

MARINE LITTER IN THE BLACK SEA

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Preliminary analysis of Marine Litter Watch data of the European Environment Agency with particular reference to the Black Sea

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Abstract

In this study the Marine Litter Watch (MLW) database comprising data from European beaches, including seas, rivers and lakes has been analysed mainly for the sea beaches from 2014-2019. Among the four EU regional seas, the Black Sea appeared as the most littered beach (with a median value of 652 items/100m) with the Baltic Sea the least polluted (with a median value of 78 items/100m). The percentage share of plastics on beaches was very high for most EU regional seas (79-88%). In the top 10 litter items, cigarette butt & filters abundances were much higher for the Black Sea (36.4%) and the Mediterranean Sea (22.6%), compared to those for the north-east Atlantic and the Baltic Sea (both 13.2%). With a share of 66.1%, the Black Sea had the highest rate of Single-Use Plastics (SUP). Considering combined data, sea-beach litter appeared to increase steadily after 2014 with median values from 125 to 436 items/100m. The high values for the Black Sea caused an overall increase trend in beach litter at the European scale.

Keywords: Marine litter, beach, Europe, Black Sea, Marine Litter Watch

Introduction

Litter in general, but plastics in particular, is piling up in all aquatic systems (Schwarz *et al.* 2019). Although predominantly plastics, marine litter comprises a wide range of materials including metal, rubber, glass, paper, textiles etc. The most visible environmental effect of beach litter is entanglement, which can cause fatal consequences for marine species, compromising the ability to capture and ingest food, sense hunger, escape from predators, and reproduce, as well as decreasing body condition and impairing locomotion (GEF 2012). Macro litter items (>2.5mm) can also be mistaken for food and ingested by fish, mammals, birds or turtles, which may cause severe health issues (Kühn and van Franeker 2020). Macro litter on beaches degrades to meso- (5-25mm) and/or microplastics (< 5mm) due to UV light and other environmental factors. They can be ingested by marine species and thus transferred through the food chain. Ingestion of litter may cause loss of biodiversity and a reduction in overall ecosystem functions (GEF 2012).

Beach and sea floor litter cause injuries: A study in Australia reflects that 21.6% of beach users received injuries from beach litter at designated 'clean' beaches (Alkalay *et al.* 2007), illustrating that even 'clean' beaches pose a threat (Campbell *et al.* 2016).

In addition to its environmental and health impacts, marine litter also incurs socio-economic costs, mostly affecting coastal communities (Beaumont *et al.* 2019). In order to improve touristic appeal, communities and businesses must clean up the beaches before the start of the summer season (EEA 2016). The theoretical estimated cost of keeping all 34 million km of global coastlines clean is 69 billion USD (50 billion EUR) per year (UNEP 2017), and this figure will continue to increase if littering does not stop.

Several EU policies exist, associated with the management of marine litter. The Marine Strategy Framework Directive (MSFD 2008/56/EC; EC 2008) required EU member states to ensure that, by 2020, "properties and quantities of marine litter do not cause harm to the coastal and marine environment". The Single-Use Plastics Directive (SUPD 2019/904/EC; EC 2019) introduced a set of ambitious measures such as a ban on selected single-use products made of plastic (including cutlery, plates, straws, cups), measures to reduce consumption of food containers and beverage cups made of plastic, and specific marking and labelling of certain products as well as measures to deal with waste fishing gear containing plastic (EC 2019).

Information and data on marine litter is essential for tackling this crucial environmental problem. The European Environment Agency (EEA) has developed a Marine Litter Watch (MLW) mobile app and has been collecting beach litter data (mainly for seas but also for rivers and lakes) since 2013 with the participation of communities from Europe and beyond. MLW aims to strengthen Europe's knowledge base on marine litter and thus provide support to European policymaking.

This study presents an assessment of the data collected by the EEA-MLW initiative activities held on the beaches of Europe's regional seas between 2013 – 2019. As a result, the analyses were performed to answer the following questions with particular reference to the Black Sea:

a) Are there differences in composition of beach litter among EU regional seas?
b) Does MLW data provide indications on trends of beach litter from European seas?

MLW dataset

The up to date information on litter collection efforts within MLW can be found at: http://www.eea.europa.eu/themes/coast_sea/marine-litterwatch. The MLW

includes data from beaches of four regional seas (the Baltic Sea, the Black Sea, the Mediterranean Sea and the North-East Atlantic Ocean) as well as from rivers and lakes.

The EEA-MLW database analysed in this report covers the period of 12th March 2013-31st December 2019. After excluding duplicates, offshore areas, ports/canals, outside wider European areas, non-aquatic areas (forest, land, town, etc.), the MLW database presented 1894070 litter items from 3012 surveys belonging to lake, river and sea beaches from the wider-European area (Figure 1) Wider-European area includes several surveys from the northern Africa coasts and eastern Mediterranean coasts.

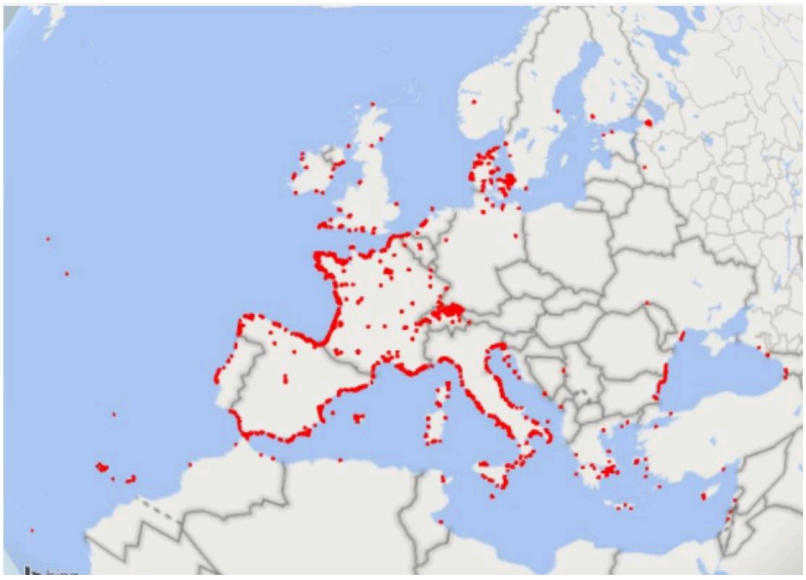

Figure 1. EEA-Marine Litter Watch data locations between 12 March 2013 and 31 December 2019.

It is worth mentioning that rivers play an important role in transporting litter to sea and lake beaches. However, this study does not include analyses from river and lake beaches (total 1138 surveys). The main analyses focused on data obtained from the sea beaches (total 1884 surveys) (Table 1).

There are two types of data collection events in the MLW: clean-up (since 12th March 2013) and "monitoring" (since 7th April 2014). With the exception of some cases where countries provide their official monitoring results to the MLW database, MLW "monitoring" data in general cannot be regarded as official monitoring data. Within the scope of MLW initiative, "monitoring" survey or "monitoring" data is used to describe the survey/data collected with timely,

organised and standardised efforts of the MLW communities, using European beach litter guidelines and the "joint list" of EU Technical Group on Marine Litter (Galgani *et al.* 2013), whereas clean-up surveys represents relatively lesser standardised efforts. Although the preferred stretch of beach for survey using the MLW apps is 100 m, these ranged between 33 and 3443 m for the "monitoring" events and between 1 and 33932 m for the clean-up in the database.

In this study, for quantitative analyses were undertaken, median values (rather than means) were used as suggested by Hanke *et al*. (2019) to eliminate error caused by extreme values in the data set, which are common with the marine litter data.

Table 1. Number of surveys and litter items reported to the EEA-Marine Litter Watch for different types of events between 12 March 2013 and 31 December 2019 (only wider-European data from sea beaches).

Database	Number of surveys	Sum of litter items
Cleanup events	**1189**	**1026503**
Baltic Sea	47	16634
Black Sea	146	108458
Mediterranean Sea	435	456520
North-east Atlantic Ocean	561	444891
"Monitoring" events	**640**	**496048**
Baltic Sea	36	13941
Black Sea	75	106192
Mediterranean Sea	402	303746
North-east Atlantic Ocean	127	72169
Event type not indicated	**55**	**98394**
Mediterranean Sea	34	51602
North-east Atlantic Ocean	21	46792
Total EU Sea-Beaches	**1884**	**1620945**

Results and Discussion

Beach litter among regional seas

The total number of "monitoring" surveys (640) was less than half the number of clean-up surveys (1189 surveys; Table 1). Among the four EU seas, Mediterranean beaches underwent the highest number of "monitoring" surveys (402), followed by the north-east Atlantic (127 surveys), Black Sea (75 surveys) and the Baltic Sea (36 surveys) (Table 1).

Based on the monitoring surveys, Black Sea beaches appeared as the most littered (median value of 652 litter items per 100 m) and the Baltic Sea the least polluted (median value of 78 litter items per 100 m) (Figure 2). Litter transport from large as well as numerous small rivers coupled with improper municipal waste dumping

and lower levels of environmental awareness with respect to littering in the Black Sea could be the major reasons for this result.

Comparison of median values with the past data which use mean is difficult. The overall mean values found for the southern Black Sea were 275 litter items/100 m for 2009 (Topçu *et al.* 2013) and 3798 litter items/100 m for 2016/2017 (Aytan *et al.* 2020).

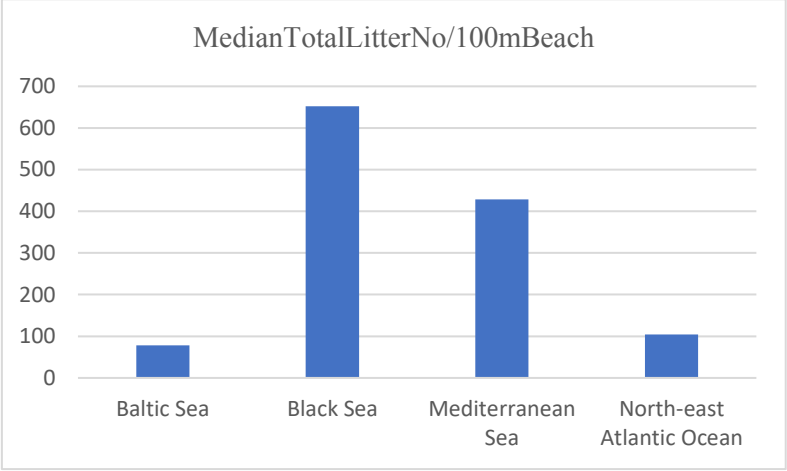

Figure 2. Comparison of litter numbers for beaches of different EU regional seas from 2014 –2019 (only European "monitoring" data for sea beaches)

The share of plastics was lowest for Baltic Sea beaches (about 61%) compared to other seas (79.8-88.5%) (Table 2). The share of plastics was also high in the southeastern Black Sea (84-91%) in 2016/2017 (Aytan *et al.* 2020) and western Black Sea (80.6%) in 2014-2017 (Paiu *et al.* 2017). Among all EU regional seas, the highest share of metals (5.3%) was recorded for the Black Sea beach litter.

Striking differences in the relative shares of different litter items were evident among the regional seas for the period 2013-2019 (Figure 3) obtained from "monitoring" events. For example, shares of cigarette butts/filters were much higher for the Black Sea (36.4%) and the Mediterranean Sea (22.6%), compared to those for the north-east Atlantic and the Baltic Sea (both 13.2%). Except for the northeast Atlantic, cigarette butts/filters were the most common litter item from beaches of all European seas. Araujo and Costa (2019) reported that the percentage share of cigarette butts/filters could be as high as 58% from beaches globally. Cigarette butts/filters, considered one of the commonest litter items on beaches, are ubiquitously disposed of, amassing as beach litter due to its light specific weight. Proper disposal of cigarette butts/filters thereby requires stringent measures. Apart from plastics fragments, drinking caps/lids, cotton bud sticks, straws and stirrers and crisp packets/sweet wrappers were notably present in all

the regional seas. The list of the top ten items list is very similar to that reported for the European scale (Addamo *et al.* 2017).

Table 2. Percentage shares of different litter groups (based on total litter per beach values) among European regional seas from 2014-2019 ("monitoring" data only, paraffin excluded)

Litter category	Baltic Sea (%)	Black Sea (%)	Mediterranean Sea (%)	NE Atlantic Ocean (%)
Plastics	61.2	79.8	88.1	88.5
Glass/ceramics	18.7	4.9	3.2	3.3
Metal	3.7	5.3	2.6	1.3
Paper/Cardboard	2.4	4.3	2.7	1.3
Processed/worked wood	4.6	2.6	1.2	2.7
Cloth/textile	6.5	2.4	1.1	1.2
Rubber	2.4	0.5	1.1	1.6
Unidentified	0.5	0.1	0.1	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**

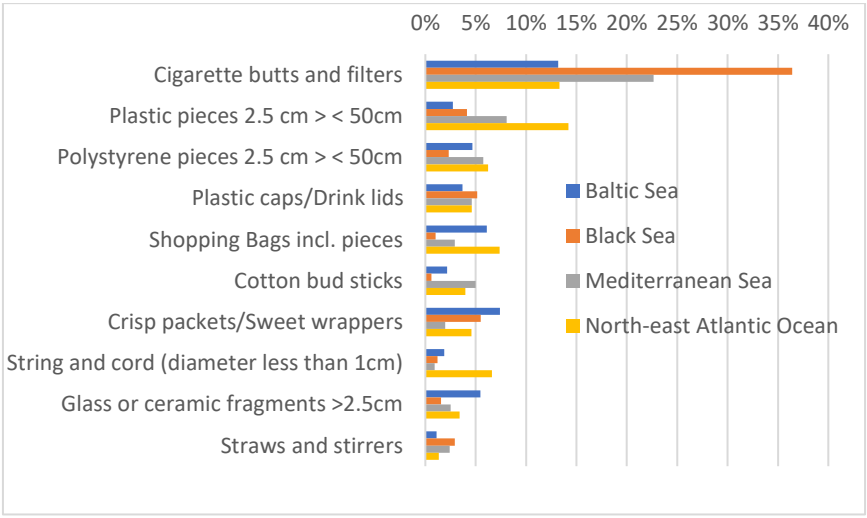

Figure 3. Comparison of Top Ten Item of litter collected by the regional sea beaches from 2014 – 2019 ("monitoring" data only, paraffin excluded)

With a percentage share of 66.1%, the Black Sea demonstrated the highest rate of Single Used Plastics (SUP) among the regional seas followed by the Mediterranean Sea (40%) (Figure 4). With a share of 12.2%, fishery related litter was highest in the north-east Atlantic and lowest for the Black Sea (1.6%) among the regional seas. Despite being among the major fishing areas of Europe, the fishery related litter also demonstrated a very low share (0.5%) in 2009 from the southern Black Sea (Topçu *et al.* 2013).

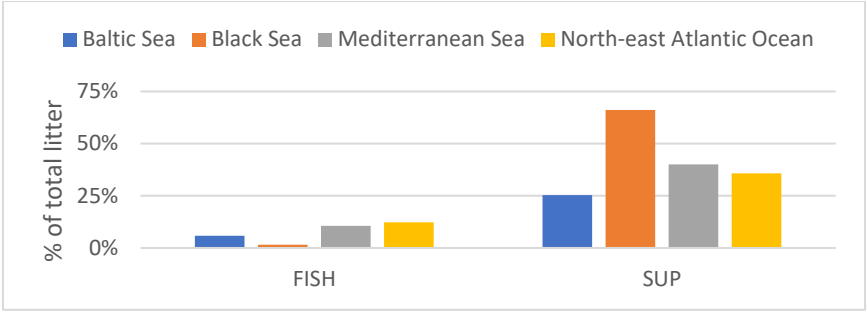

Figure 4. Comparison of regional seas for SUP and fishing-related items collected from European sea beaches between 2014 – 2019 ("monitoring" data only, paraffin excluded)

Beach litter trends for European seas

Annual median values per 100 m sea beach are shown in Figure 5 (for all seas combined) and Figure 6 (for each regional sea separately). For the combined data, sea-beach litter appeared as increasing steadily through the years; with median values rising from 125 to 436 items per 100 m beach (Figure 5). When data were displayed separately for each regional sea for the entire study period (Figure 6), the litter pollution was also at its highest for the north-east Atlantic and the Black Sea beaches in 2019. In contrary, lowest values were obtained for the Baltic and Mediterranean Seas in 2019. The high values observed in 2019 as well as in previous years were mainly due to Black Sea values, which caused an increasing trend in beach litter for the combined data at the European scale. When data from the Black Sea is excluded, litter pollution initially appears to be increasing until 2017 and later decreasing steadily (Figure 7).

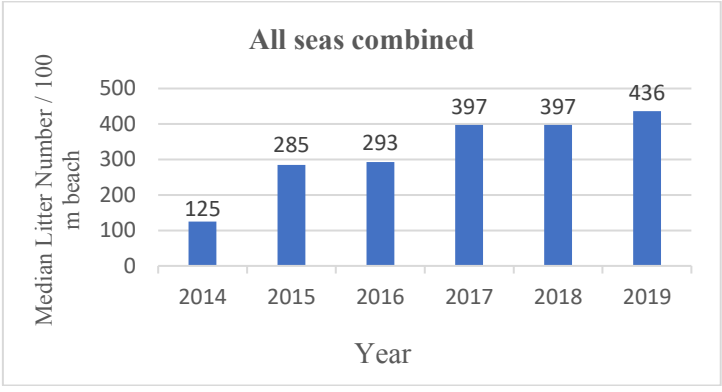

Figure 5. Changes in median beach litter numbers from 2014 – 2019 ("monitoring" data only, paraffin excluded, all regional seas combined).

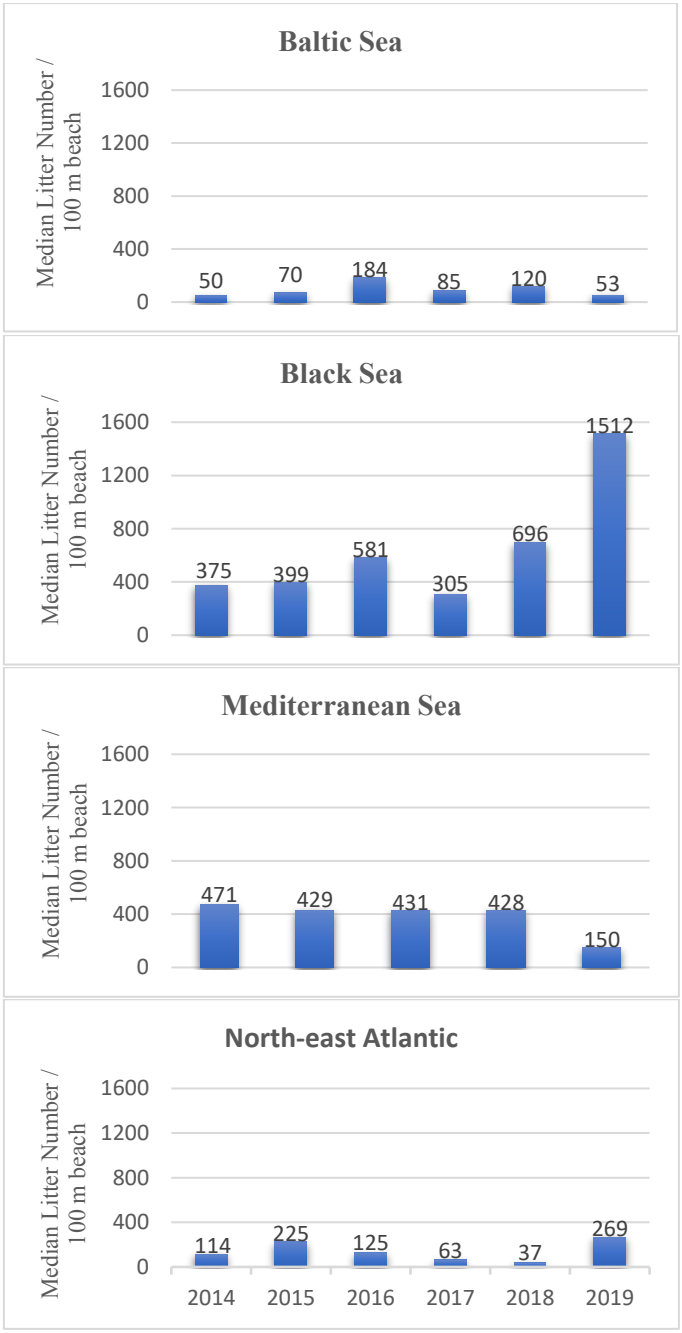

Figure 6. Changes in median beach litter numbers for each regional sea, from 2014 – 2019 ("monitoring" data only)

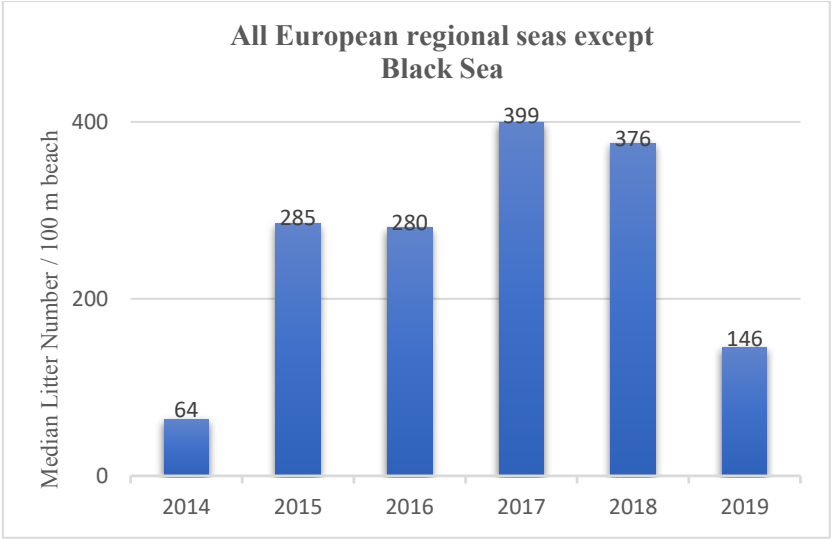

Figure 7. Changes in median beach litter numbers (combined only from the three regional seas (the Baltic, north-east Atlantic and the Mediterranean), from 2014 – 2019 ("monitoring" data only)

Over the years, an increase in beach litter pollution from 275 litter items/100m in 2009 (Topçu *et al.* 2013) to 3798 litter items/100m in 2016/2017 (Aytan *et al.* 2020) for the beach litter is also apparent for the southern Black Sea.

References

Addamo, A.M., Laroche, P., Hanke, G. (2017) Top marine beach litter items in Europe: A review and synthesis based on beach litter data. EUR 29249 EN, Publications Office of the European Union, Luxembourg, 2017, doi:10.2760/496717, JRC108181.

Alkalay, R., Pasternak, G., Zask, A. (2007) Clean-coast index-A new approach for beach cleanliness assessment. *Ocean & Coastal Management* 50: 352-362.

Araujo, M.C., Costa, M.F. (2019) A critical review of the issue of cigarette butt pollution in coastal environments. *Env Research* 172: 137-149.

Aytan, U., Sahin, F.B.E., Karacan, F. (2020) Beach Litter on Sarayköy beach (SE Black Sea): Density, composition, possible sources and associated organisms. *Turkish Journal of Fisheries and Aquatic Sciences* 20: 137-145.

Beaumont, N.J., Aanesen, M., Austen, M.C., Börger, T., Clark, J.R., Cole, M., Hooper, T., Lindeque, P.K., Pascoe, C., Wyles, K.J. (2019) Global ecological,

social and economic impacts of marine plastic. *Marine Pollution Bulletin* 142: 189-195.

Campbell, M.L., Slavin, C., Grage, A., Kinslow, A. (2016) Human health impacts from litter on beaches and associated perceptions: A case study of 'clean' Tasmanian beaches. *Ocean & Coastal Management* 126: 22-30.

EC (2008) Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 (Marine Strategy Framework Directive).

EC (2019) 'Our Oceans, Seas and Coasts' (Online) Available at: https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm

EEA (2016) European bathing water quality in 2015, EEA Report No 9/2016, European Environment Agency Available at: https://www.eea.europa.eu/publications/european-bathing-water-quality-2015

GEF (2012) Impacts of marine debris on biodiversity: Current status and potential solutions. Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel, CBD Technical Series Montreal. 67, pp. 61.

Galgani, F., Hanke, G., Werner, S., Oosterbaan, L., Nilsson, P., Fleet, D., Kinsey, S., Thompson, R.C., van Franeker, J., Vlachogianni, T., Scoullos, M., Veiga, J. M., Palatinus, A., Matiddi, M., Maes, T., Korpinen, S., Budziak, A., Leslie, H., Gago, J., Liebezeit, G. (2013) Guidance on monitoring of marine litter in European seas, JRC Scientific and Policy Reports, Report EUR 26113 EN.

Hanke, G., Walvoort, D., Loon, W.G.M., Addamo, A., Brosich, A., Montero, M., Molina, J., Maria, E., Vinci, M., Georgetti, A. (2019) EU marine beach litter baselines: Analysis of a pan-European 2012-2016 beach litter dataset. *EU-JRC Technical Reports* doi: 10.2760/16903.

Kühn, S., van Franeker, J.A. (2020) Quantitative overview of marine debris ingested by marine megafauna. *Marine Pollution Bulletin* 151: 110858

Paiu, A., Candea, M.M., Paiu, R.M., Gheorghe, A.M. (2017) Composition and spatial distribution of marine litter along the Romanian coast. *Cercetari Marine* 47: 232-239.

Schwarz, A.E., Ligthart, T.N., Boukris, E., van Harmelen, T. (2019) Sources, transport, and accumulation of different types of plastic litter in aquatic environments: A review study. *Mar Poll Bull* 143: 92-100.

Topçu E.N., A.M. Tonay, A. Dede, A.A. Öztürk, B. Öztürk (2013) Origin and abundance of marine litter along sandy beaches of the Turkish western Black Sea coast. *Mar Env Res* 85: 21-28.

UNEP (2017) Marine Litter Socio Economic Study, United Nations Environment Programme, Nairobi. (Online) Available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/26014/Marinelitter_socioeco_study.pdf?sequence