Tackling Marine Litter in the Atlantic Area

DELIVERABLE 4.1.- Regional characterisation of marine litter in the Atlantic Area

WP 4: Overview of the marine litter status in the Atlantic Area: floating litter

Interreg Atlantic Area
European Regional Development Fund
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DISCLAIMER

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Contextualisation

CleanAtlantic is an INTERREG Atlantic Area Programme project that aimed at protecting biodiversity and ecosystem services in the Atlantic Area by improving capabilities to monitor, prevent and remove (macro) marine litter. Besides, the project also contributed to raise awareness and change attitudes among stakeholders and to improve marine litter managing systems.

To achieve these aims, the work was organised in 8 work packages. The present deliverable aims at synthesizing the main results achieved on the frame of the action 1 of work package 4, which focused on the *Regional characterisation of marine litter in the Atlantic Area*. More specifically, this report deals with the assessment of the floating litter data available in this area. Additionally, the major key findings, gaps on monitoring and research as well as potential improvements and recommendations are identified.

Floating litter status in the Atlantic Area

1. Introduction

Floating macrolitter abundance and composition was assessed for the NW Iberian Shelf by IEO and for the South of the North Sea/English Channel and Bay of Biscay/Celtic Sea by IFREMER.

2. NW Iberian shelf

2.1. Study area

The pelagic campaign ''PELACUS'' is performed by IEO in a yearly basis during spring (April) covering the N and NW Iberian Shelf along coastline-perpendicular transects, 8 nautical miles away from each other. These surveys are aimed primarily at pelagic fisheries, although an array of multidisciplinary studies and data collection are carried out during the campaign. Experienced observers on board are responsible for the recording of top predator sights (marine mammals, sharks, turtles and seabirds), as well as floating litter. The data was collected during the period 2007-2017, for five main areas, encompassing Rias Baixas, Rias Altas, West Cantabrian Sea, Central Cantabrian Sea and West Cantabrian Sea (Fig. 2.1).

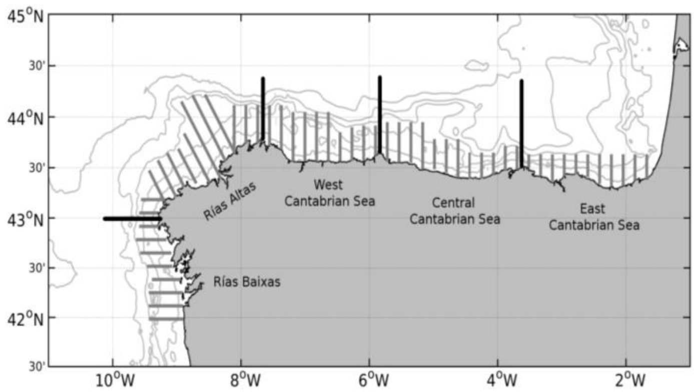


Figure 2.1. Sampling areas (black lines) and transects (grey lines) carried out in PELACUS surveys (extracted from the original report).

2.2. Results

The average of density of floating litter was 0.71 ± 0.04 items km^{-2} in the surveyed area, being the lowest registered values in Rías Altas and West Cantabrian Sea (< 0.8 items km^{-2}) and the highest in the East Cantabrian Sea (up to 2.0 items km^{-2}). Intermediate values were found in Rías Baixas and Central Cantabrian Sea, with densities of about 1.3 items km^{-2} (Fig.2.2).

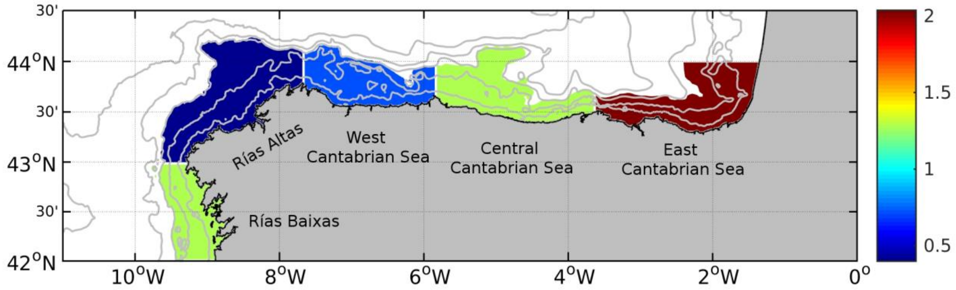


Figure 2.2. Floating litter density averages for the studied period at each sampling area (extracted from the original report).

Plastics contributed to 40.8% of the total observed litter, being wood the second most abundant detected item, yet in a much lower percentage (9%). Fishery-related litter comprised 1.2% of the whole. An important percentage was constituted by unidentified items, categorized as "small trash" (31.9%) and "trash" (15.9%) (Fig. 2.3).

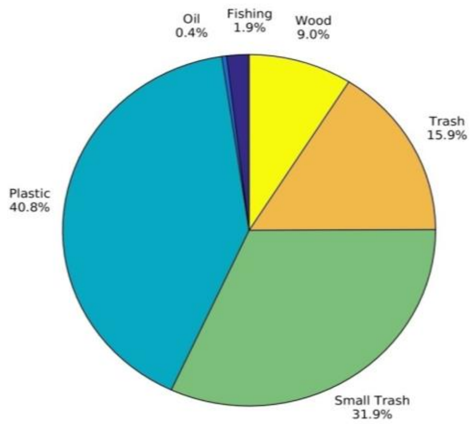


Figure 2.3. Contribution (%) of each floating litter type to the total amount of observed litter.

No inter-annual variability or temporal trends were identified for litter densities and composition although litter was more frequent near the coast. At least 50% of the total floating items were detected at distances closer than 12.6 km away from the shoreline, although plastics and trash items were observed at more distant locations (16.7 km and 16.3 km, respectively).

2.3. Gaps on monitoring and research

A relative high percentage of observed items could not be fully identified, neither their material nor their sources. It is likely that "trash" and "small trash" are made of plastic and in this case the plastic contribution to the total floating litter would reach 78%.

3. South of North Sea/English Channel and Bay of Biscay/Celtic Sea

3.1. Study areas

The implementation of the MSFD monitoring program was carried out in 2015 based on TGML recommendations (Guidelines 2013). In French Atlantic Areas (see figures 2.4 and 2.5), floating marine macrolitter was monitored on four yearly French fisheries stock assessment surveys on the R/V “Thalassa” vessel (Baudrier et al, 2018):

- IBTS (International Bottom Trawl Survey) during winter (January/February) in South North Sea/Eastern Channel,
- CGFS (Channel Ground Fish Survey) during early autumn (September/October) in zones 7d (Easter English Channel) and 7e (Western English Channel),
- PELGAS (*Petits Pélagiques Gascogne*) during spring time (April/May) in Bay of Biscay
- EVHOE (*Evaluation des resources halieutiques de l’ouest européen*) during autumn (end October, November, early December) in Bay of Biscay and Celtic Sea.

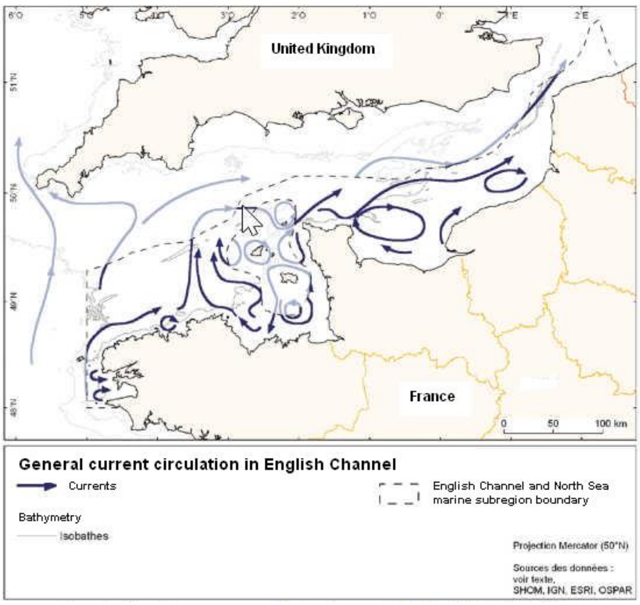


Figure 2.4: General circulation in the English Channel and South of North Sea (source Lazure and Desmare, 2012) from Gerigny et al, 2018.

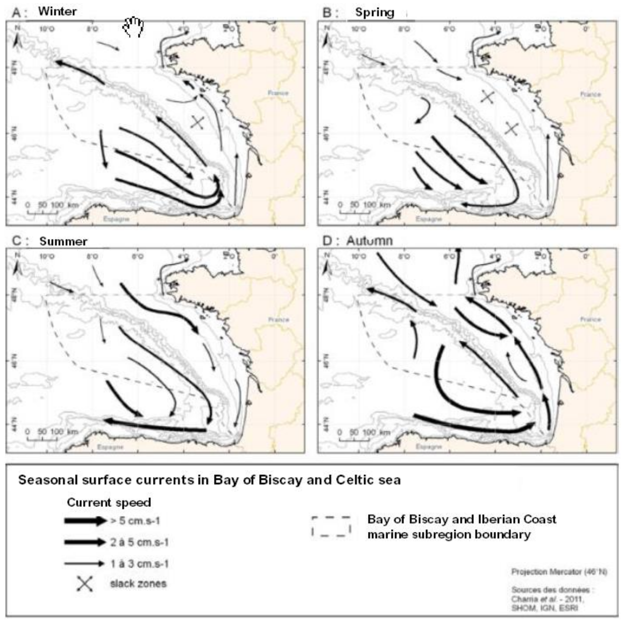


Figure 2.5: Seasonal surface currents on Bay of Biscay and Celtic Sea (source Lazure and Desmare, 2012) from Gerigny et al, 2018.

The MEGASCOPE protocol (Doremus and Van Canneyt, 2015) from UMS PELAGIS Institute is applied by observers on board. This protocol aims to observe marine mammals, seabirds, human activities, and floating marine macrolitter from the upper bridge or inside the bridge depending on weather conditions.

The table 2.1 below shows that PELGAS is the cruise with the most important number of legs with an average of more than 60% per year; followed by CGFS campaign with 25%, EVHOE campaigns with 19% and finally IBTS with 8% of the legs yearly.

	IBTS (Winter)	PELGAS (Spring)	CGFS (summer/automn)	EVHOE (automn)	Total
2015	23 *(4,8%)*	306 *(63,6%)*	78 *(16,2%)*	74 *(15,4%)*	**481** ***(100%)***
2016	23 *(4,9%)*	263 *(56,7%)*	97 *(20,9%)*	81 *(17,5%)*	**464** ***(100%)***
2017	75 *(15,2%)*	301 *(60,9%)*	118 *(23,9%)*	*0*	**494** ***(100%)***
2018	56 *(8,9%)*	388 *(61,4)*	114 *(18%)*	74 *(11,7%)*	**632** ***(100%)***
2019	42 *(8,8%)*	302 *(63,5%)*	74 *(15,5%)*	58 *(12,2%)*	**476** ***(100%)***
2020	9 *(7,1%)*	*0*	69 *(54,8%)*	48 *(38,1%)*	**126** ***(100%)***

Table 2.1: Number and percentage of legs per campaign and per year.

To have comparable results with the Spanish Institute of Oceanography (EIO), only observations realized under "good" weather conditions (i.e. Beaufort lower than 5), have been analysed. Thus, 2,673 legs out of 3,529 were kept in the dataset.

Considering the number of litter observations, Figure 2.6 summarises the number of legs per campaign, with and without litter.

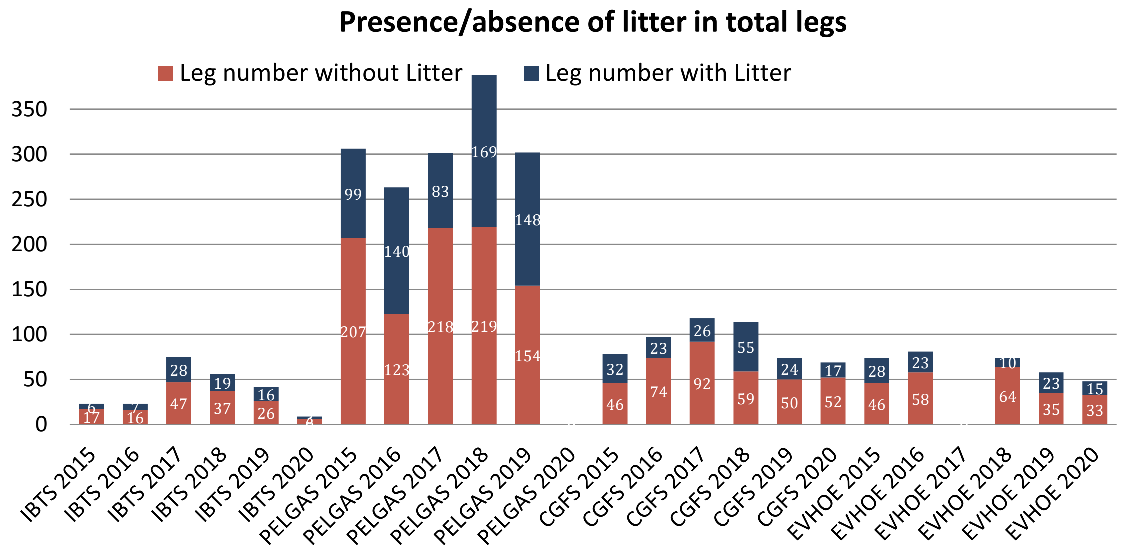


Figure 2.6: Number of legs with litter observations per cruise and per year.

In summary, litter was recorded in 37% of the 2673 legs analysed in this study.

3.2. Results

“**Plastic unspecified**” is the most common litter type with an average of 73.8% for all the cruises. The rank of the other types varied depending on the surveys (Figure 2.7 and 2.8).

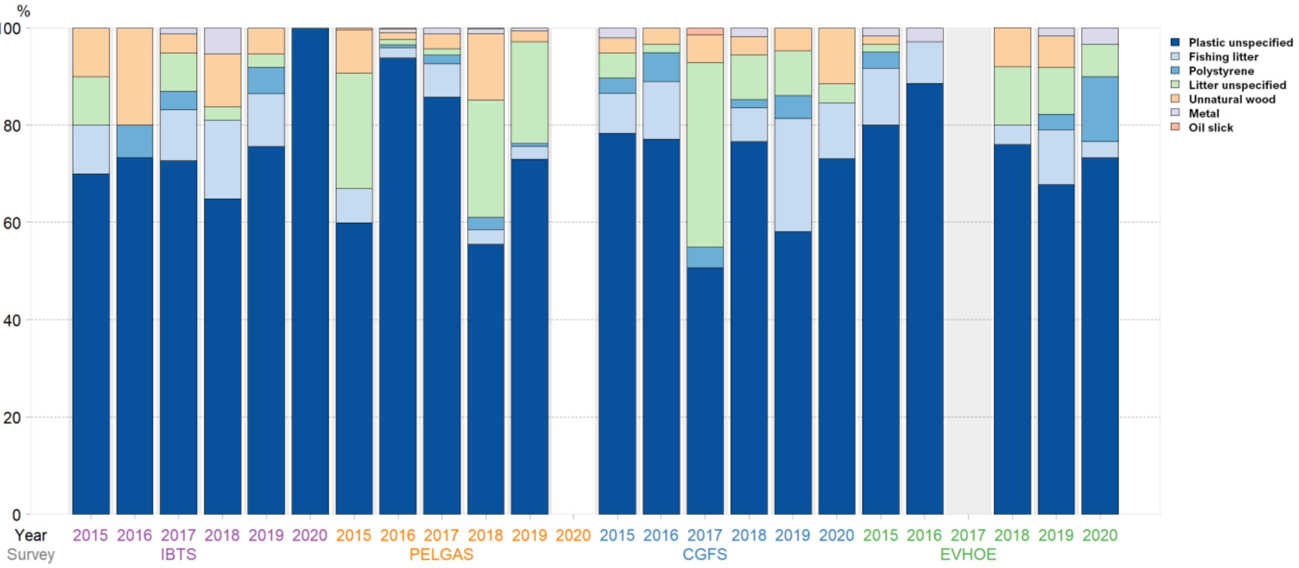
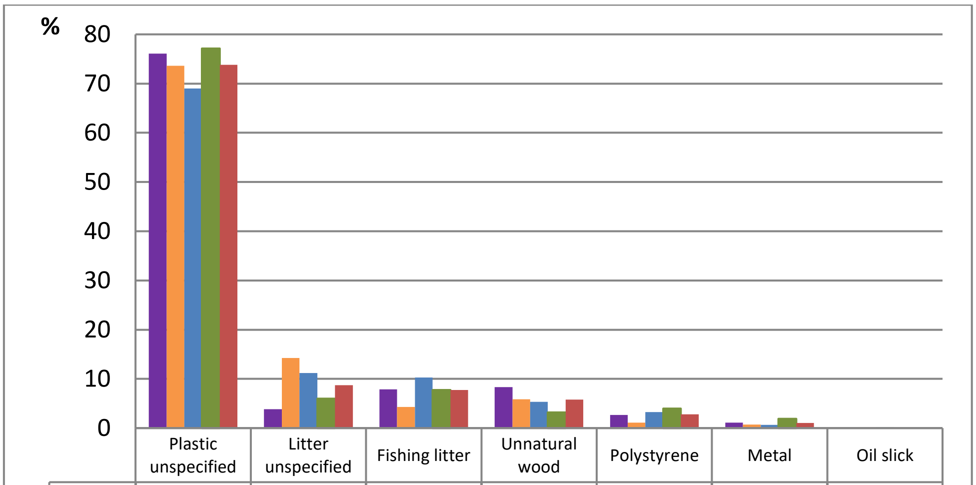


Figure 2.7: Percentage of the different types of floating litter collected during IBTS, PELGAS, CGFS and EVHOE surveys from 2015 to 2020.

Far behind “plastic unspecified”, the second most observed type of litter was “**Litter unspecified**” in PELGAS (14,2%) and CGFS (11,2%) surveys, whereas it was “**Unnatural Wood**” (8,4%) in IBTS surveys and “**Fishing litter**” (7.8%) in EVHOE surveys (Figure 2.8).



	Plastic unspecified	Litter unspecified	Fishing litter	Unnatural wood	Polystyrene	Metal	Oil slick
IBTS	76.1	3.9	7.9	8.4	2.7	1.1	0.0
PELGAS	73.6	14.2	4.3	5.9	1.1	0.7	0.2
CGFS	69.0	11.2	10.3	5.4	3.3	0.6	0.2
EVHOE	77.1	6.0	7.8	3.2	4.0	1.9	0.0
TOTAL	73.8	8.7	7.7	5.8	2.8	1.1	0.1

Figure 2.8: Percentages of the various types of floating litter collected during IBTS, PELGAS and CGFS and EVHOE surveys between 2015 and 2020.

The third one is “**Fishing litter**” in CGFS (10.3%) and IBTS (7.9%), whereas it is Litter unspecified (6.1%) in EVHOE and “**Unnatural Wood**” (5.8%) in PELGAS surveys. “**Metal**” and “**Oil slick**” were always the two less abundant types of litter with averages of 1% and less than 0.1% respectively for all the cruises.

Except for IBTS 2015, where sizes were not recorded due to the inexperience of the observers during the first survey, litter between 10 and 50 cm were the most commonly observed sizes (Figure 2.9).

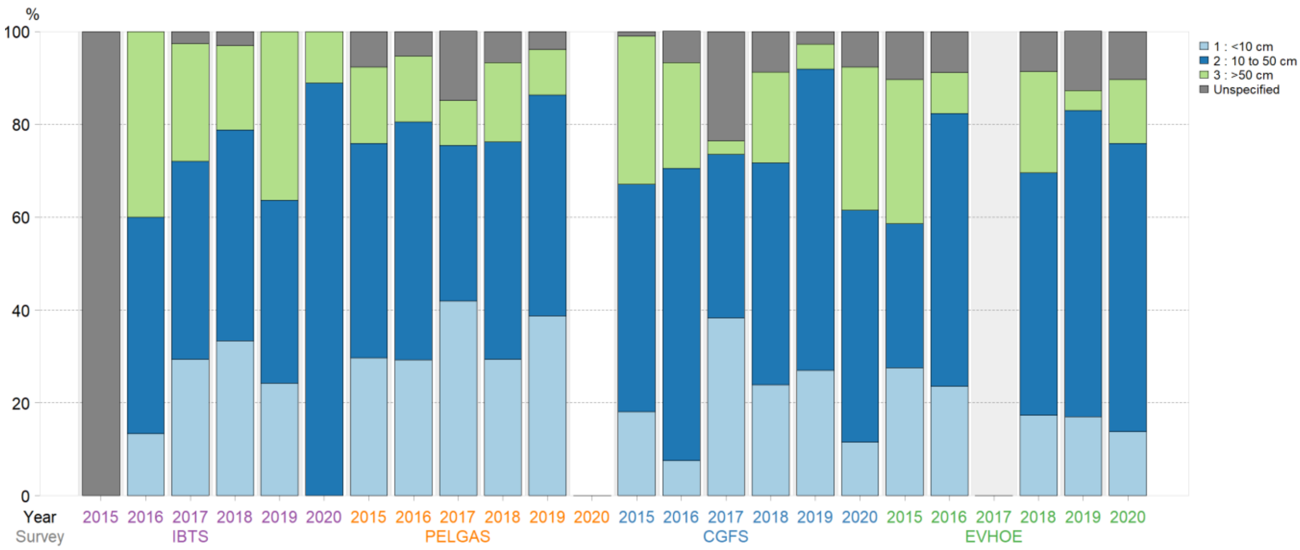
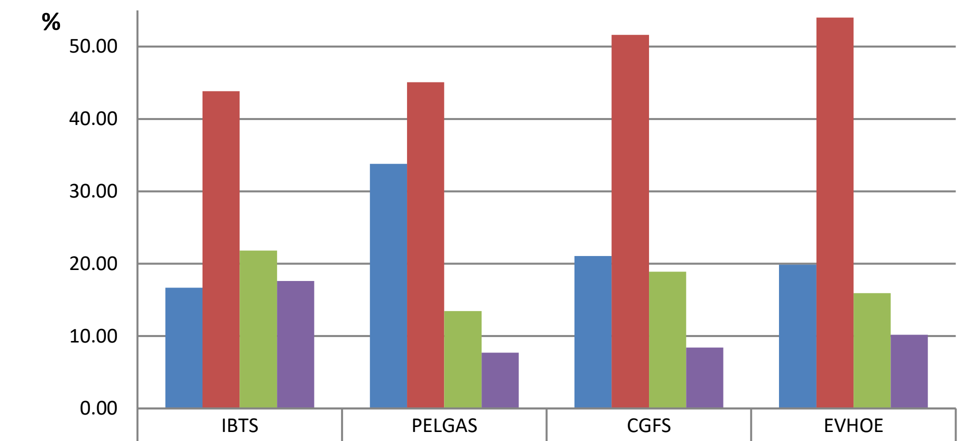


Figure 2.9: Percentages of the various litter size classes per survey (IBTS, PELGAS, CGFS, EVHOE) and per year (from 2015 to 2020).

Litter of less than 10 cm were also largely observed during PELGAS surveys, with approximately 33% of the total, whereas it made less than 21% of the observations in the other cruises (Figure 2.10). A high number of litter > 50 cm was also observed during the IBTS campaigns.



	IBTS	PELGAS	CGFS	EVHOE
<10 cm	16.71	33.79	21.07	19.86
10 to 50 cm	43.85	45.08	51.63	54.01
>50 cm	21.83	13.44	18.90	15.93
Unspecified	17.62	7.69	8.41	10.19

Figure 2.10: Percentage of various size classes of litter in relation to the cruise.

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The size class from 10 to 50 cm represents 50.6% of the observations, followed by size class <10cm (23.5%) and litter >50cm (18.7%) (Figure 2.11). Years 2017 and 2020 did not have the same size distribution as the other years, probably due to the absence of 2 surveys: EVHOE in 2017 and PELGAS in 2020

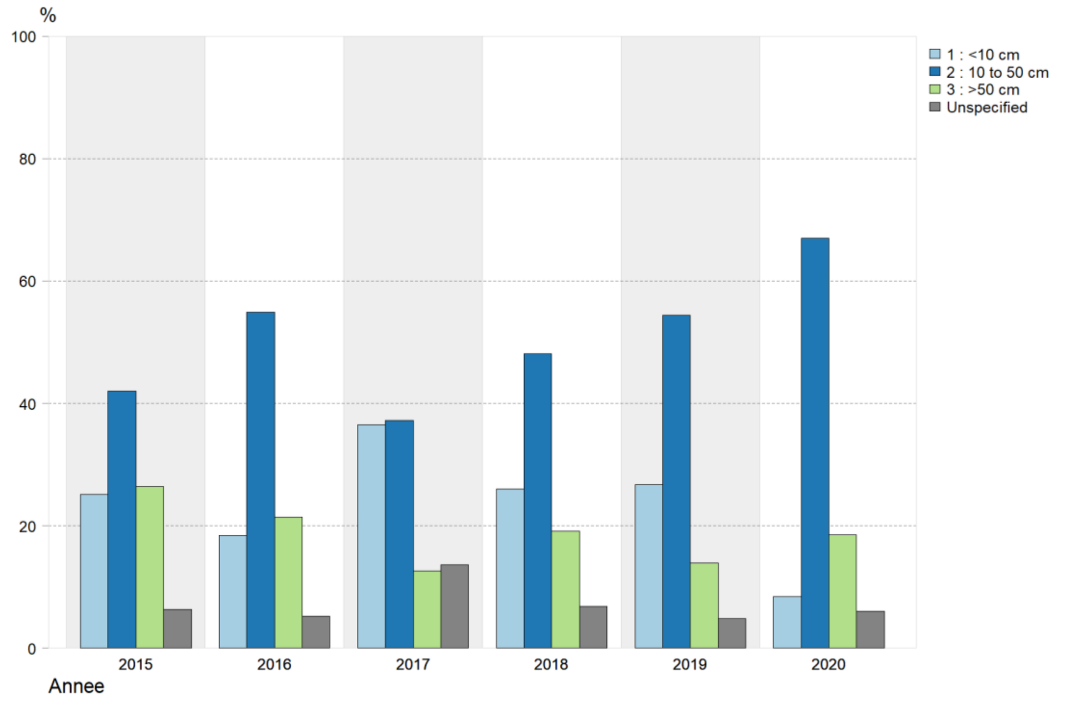

Figure 2.11: Annual variations of different size classes of floating litter.

Litter abundances were between 0 and 1.32 unit/km² in IBTS surveys (Figure 2.12), between 0 and 102.8 unit/km² in PELGAS surveys (Figure 2.14), between 0 and 5.94 unit/km² in CGFS surveys (Figure 2.13) and between 0 and 2.70 unit/km² in EVHOE surveys (Figure 2.15). Highest densities were found during the PELGAS surveys, especially in 2016 and 2019 (102.8 and 50.68 respectively). These surveys were characterized by a large number of legs (around 310 each year compared to 90 in CGFS, 70 in EVHOE and 40 in IBTS), with a higher variability.

In terms of annual mean densities, values ranged between 0,03 ±0,06 and 0,15 ±0,25 units/km² in IBTS surveys, between 0,16 ±0,37 and 1,48 ±7,19 units/km² in PELGAS surveys, between 0,08 ±0,16 and 0,43 ±0,88 unit/km² in CGFS surveys, and finally between 0,06 ±0,23 and 0,18 ±0,42 in EVHOE surveys.

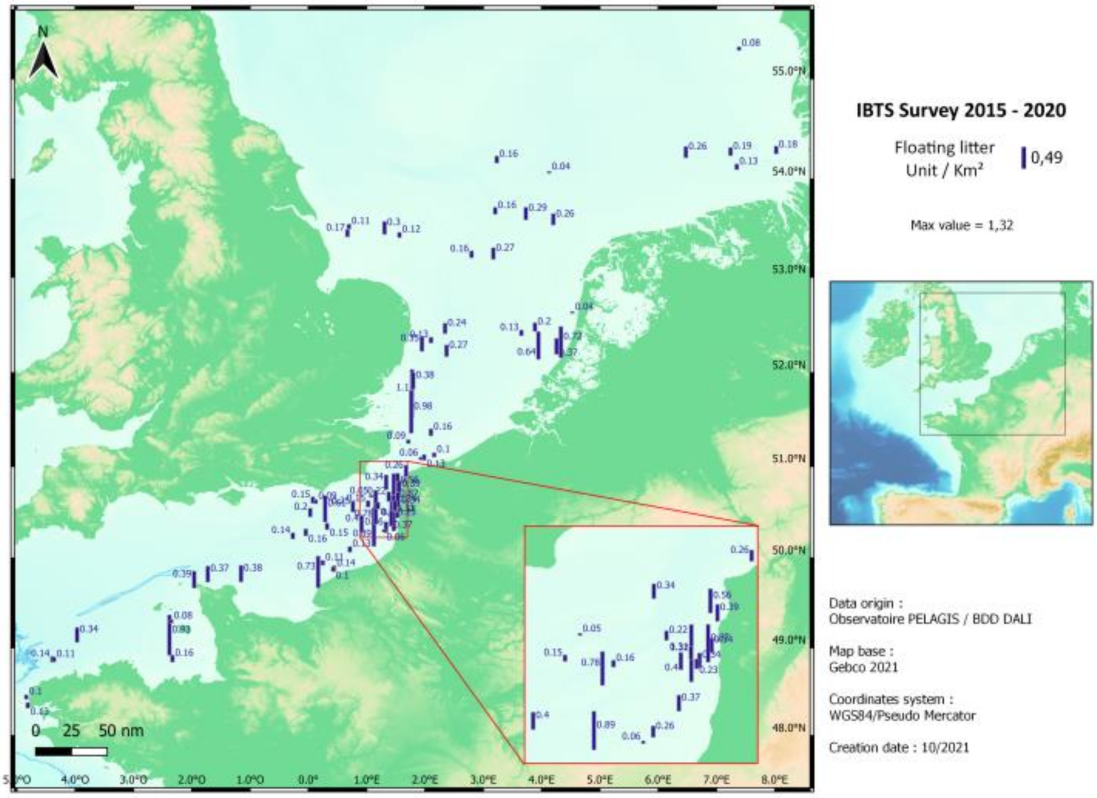

Figure 2.12: Litter abundance in IBTS campaigns 2015-2020

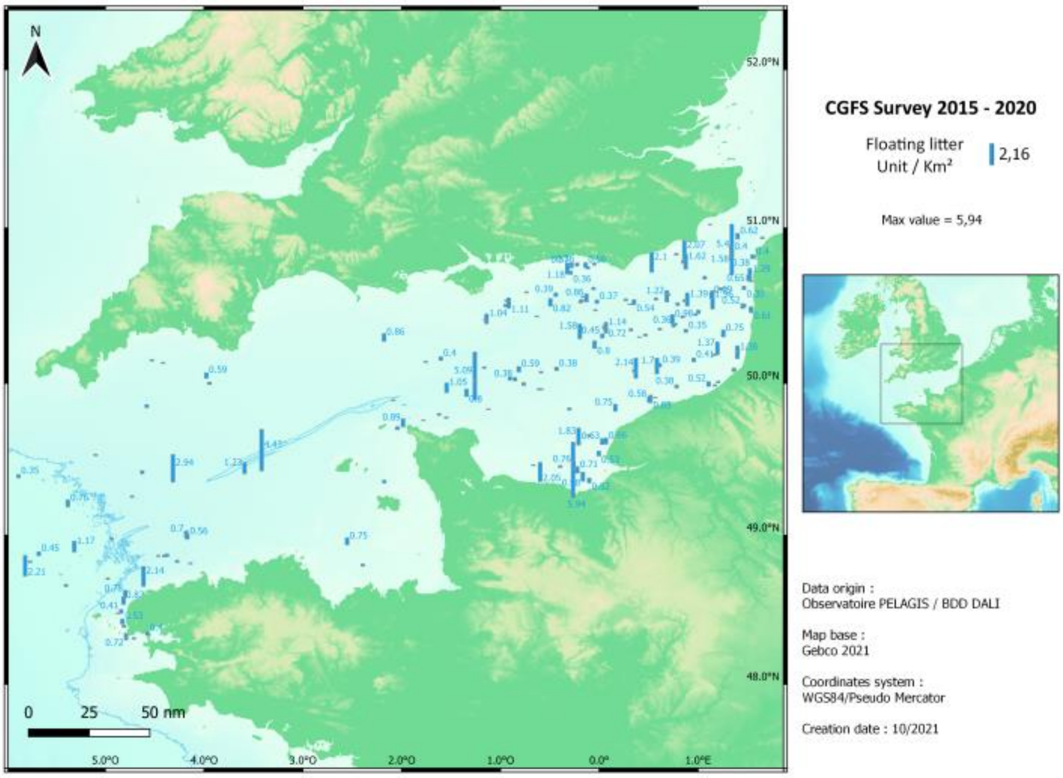

Figure 2.13: Litter abundance in CGFS campaigns 2015-2020

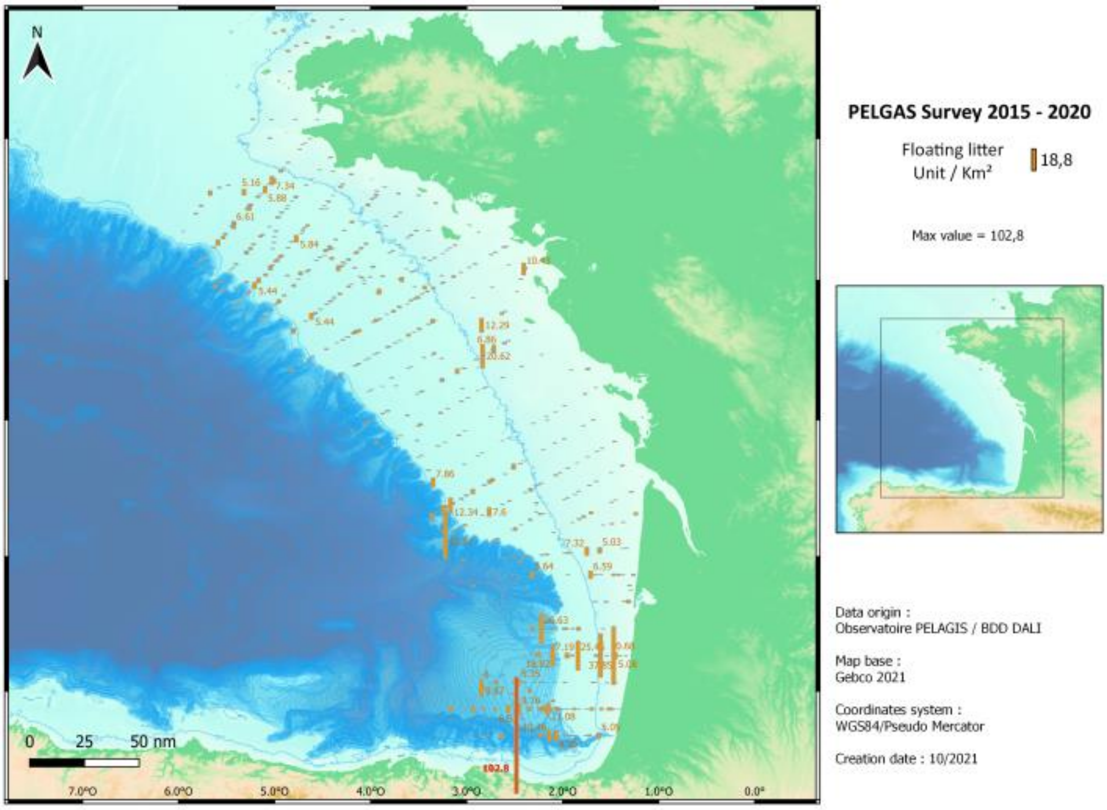

Figure 2.14: Litter abundance in PELGAS campaigns 2015-2020

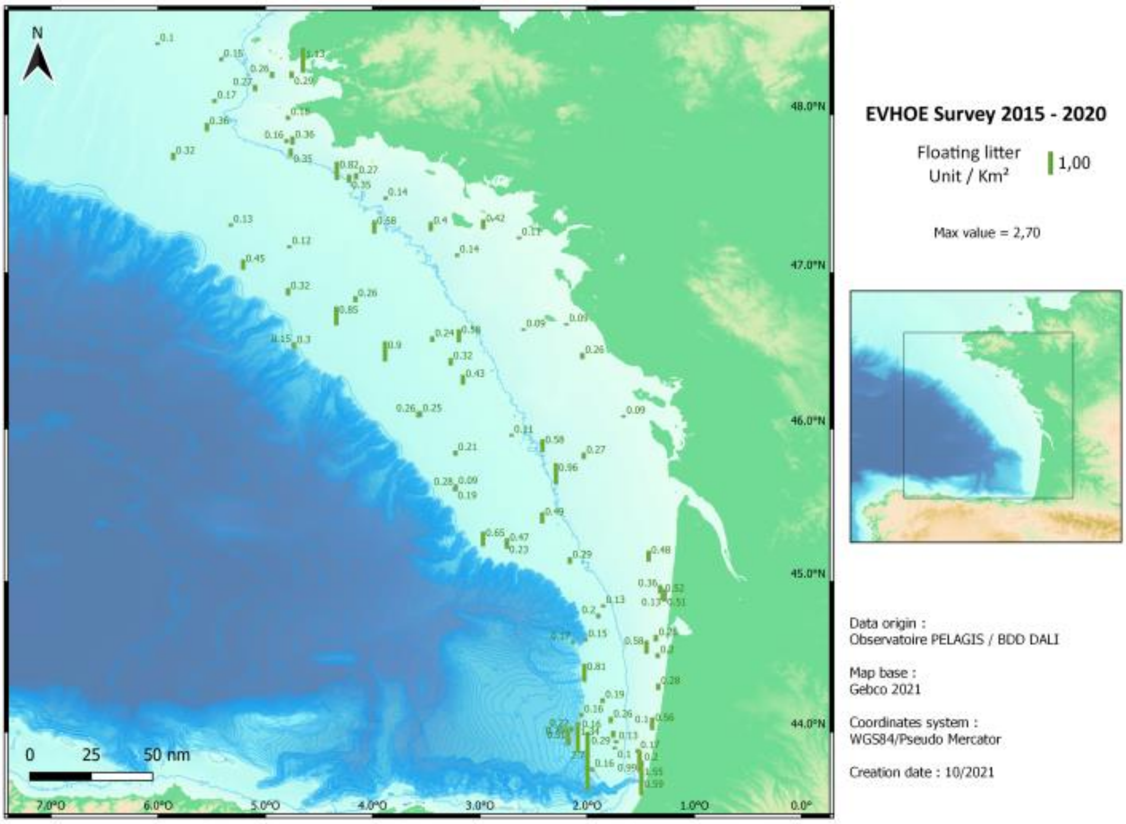

Figure 2.15: Litter abundance in EVHOE campaigns 2015-2020

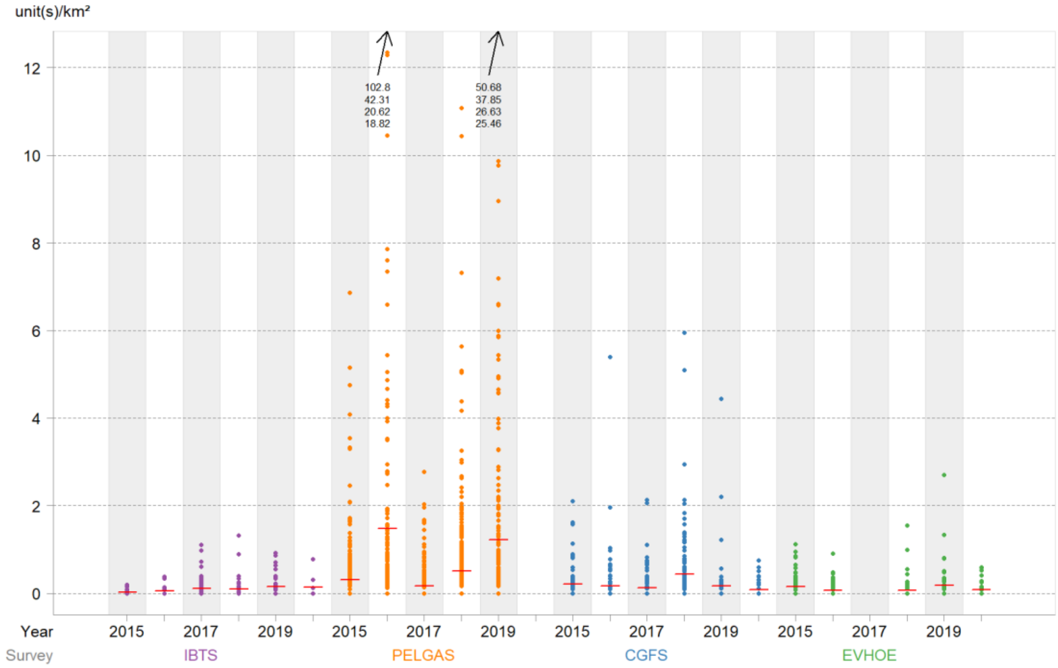

Figure 2.16: Year to year variation in litter densities per year and cruise (the red bars represent mean values).

Since the number of legs may largely vary from one survey to another (see figure 2.16), and possibly generate bias, calculation of annual means of total litter were calculated as the average of the means per survey (Figure 2.17).

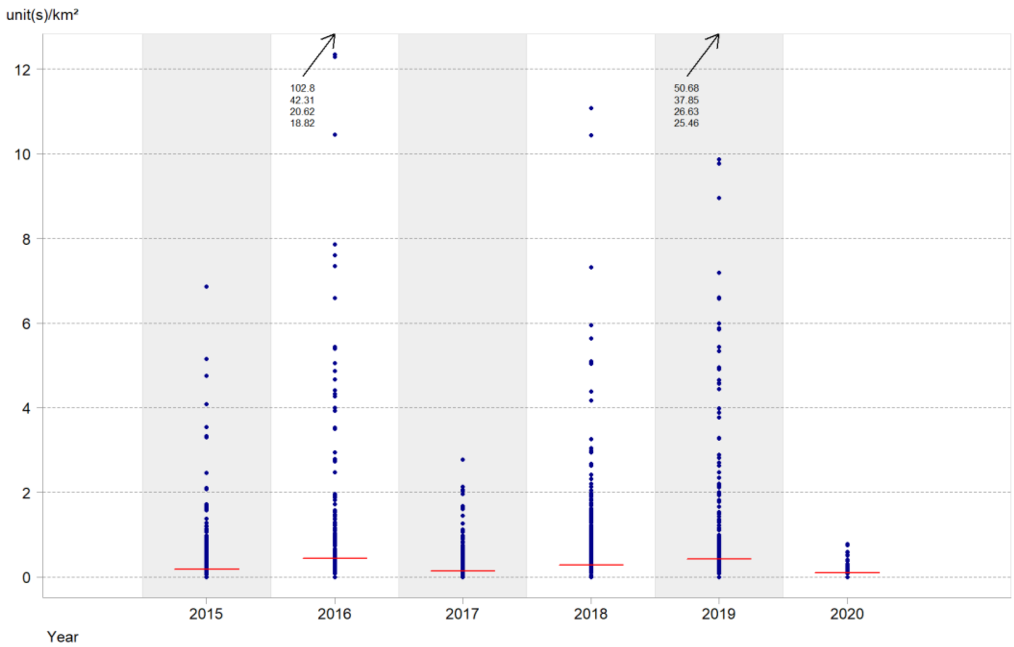

Figure 2.17: Year to year variation in weighted means (per 100 legs/campaign) of litter densities for all surveys.

The highest weighted means were observed in 2016 and 2019 with 0.44 and 0.43 units/km² respectively. These two years correspond to two very active years for PELGAS, in terms of litter abundance, indicating that the design of the survey influences the results. This was confirmed in 2020 when this campaign was cancelled, due to COVID-19, resulting in both a lower annual mean and variability of densities.

3.3. Gaps on monitoring and research

To improve the knowledge on floating litter and to rely on recommendations from the MSFD, a litter typology referring to Single Use Plastic could be added to the protocol. More information on "Unspecified Litter types" should be collected to better define the sources. Finally an alignment of the results with the modelling of current and lagrangian transport is expected to provide more information and enable the prediction of the transport of litter. Linking the outputs from WP6 to the results from field surveys will be very useful and a follow up of the present work.

4. Potential improvements and recommendations

Considering the conclusions derived from the analysis of data available on the Iberian Peninsula NW shelf, special attention should be paid to the East Cantabrian Sea, where this and other recent studies found the highest concentration of litter and plastic litter, including microplastics (Mendoza et al, 2020). More accurate protocols for identification of sources and material of floating litter categorised as "trash" are needed in order to effectively addressed the causes and eventually reduce the abundance of floating litter.

The use of regular multidisciplinary campaigns for floating litter assessment is highly recommendable since it enables the recording of long-time data series thus the analyses of trends in litter abundance and composition, while saving resources and efforts.

The application of MEGASCOPE protocol since 2015 in South of the North Sea/English Channel and the Bay of Biscay/Celtic Sea during these four multidisciplinary cruises generated a consistent dataset on floating marine litter on a large spatial area. More "in deep "analyses will support better knowledge on the characterization of the differences between seasons, types, areas, and quantities. Actually, data is not sufficient to detect trends in litter abundance. Nevertheless, results show that the South of the Bay of Biscay presents the highest litter concentration. Linking the data with information on river inputs, shipping routes, urban sources and even sea floor litter amounts and composition will largely help to better understand the cycle of plastic at sea.

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