | 82 (35) |

Some of these issues are relatively easy to address, others are more deep-rooted. At present, our only option is to use presence-absence data. My view is that a good aim is for us to produce maps of the probability a haul contains a chosen item (e.g. plastic, plastic bags). The precision of this map will be low in some areas – e.g. where BAK gears have been used and where there is no data from other gears nearby.

The first challenge will be to get the data from the 12 surveys into a form suitable for modelling and analysis. We will convert the data from the current ICES format, where there is a single row for each litter item to one where there is a single row for each haul. Thus, for each row, there are columns that record the presence/absence for each litter category. Note that for countries that counted the litter items properly, it would be possible to produce this file with actual counts in. We haven't done this at present until a comprehensive list of the data that is binary has been produced.

We propose to model the data as one big data file. For ease of explanation, we will assume that we are modelling that a trawl contains a plastic item - call this Pr(P). We suggest to fit a Generalised Additive Model to explain Pr(P) with a logistic link to make sure

that Pr(P) does not go outside the range (0,1). We suggest to use the following explanatory variables and that we initially fit this spatial model to each year:

- Gear – as a factor
- Quarter – as a factor
- Latitude / Longitude – as a bivariate GAM smoother (perhaps with restricted degrees of freedom)
- Area of haul or duration of haul depending on variability

For the resultant map, we would do this for fixed values of the explanatory variables. For example, GOV traul, Quarter 3, duration 30 minutes.

Figure 1 below shows a similar assessment which was done for the OSPAR Intermediate assessment in 2016 although in this instance we used data with similar gears. We aim to produce a similar sort of plot, but for the whole of the ICES region. Suc map would form the basis of a strong publication – bringing together the work done by all the participating countries.

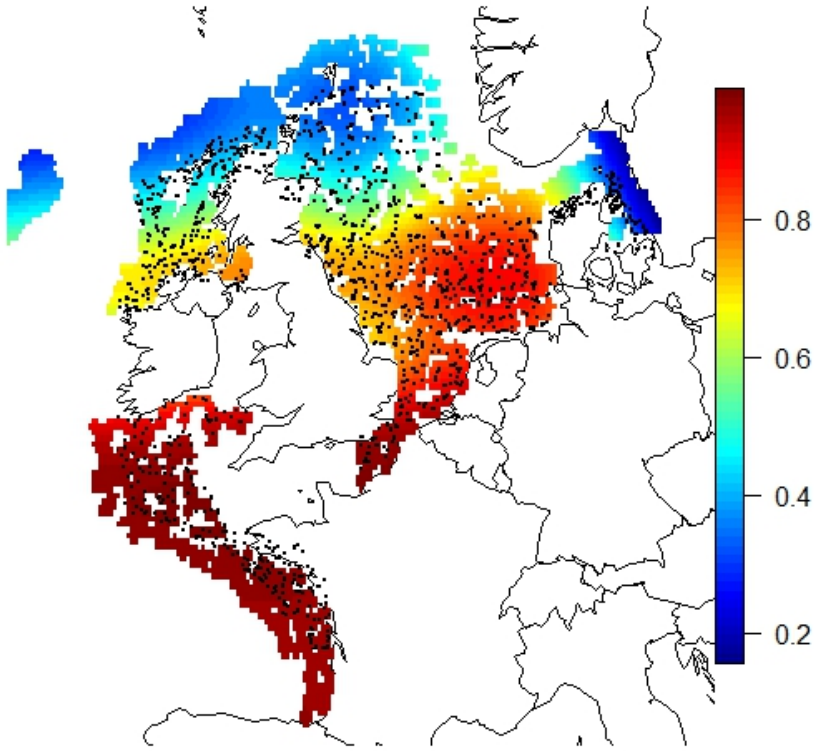



**Figure 1. Smoothed probability that a haul contains plastic.**

## Annex 11: OSPAR Candidate Indicator for Microplastic in Sediment

0610_Micro_litter_C
andidate_Indicator.p

# ANNEX 12: QA/QC Framework for microplastic monitoring and analysis

### Microplastic assessment – overview

Within microplastic assessment, multiple decisions have to be made: a broad range of analytical methods are available, giving a different degree of information but also cost-effectiveness. Choices have to be made regarding monitoring or research scheme and sampling procedure. Within each step, quality assessment and quality control are essential and should be taken into account throughout the entire procedure.

### Type of monitoring and research, objectives and matrix

To set up the microplastic assessment, best fit for purpose, researcher should be aware of which type of monitoring and research is requested: if it is important to determine a status or condition, to identify trends or reach specific research goals will influence the way forward. This will also be strongly dependent on the objectives of the assessment. Different objectives can be identified, which will define the degree of information wanted, e.g. if detailed polymer information is necessary or not.

Identified objectives may be:

- Identification of abundance
- Identification of occurrence
- Identification of sources
- Identification of pathways
- Identification of food chain
- Set Ecological Quality Standard

Marine matrices that can be analyzed to achieve these goals are water, sediments and/or biota. Performance criteria for microplastic analysis may be put forward in order to select the best sampling and analysis approach.

### Monitoring or sampling scheme

After identifying goals and objectives, researchers should decide on the monitoring/sampling scheme. It is important to consider what the best selected sample will be: should the researcher sample surface water or deeper water, top layer sediment, mixed sediments or different layers, the entire organism or the edible part of an organism, … Spatial and temporal variability of the monitoring scheme should be considered. Whereas a study may want to identify small temporal changes, other studies may put their focus on spatial variability. Both natural as well as analytical variability should be taken into account in order to meet the requested statistical power to meet good sensitivity and to determine the amount of replicate samples and subsamples. Use of pilot studies to estimate variability is hereby essential. The presence of quality controlled international data on microplastic occurrence within the ICES databases may play an important role in estimating variability and performing power analysis.

### Sampling and transport

Depending on the depicted matrix, different sampling techniques can be selected. Nets and pump for water analysis, corers, grabs or shovels for sediment analysis, different fishing techniques or manual sampling for biota sampling, …

Due to the omnipresence of microplastics in the environment, stringent background reduction measures should be taken during sampling, subsampling and transport. Possible background reduction measures may be:

- Avoid the use of plastic material within the sampling procedure, the division into subsamples and the use of sampling containers or sampling packaging.
- Precleaning of all materials used during sampling and transport is mandatory. Filtered water can be used. Use of solvents such as ethanol may even perform better since solvents reduce surface tension and enhance cleaning efficiency.
- In case of water sampling by a net, the net should be thoroughly cleaned before sampling. When multiple tracks are planned close to each other, the use of 2 nets can be advisable.
- All containers should be sealed as much as possible during and directly after sampling.
- Train all persons involved in sampling with special focus on QA/QC measures.
- If a plastic material cannot be avoided during the sampling procedure, a subsample of the plastic used can be taken, e.g. to recheck by FTIR (e.g. net material).
- Record the color of clothes as well as the color of the research vessel.
- Where possible, field blanks can be taken in order to take into account background contamination at the sampling site.
- To estimate airborne contamination during handling, filters can be set for the time of sampling to estimate this effect.

### Laboratory analysis

After sample transport and sample storage, samples are analyzed in the lab. Harmonization of methods is important, although research/monitoring goals and cost-effectiveness are important to take into account in selecting the method best fit for the purpose. Multiple research papers have described analytical methods, dealing with different extraction techniques, density separation, digestion media and filtration steps. A thorough comparison of methods is beyond the scope of this report. It is, however, important to notice that users should be aware of the limitations of their methods. E.g. within density separation, the selected salt will define the efficiency of the separation process but also affect the analysis cost. For biota analysis, different digestion media have different impacts on the matrix as well as the plastic itself. The optimum combination is therefore case-dependent. To determine the amount of microplastics, difference can be made between microscope counting, use of dye methods to enlarge microplastic visibility, identification of plastics by microFTIR or FTIR or other, advanced techniques. Also here, difference in research goals and cost-effectiveness determine the best choice.

Independent of the method selected, stringent background reduction measures should be taken. Possible background reduction measures may be:

- Preclean labware
- Filter all solutions that are added to the sample
- Cover all glassware
- Use clean air room if possible
- Check air contamination by tapes or exposing filters
- Frequently clean the place were analysis is performed
- Forbid synthetic clothes within the analysis lab
- Minimize the amount of people allowed in the analysis lab
- Dust filters may be applied to reduce air contamination
- Avoid plastic labware
- Minimize transfer steps

### Analytical method QA/QC

To assess the quality of the analytical procedure, multiple QA/QC steps should be taken into account. Advisable procedures are:

- Use of procedure blanks. Since background contamination is a large issue within microplastic analysis, laboratories should apply procedure blanks in order to estimate background contamination impact. Procedure blanks include the whole procedure. Procedure blanks may make use of a microplastic-free sample, e.g. filtered water for seawater analysis or fish filet for biota analysis. Otherwise, he procedure can run without matrix.
- Use of spiked samples. As positive control samples, spiked samples may be used. Microplastics are commercially available or laboratories may use custom-build microplastics. The use of different shapes and sizes is advisable. The amount of spiked microplastics may be determined by prior counting the added amount of microplastics or by weighing when spiked microplastics are uniform.
- Microplastic specificity. Even when the polymer type is not routinely determined, it is advisable to check to what extent the procedure allows to identify microplastics from other materials and which types of microplastic can be identified. (Micro)FTIR can hereby be of help.
- Quantification limit. Since background contamination is difficult or even impossible to exclude to 100%, values near background contamination levels can be questionable to report. It is therefore advisable to apply a limit of quantification, e.g. as three times the standard deviation of the procedure blanks.
- Procedure validation. To know the strengths and limitations of a method, method validation is advisable. Making use of procedure blanks and spiked samples, the determination of accuracy, precision, limit of quantification, specificity and robustness is advisable. Each microplastic method has also a lower size limit. The determination of this lower size limit can be an essential part of the validation procedure.

- Proficiency testing schemes and reference materials. By our knowledge, no proficiency testing schemes exist for microplastic analysis, neither are reference materials with known microplastic content available. However, efforts are being done to have proficiency schemes in the near future. WGML strongly advice laboratories to participate in these schemes in order to increase harmonization and quality control.