This project has received funding from the European Union's Seventh Framework Programme (FP7 2007-2013) under grant agreement n° 289042.

MARine Litter in Europe Seas: Social AwarenesS and CO-Responsibility

D1.1
REVIEW OF THE CURRENT STATE OF UNDERSTANDING OF THE DISTRIBUTION, QUANTITIES AND TYPES OF MARINE LITTER

MARLISCO
Stopping Marine Litter Together

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Document Information

This deliverable report (D1.1) reviews the current state of understanding of distribution, quntities and types of marine litter in European Seas and by MSFD region. It aslo considers regional differences and represenatative examples to to help defines topics for debate within WP4 and informtion for educational material within WP6.

Approvals

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List of annexes

Annex1_National Surveys Activities in the NE Atlantic
Annex2_National Surveys Activities in the Baltic
Annex3_National Surveys Activities in the Mediterranean
Annex4_National Surveys Activities in the Black Sea
Annex5_Questionnaire and Guidance for collection on national surveys activities

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TABLE OF CONTENTS

This project has received funding from the European Union's Seventh Framework Programme (FP7 2007-2013) under grant agreement n° 289042.

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1 EXECUTIVE SUMMARY

This report aims to review the current state of information and general interpretation on the existing data that may reflect trends in the distribution, quantities and types of marine litter in European Seas; and whenever possible by MSFD region and specified to involved countries. It combines a traditional review of published literature with a survey amongst national partners of monitoring or survey and assessment activities in EU Member States.

The literature review considered publications at a global, European and Regional Seas levels, and where information available allows, it describes specific regional patterns in the four major European Seas. It also provides representative examples of the effects of litter on the marine and coastal environment, illustrating regional differences.

The review considers the potential negative ecological and socio-economic impacts of marine litter. It is intended that these examples can then be used primarily as illustrations and background information for internal use within MARLISCO in WPs 3-6 as appropriate; for example, to help define the topics for debate within WP4, or to provide educational materials within WP6.

The review by MSFD regions included the gathering of information from MARISCO partners on marine litter survey activities at a national level. This report provides a summary of national surveys from official monitoring, NGOs or local authorities and R&D activities. It also shows the type of environmental compartments included in such surveys indicating the point of contact or relevant link to find further details.

The report outlines limitations and gaps in the current state of knowledge and highlights some popular misconceptions relating to marine litter which the MARLISCO project should not propagate.

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2 INTRODUCTION AND BACKGROUND

2.1 Objectives and scope

'Conduct a review on the current state of information and general interpretation on the existing data that may reflect trends in the distribution, quantities and types of marine litter in European Seas, by MSFD region and whenever possible specified to involved countries, including the current state of information on the type and relative importance of sources of marine litter, taking account of the output from relevant EU-funded pilot projects concerning marine litter, and – as far as available – National reports of Member States on the descriptor on marine litter under the MSFD and providing examples of regional differences and the land-based activities that may be implicated. To provide representative examples of the effects of litter on the marine environment, as illustrations, for use by WPs 3-6 as appropriate; for example, to help define the topics for debate within WP4. Interim products will be supplied to meet the timelines of the other WPs [Month 0-14] (Lead by Partner 4, Partners 1-3, 5-18)'

The main aim of this report is to summarise information on sources and distribution of marine litter in Europe's Seas, and provide representative examples of the effects of litter on the marine and coastal environment. It combines a traditional review of published literature with a survey amongst national partners of monitoring and assessment activities in EU Member States. It also includes a section on potential solutions to stimulate debate, and provides explanations for some popular misconceptions about marine litter.

The report documents the sources, distribution, and composition of marine litter, where possible identifying the land and ocean-based activities that are involved. It also considers the potential negative ecological and socio-economic impacts of marine litter. It is intended that these examples can then be used primarily as illustrations and background information for internal use within MARLISCO in WPs 3-6 as appropriate. For example, to help define the topics for debate within WP4, or to provide educational materials within WP6.

2.2 Methods

2.2.1 Literature review

The literature review was considered publications at a global, European and Regional Seas levels. This was the responsibility of UoP. Then, as far as possible on the basis of the more limited available information, describes specific regional patterns in the four major European Seas: North East Atlantic (section 3.1), Baltic (section 3.2), Mediterranean (section 3.3), and Black Sea (section 3.4). It provides a succinct review of the current state of knowledge about marine litter, summarising reliable and relevant information, in the context of MARLISCO, from recent reports and reviews (e.g. Kershaw et al. 2011; Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012; STAP 2011; Thompson et al. 2009a) and where applicable updating this with new information that has become available. It does not attempt to provide a full synthesis of all original primary literature on the topic.

Finally, the report outlines limitations and gaps in the current state of knowledge and understanding and considers some popular misconceptions relating to marine litter, which the MARLISCO project should not propagate.

2.2.2 National Surveys

A questionnaire was issued in the autumn of 2012 asking Marlisco partners to provide to provide details of the distribution and sources of marine litter in their respective countries. The survey requested information from a wide variety of activities including official monitoring, NGOs or IGOs activities, local authorities, and R&D.

2.3 Context

The MARLISCO project seeks to raise societal awareness of both the problems and the potential solutions relating to a key issue threatening marine habitats worldwide: the accumulation of marine litter. A major

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objective of the project is to understand and subsequently facilitate societal engagement in order to inspire changes in attitudes and behaviour. This project is a Mobilisation and Mutual Learning Action Plan with the aim of providing a series of mechanisms to engage key stakeholders with an interest in, or responsibility for, some aspect of reducing the quantity of litter entering the ocean. These includes: industrial sectors; users of coastal and marine waters; the waste management and recycling sectors; Regional Sea Commissions and EU representatives; local municipalities; citizens' groups; environmental NGOs; school children and the general public; social and natural scientists. MARLISCO recognises the need for a concerted approach to encourage co-responsibility through a joint dialogue between the many players. This is achieved by organising activities across 15 European countries, including national debates in 12 of those countries, involving industry sectors, scientists and the public (WP4), a European video contest for school students (WP5), educational activities targeting the younger generation together with exhibitions to raise awareness among the wider public (WP6). MARLISCO is making use of innovative multimedia approaches to reach the widest possible audience, in the most effective manner (WP3). The project will develop and evaluate an approach that can be used to address the problems associated with marine litter and which can also be applied more widely to other challenges where there are substantial benefits to be achieved through better societal integration among researchers, stakeholders and society.

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3 SOURCES AND DISTRIBUTION OF MARINE LITTER – GLOBAL LITTER

3.1 Defining Marine Litter:

In the context of the EU MSFD marine litter is any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment. Marine litter consists of items that have been made or used by people and deliberately discarded or unintentionally lost into the sea and on beaches including such materials transported into the marine environment from land by rivers, draining or sewage systems or winds. This definition does not include semi-solid remains of for example mineral and vegetable oils, paraffin and chemicals that sometimes litter sea and shores (Galgani et al. 2010).

Marine litter includes objects that are not of natural origin and would not naturally occur in the marine and coastal environment. Marine litter can consist of a wide range of materials, but the majority of items fall into a relatively small number of material types such as glass, metal, paper, and plastic, including microplastics (see section 3.3).

3.2 Land and sea-based sources

A variety of land and sea-based activities can result in litter entering the marine environment; it can enter the coastal and marine environment directly, or be brought indirectly to the sea by rivers, sewage outlets, storm water outflows, currents, winds or eve tides. It can result from point or diffuse sources (Figure 2.1). According to UNEP (2005) and MSFD (Galgani et al. 2010) some of the main sources of marine litter summarised in Table 3.1.

Table 3.1 Main categories of litter from sea- and land-based sources

Main sea-based sources	**Main land-based sources**
▪ Merchant shipping, ferries and cruise liners; ▪ Fishing vessels; ▪ Military fleets and research vessels; ▪ Pleasure craft; ▪ Offshore oil and gas platforms; ▪ Aquaculture installations.	▪ Municipal landfills (waste dumps) located on the coast; ▪ Industrial facilities (solid waste from landfills, and untreated waste water); ▪ Harbours, ports and marinas ▪ Tourism (recreational visitors to the coast). ▪ General public litter, fly-tipping, which can be transported from in land to the sea via rivers and other inland waterways or blown by the wind ▪ Tourism (including recreational visitors to the coast). ▪ Improper disposal of items in the toilet and/or untreated municipal sewage and storm water, which can be discharged in the sea

It is important to recognise that the origin, drift and fate of litter will be influenced by a range of factors including: rainfall, riverine transport, water currents, winds and geomorphology as well as the durability of the litter. Hence while litter can accumulate near the source of entry to the ocean, it can also travel substantial distances and may accumulate far away in both space and time from the point of entry (Barnes 2005; Barnes et al. 2009; Browne et al. 2011; Galgani et al. 2010).

With some types of debris it is difficult to be certain about the origin, for example a plastic bottle on a shoreline may have been discarded from a vessel at sea, have been carried from far inland by a river or have been abandoned by a beachgoer nearby. Items of sewage related debris may also result from both land and sea-based discharges, while items of rope and netting are most probably linked to shipping or fishing activities. In general, more plastic litter is found closer to population centres, including a greater proportion of consumer plastic items such as bottles and shopping bags (Garrity & Levings 1993; Ryan et al. 2009), and increased

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abundance close to popular tourist beaches. However, beach cleaning activities can obscure the real underlying temporal and spatial trends (Ryan et al. 2009). To some extent the distinction between land- and sea-based sources is a distraction since all of the items that become marine litter ultimately came from the land and end-of-life return to the land is essential in order to avoid inputs to the ocean. However, understanding the pathway of entry from land or sea is important in order to devise and focus measures to reduce marine litter, and consider the most important audiences for educational material.

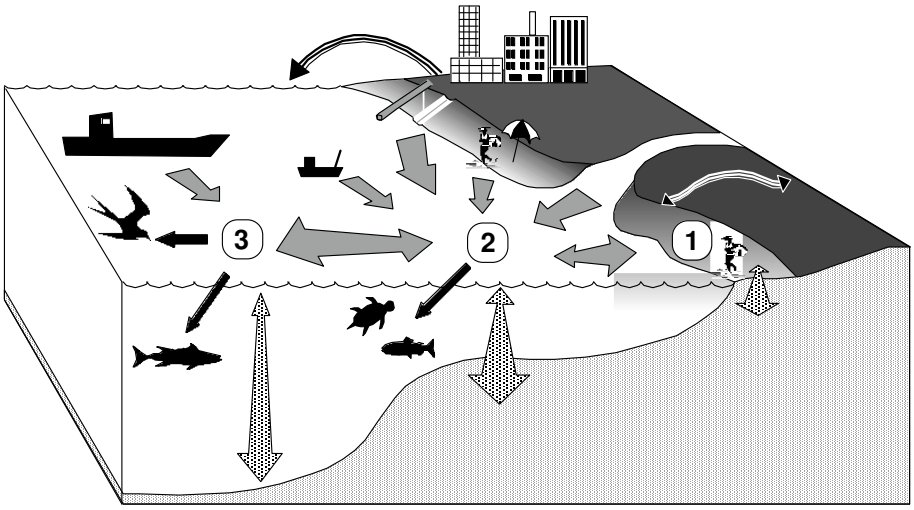

Figure 3.1 Schematic diagram showing the main sources and movement pathways for plastics in the marine environment, with sinks occurring (1) on beaches, (2) in coastal waters and their sediments and (3) in the open ocean. Curved arrows depict wind-blown litter, grey arrows water-borne litter, stippled arrows vertical movement through the water column (including burial in sediments) and black arrows ingestion by marine organisms. Source (Ryan et al. 2009)

The annual International Coastal Clean-up (ICC) 10 programme provides global figures for the period 1989 – 2007 which highlight the predominance of land-based sources, including shoreline-recreational activities, smoking related activities, and medical personal hygiene, which together account for around 90% of marine litter (Figure 3.2)

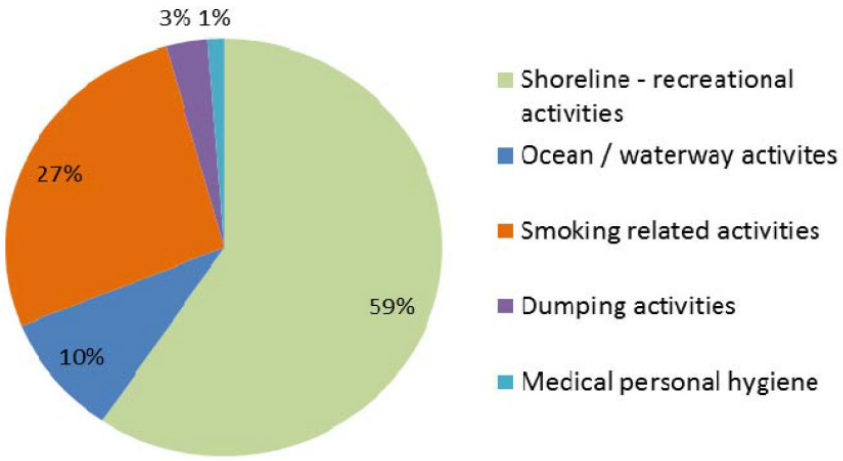

Figure 3.2 Distribution of indicator items for land- and sea-based litter, Source: Compiled from annual ICC data reports, Center for Marine Conservation/Ocean Conservancy (1989-2007) in: UNEP 2009

According to ICC data reports these sources are thought to dominate the overall supply of marine debris, but there are important regional variations. For example, shipping and fisheries are significant contributors in the East Asian Seas region and the southern North Sea (UNEP/COBSEA 2009, Galgani et al. 2010). Similar regional differences will occur within the EU and these are examined in Section 3. For example, in Dutch waters, 90 per cent of litter washed ashore comes from merchant shipping or fishing (van Franeker et al. 2010).

3.3 Distribution and fate

Local, national, and international surveys are frequently conducted to assess the quantity, material composition and, where possible, source of marine litter found on shorelines. Marine litter is also present entangled in vegetation, on the seabed, floating on the water surface and in the water column, it is found in shallow waters close to the land and close to population centres as well as in the open ocean and on remote shorelines (Barnes et al. 2009; STAP 2011; UNEP 2009). For example, an extensive seabed survey of the northwest European continental shelf revealed a widespread distribution of litter, consisting predominantly of plastic from varied sources (Galgani et al., 2000). Long-term, wide-scale surveys of marine litter in surface water, seabed and circulating in the water column are rare, as for practical reasons, it is more difficult to monitor the accumulation of debris on the seabed and water column than on beaches. However, data from Ocean Conservancy (2004), which is coordinated from the USA and implemented in 100 countries worldwide, suggest that approximately 70% of marine litter sinks to the seabed and 15% floats. Further data from European waters in the north-east Atlantic (north of Scotland, Figure 2.3, E) indicate a significant increase in the abundance of small plastic fragments and particles known as "microplastic" (Thompson et al. 2004; see section 3.3.3 below for more on microplastics). Similarly, sampling in the Pacific Gyre also shows a significant increase in abundance over time (Goldstein et al. 2012). In contrast extensive spatial and temporal data from the eastern Atlantic show no clear temporal patterns but indicate spatial aggregation of plastic debris at locations far from land as a consequence of broad scale ocean circulation patterns leading to accumulation of debris in an oceanic gyre (Law et al. 2010).

Marine litter is typically recorded as number of 'items' or less frequently as a 'weight' or 'volume'. Counting the number of individual items according to categories of material type, use and source is considered to provide best information for formulation of management measures at all levels (linking items to sources and uses). It is also the most practical method although other additional methods can be valuable: e.g. the assessment of the weight of the items found (MSFD GES Technical Subgroup on Marine Litter 2011).

Marine litter is composed of a wide variety of materials, with the majority of items falling into a relatively small number of material types such as glass, metal, paper, and plastic. Literature across international reports (e.g. UNEP regional Seas, OSPAR), scientific papers, and government reports, consistently shows that plastic items represent the most abundant type of marine litter globally and within Europe, typically constituting around 75% of all items found (Barnes et al. 2009; EA 2001; OSPAR 2007; UNEP, 2005) (see Figure 3.4). Similarly, items of plastics are most commonly (80%) reported in encounters with wildlife, such as ingestion and entanglement (Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012).

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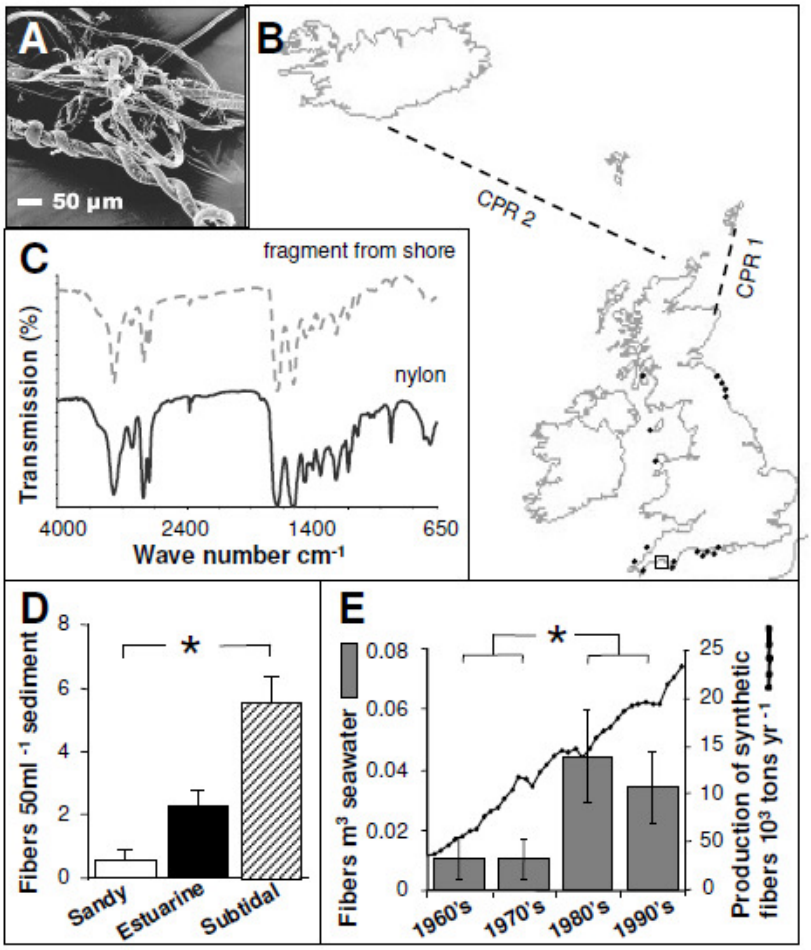

*Figure 3.4 (**A**) Fragment of microscopic plastic from shoreline. (**B**) Sampling locations in North-East Atlantic, showing Routes (CPR 1 and 2) sampled by Continuous Plankton Recorder (CPR) since 1960 and used to assess changes in the abundance of microplastics in the water column (see Fig. 1E). Shores around the UK where similar fragments were found (●) and the location of sites near Plymouth (□) used to compare the abundance of microscopic plastic among habitats (see Fig. 1D). (**C**) Example showing how FT-IR spectroscopy was used to identify fragments from the shoreline and the water column. Here an unknown fragment is identified as nylon. (**D**) There were significant differences in abundance of microplastics between sandy beaches and subtidal habitats (ANOVA on log10(x + 1) transformed data, $F_{2,3} = 13.26$, $P < 0.05$, * = $P < 0.01$), but abundance was consistent among sites within habitat type. (E) Accumulation of microscopic plastic in CPR samples revealed a significant increase in abundance when comparing the 1960's and 1970's to the 1980's and 1990's (ANOVA on log10(x + 1) transformed data, $F_{3,3} = 14.42$, $P < 0.05$, * = $P < 0.05$). Approximate figures for global production of synthetic fibres overlain for comparison. Microplastics were also less abundant along the oceanic route CPR 2 than CPR 1 ($F_{1, 24} = 5.18$, $P < 0.5$). Reproduced from Thompson et al. (2004), with permission.*

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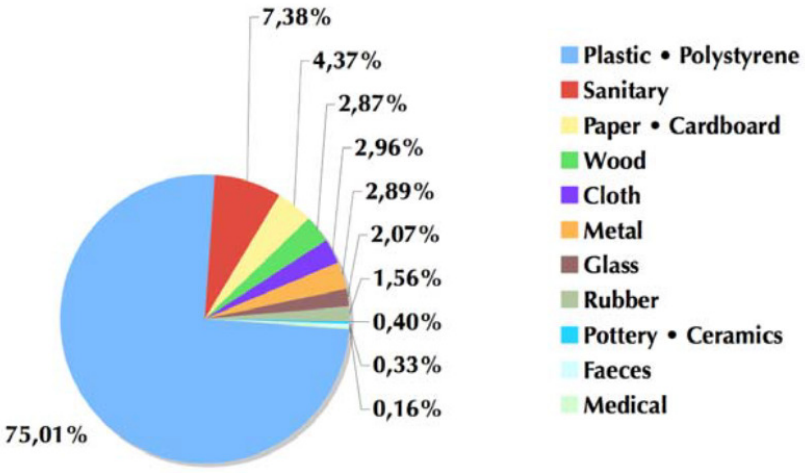

Figure 3.5 Proportion of different categories of marine debris found on reference beaches between 2001 and 2006. Note the prevalence of plastic items as the major components of the debris recorded. These trends are broadly consistent across regions and at a global scale. The analysis was based on data from 609 surveys made in eight countries—Belgium, Denmark, Germany, The Netherlands, Portugal, Spain, Sweden and the United Kingdom (51 regular reference beaches altogether) (OSPAR 2007).

The majority of marine litter consists of material that degrades slowly, if at all. For example, plastic, metal and glass are highly durable materials which are often used specifically for their longevity (STAP 2011). However, this means that when these items become marine litter they will persist in the marine environment and quantities will, in theory at least, increase directly in relation to the quantities of litter entering the oceans.

The most visible types of plastic debris are large derelict fishing gears, bottles, bags, and other consumer products, however much of the debris collected during survey trawls and on shorelines now consists of tiny particles or "microplastic" (Browne et al. 2011; Browne et al. 2010; Law et al. 2010; Thompson et al. 2004; see Figure 3). This material has been defined as pieces or fragments less than 5mm in diameter (Arthur et al. 2009; Barnes et al. 2009). Microplastic is formed by the physical, chemical and biological fragmentation of larger items, or from the direct release of small pieces of plastic, for example through industrial spillage of pre-production pellets and powders, the release of microscopic plastic particles that are used as abrasive scrubbers in domestic cleaning products (Fendall & Sewell 2009; Gouin et al. 2011), releases from domestic and industrial cleaning applications including washing of textiles, and shot blasting to clean paint from ships and aircraft. Plastic items fragment in the environment because of exposure to UV light and abrasion, such that smaller and smaller particles form (Barnes *et al.* 2009). Some 'degradable' plastics are even designed to fragment into small particles, but the resulting material does not necessarily biodegrade (Roy et al. 2011). Microplastics have accumulated in the water column, on the shoreline and in sub-tidal sediments (Andrady 2011; Barnes et al. 2009; Browne et al. 2011; Goldstein et al. 2012; Martins and Sobral 2011; Thompson et al. 2004; Zarfl et al. 2011). Some reports indicate that the abundance of mircoplastics in the oceans is increasing (Thompson et al., 2004). Data on micro plastics are very limited, a few local studies have focused on shoreline micro plastics (Frias et al, 2010, Martins and Sobral, 2011, Mizukawa et al, 2013, Antunes et al, 2013), and to our knowledge, there are no such data for the North East Atlantic sea surface. Goldstein et al. (2012) document that the concentration of microplastics within the North Pacific Central Gyre has increased by two orders of magnitude in the past four decades.

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4 POTENTIAL ECOLOGICAL, SOCIAL AND ECONOMIC IMPACTS

Marine litter presents an environmental, economic, human health and safety, and aesthetic problem (STAP 2011). It can cause injury or death to wildlife which can ingest or become entangled in marine litter. It can alter, damage and degrade benthic habitats and communities through e.g. abrasion of coral reefs from fishing gear; disrupted oxygenation of the sediment or 'smothering', disruption of the assemblages of organisms living on or in the sediment (Katsanevakis et al. 2007). Furthermore, it threatens marine biodiversity by facilitating the transport of invasive alien species between seas (Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012), which are one of the greatest drivers to biodiversity loss worldwide, second only to habitat loss and fragmentation. Marine litter incurs losses to coastal tourism, shipping and fishing industries, and clean-ups add substantial extra costs (Mouat et al. 2010). In addition some items, such as sewage related waste, present health hazards for humans. Other debris items such as rusty metal and broken glass on the beach or the seabed may injure people, while rope and netting can present a hazard to mariners (Mouat et al. 2010; STAP 2011).

4.1 Ecological Impacts

4.1.1 Physical impacts – Entanglement, ingestion

Impacts of marine debris have recently been reviewed and encounters between marine debris and organisms are reported for 663 species (Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012). In all, 319 original publications addressing the impacts of marine debris on biodiversity were examined and over 80% of these related to encounters with plastic debris (Figures 4.1 and 4.2).

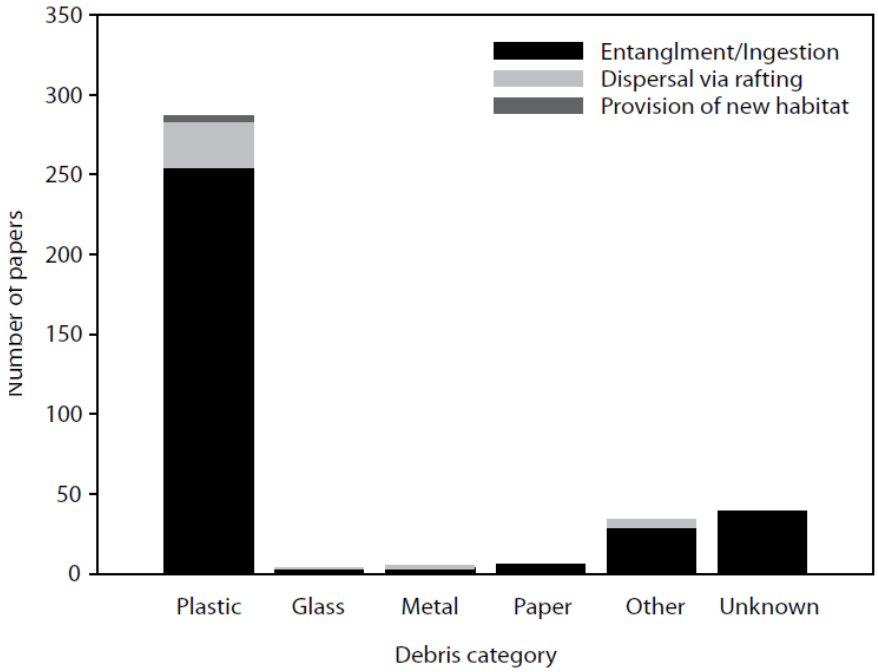

Figure 4.1 Number of papers or reports documenting encounters between marine organisms for entanglement/ ingestion, dispersal via rafting (potential to facilitate the transport of invasive species), and provision of new habitat (potential to provide new habitats) expressed as numbers of reports according to material type. (Source Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012).

Well over half of these reports documented entanglement in and ingestion of marine debris (Figure 4.1), representing a 40 % increase since the most substantive previous review in 1997, which reported 247 species (Laist, 1997). Entanglement in and ingestion of marine debris can be fatal but can also have a range of

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sublethal consequences, compromising the ability to capture and digest food, sense hunger, escape from predators, and reproduce, as well as decreasing body condition and compromising locomotion, including migration (Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012). Reports revealed that all known species of sea turtles, about half of all species of marine mammals, and one-fifth of all species of sea birds were affected by entanglement or ingestion of marine debris (Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012). Of the top 10 species affected by ingestion/entanglement as documented in this report, 6 are found in European waters (Table 4.1). The frequency of impacts varied according to the type of debris; over 80 % of the impacts were associated with plastic debris while paper, glass and metal accounted for less than 2% (Figure 4.1). Globally, the species for which incidence of entanglement in, or ingestion of, marine debris was greatest are listed in Table 4.1.

Table 4.1. Species with the greatest number of individuals reported entangled and ingesting debris

Species name	Common name	Found in European waters?
Callorhinus ursinus	Northern fur seal	No
Zalophus californianus	Californian sea lion	No
Fulmarus glacialis	Northern fulmar	Yes
Fratercula arctica	Horned puffin	Yes
Phoca vitulina	Harbour seal	Yes
Puffinus gravis	Greater shearwater	Yes
Arctocephalus gazella	Antarctic fur seal	No
Puffinus griseus	Sooty shearwater	Yes
Uria aalge	Common guillemot	Yes
Diomedea immutabilis	Laysan Albatross	No
Caretta caretta	Loggerhead seaturtle	Yes

A B C D

Figure 4.2 A) Turtle entangled in plastic rope in Caribbean (photo: UNEP-CAR/RCU, 2008); B) Entangled seal (Courtesy of Salko de Wolff, ECOMARE at Texel); C) plastic packaging from the carcass of a Laysan albatross at Kure Atoll, (Courtesy of Cynthia Vanderlip and Algalita Marine Research Institute); D) Plastic bags and film from

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stomach of young Minke whale that had been washed ashore dead in France (Courtesy of G. Mauger and F. Kerleau, Group d'Etudes de Cétacés du Cotentin (GECC).

About 15 % of the species affected through entanglement and ingestion are on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. Of particular concern are the critically endangered Hawaiian monk seal *Monachus schauinslandi*, endangered loggerhead turtle *Caretta caretta*, vulnerable northern fur seal *Callorhinus ursinus* and white chinned petrel *Procellaria aequinoctialis*. Population level effects are evident in some species such as the northern fulmar *Fulmarus glacialis* (van Franeker et al., 2011), and commercially important crustaceans (Murray & Cowie, 2011).

On the basis of reported effects cuts, lacerations and deformity resulting from entanglement appear much more common than harm as a result of ingestion (Figure 4.3). However the former can be readily observed with external examination, whereas effects associated with ingestion can only be determined by internal examination via necropsy. Hence the impacts of ingestion are likely to be underrepresented (Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012).

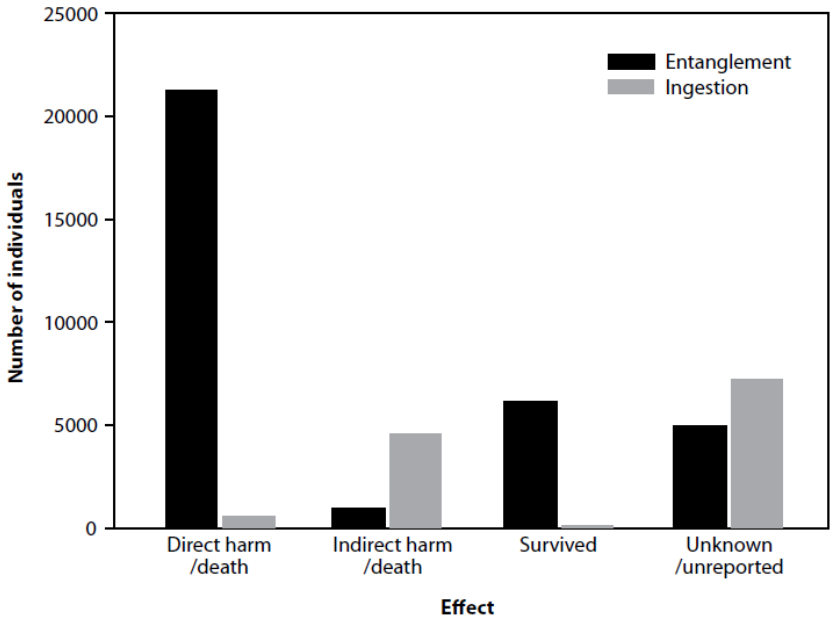

Figure 4.3 Incidence of ingestion of or entanglement in marine debris, indicating the consequence of the encounter where described (Source: Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012).

As part of this document we have separated published reports (recently reviewed by Thompson and Gall for the Secretariat of the Convention on Biological Diversity and Scientific and Technical Advisory Panel GEF 2012 – see publication for full details of method) on encounters with marine litter and organism in order to give a comparison between Europe and the rest of the world. Personal communication (Thompson and Gall) suggests that marine litter presents a substantial problem to marine life within the EU and that broadly speaking the types of organism affected and the types of debris are similar between Europe and the rest of the world. However, reports of encounters between marine litter and marine mammals in terms of both number of individuals and number of species are relatively lower within the EU than for the rest of the world. It is not clear whether this reflects differences in reporting, differences in the distribution of the organisms or differences in the relative abundance of some types of debris.

Ingestion of plastics is well documented in sea birds, sea turtles and marine mammals and can be fatal (Jacobsen et al. 2010). Ingested particles may cause an obstruction or otherwise damage the gut lining. Alternatively, it has been suggested that particles may compromise the ability to feed (Young et al. 2009). For

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some species, ingestion and entanglement affect a substantial proportion of the population. Some of the most comprehensive population level data are for the Northern Fulmar, indicating that over 95% of birds washed ashore dead contained plastic in their gut (see Figure 4.5 below; van Franeker et al., 2005, 2011).

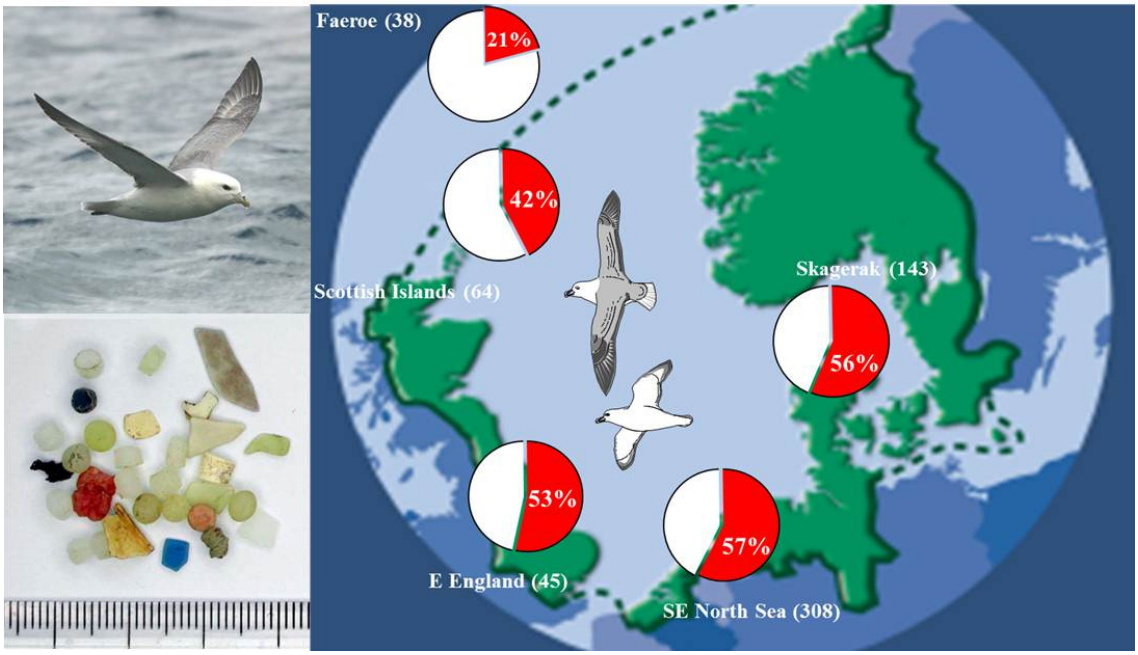

Figure 4.5 A) Fulmars are known to ingest plastic debris. (B) Example of plastic debris from the stomach of a dead fulmar, 95% of which have some plastic in their stomachs. (C) A target Ecological Quality Objective (EcoQO) that <10% of dead birds should have < 0.1g of plastics in their stomachs has been proposed (top right). However, this target is far from being realised. Map shows regional trends, 2002 -2004, for the percentage of birds that had more than 0.1g of plastic in their stomachs. Courtesy of J. A. van Franeker.

Similarly to Fulmars in the North Sea and neighboring Atlantic waters, sea turtles *Caretta caretta* (Linnaeus, 1758) is being considered as an indicator species for marine litter in the Marine Strategy Framework Directive for the Mediterranean and bordering marine areas. Some studies report that 40-80% of specimen found stranded on shoreline containing in their gut marine litter (especially plastic, hooks and nylon) (Tomas et al. 2002; Casale et al. 2010; Lazar., Gračan, 2011).

The physical impacts of larger items of marine litter have been extensively reported. However in addition to effects according to material type it is also important to consider how effects vary according to the size of the litter item (Figure 4.6). Small fragments and in particular microplastics are of increasing concern because they have the potential to be ingested by a wider range of organisms including those at the base of the marine food web and have the potential to cause both physical and chemical (toxicological) effects on organisms (Andrady 2011; Cole et al. 2011; Zarfl et al. 2011).

Laboratory studies have shown that microplastics can be ingested by organisms with a range of feeding strategies including deposit feeding worms, detritivores and filter feeders. Further research has shown that once injested, microplastic particles can be retained by invertebrates for periods in excess of 48 days (Browne et al. 2008). There is growing evidence that encounters between microplastics and marine organisms are widespread and prevalent across a substantial number of individuals. For example, many of the pieces of plastic found in the gut of dead seabirds such as the Norther Fulmar are less than 5 mm in size and so are technically considered microplastic. A recent study on the commercially important crustacean *Nephrops norvegicus*, commonly known as the Norway Lobster, langoustine or scampo, in the Firth of Clyde, Scotland,

showed that a substantial proportion of individuals contained microscopic fragments (Murray & Cowie 2011) of plastic in their gut. Similarly, a study of 500 fish in the English Channel showed that around one third of individuals had microplastic in their gut. The study examined 5 demersal and 5 pelagic species and found microplastics in the gut of all 10 species. Quantities ranged from 0 to 15 items per fish, but were typically very low with around one item per individual (Lusher 2012). However, at these quantities the presence of plastic is unlikely to present a hazard to human health. These papers do indicate that microplastics are now widespread, not only in the environment but also in natural populations of marine organisms.

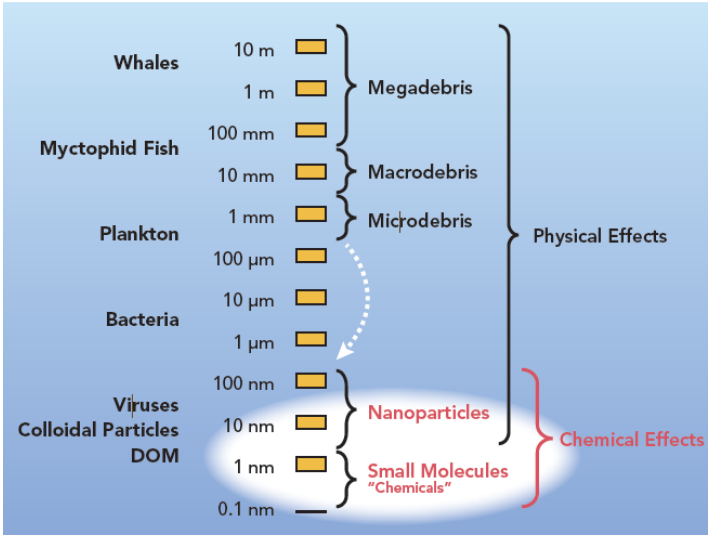

Figure 4.6 Schematic diagram illustrating various sizes of plastic debris and marine organisms together with the potential impacts both physical and chemical. It should be noted that our understanding of impacts of microscopic and nano-sized particles is at present very limited (Source STAP 2011).

Abandoned, deliberately discarded or lost at sea fishing gear (ADLFG), also called ghost nets, is an important component of marine litter. The fishing gear could be lost at sea for several reasons (bad weather conditions, accidental cutting of buoys by vessels, etc.) or abandoned because leaving it in the sea is a convenient means of illegal disposal. Ghost nets are often considered perpetual "killing machines" that never stop fishing (Esteban, 2002). Ghost-nets are a big concern generating additional mortality in overexploited marine ecosystems. Some studies report that they cause death of 5% of the total commercial catch (Sancho *et al.* 2003). They continue to catch 'unintentionally' (by-catch) wildlife such as marine mammals, sea turtles, sea birds and fish, often attracted by fishes that have been caught or entangled in nets and fishing lines (Laist, 1995; Laist and Liffman, 2000). For example, a study on ghost fishing in the pot fishery for blue swimmer crabs *Portunus pelagicus* illustrates that each lost pot will catch between 3 and 223 *P. pelagicus* per year after the bait has been exhausted and ghost fishing mortality could be as high as 111.811–670.866 crabs per year (Campbell and Sumpton, 2009).

4.1.2 Chemical impacts

There is increasing concern about the potential for marine litter to release chemicals into the environment and in particular to organisms that ingest plastic debris. Plastics contain a variety of potentially toxic chemicals incorporated during manufacture (monomers and oligomers, bisphenol-A (BPA), phthalate plasticisers, flame retardants and antimicrobials) (Lithner et al., 2011), which could be released into the environment. Chemicals used in plastics such as phthalates and flame retardants can have toxicological effects on fish, mammals and birds (Oehlmann et al. 2009; Talsness et al. 2009).

These chemicals can enter marine organisms directly by ingestion of plastics or indirectly by ingestion of marine organisms that have eaten plastic. The toxics can bio-accumulate in these animals and have severe impacts on their health or their concentrations can be amplified through the food-web (bio-magnification) and

eventually pose health risks to other organisms at higher trophic level, including humans who are at the top of the food chain (Teuten et al. 2009).

Although there is no evidence to confirm a direct link between the chemical characteristics of marine debris and adverse effects on marine life, experimental studies have shown that phthalates and BPA affect reproduction in all study species, impairing development in crustaceans and amphibians, and generally inducing genetic aberrations (See review by Oehlmann et al., 2009). Concentrations of these substances in the marine environment have been found to match those identified as harmful in laboratory studies, inferring that they could be impacting natural populations (Oehlmann et al., 2009).

In addition, persistent, bio-accumulative and toxic (PBT) substances, including persistent organic pollutants (POPs) that are already present in the oceans from other sources can attach to and become concentrated on the surface of plastic debris. This may facilitate the transport of chemicals and present a risk to marine organisms that ingest the material (Hirai et al. 2011; Mato et al. 2001; Teuten et al. 2007; Teuten et al. 2009). However there is currently only very limited evidence indicating a direct link between the release of chemicals from plastic and harm to organisms ingesting plastic.

4.1.3 Provision of new habitats and transportation of invasive species

Marine litter also provides a new habitat which will readily become colonised by microorganisms and macrobiota (Whal, 1989; Ye & Andrady, 1991; Harrison et al., 2011). Therefore marine litter may affect the relative abundance of marine organisms. Floating objects or fragments further provide a temporary "home" for invasive non-native species, including sessile invertebrates, seaweeds and pathogens (Astudillo et al., 2009; Barnes, 2002). Hence, organisms could be transported considerable distances via "rafting" on marine litter and have the potential to disrupt the balance of species in receiving habitats. However the importance of marine debris compared to other vectors is yet to be established.

4.2 Socio-economic impacts

The socio-economic impacts of marine litter are extensive, as can be seen from Figure 4.7, with economic losses to industries such as commercial fishing and shipping and to recreation and tourism. Marine litter can both reduce the economic benefits derived from the above mentioned marine and coastal activities and/or increase the costs associated with their removal. Due to the transboundary nature of marine litter, costs may be incurred by countries which are far from source. Indeed, the costs associated with marine litter are typically borne by those affected by, rather than those causing, the problem (Galgani et al. 2010; Mouat et al. 2010; STAP 2011).

It is notweworthy to mention that in practice, the wide diversity of impacts makes measuring the full economic cost resulting from marine litter extremely complex. Primarily, direct economic impacts such as increased litter cleansing costs are clearly easier to assess than the economic implications of ecosystem degradation or reduced quality of life.

4.2.1 Fishing and shipping industry

There are substantial costs to the fishing industry through loss of fishing opportunities due to time spent cleaning nets, propellers and blocked water intakes. For example, it has been reported to cost the Scottish fishing industry around 12 million Euro per year (KIMO 2008) through the loss of fishing time and potentially costly repairs due to the need to remove debris from fishing gear, propellers and water intake pipes (Brink et al. 2009). In the Shetland Isles, UK, 92 % of fishermen reported that they experienced recurring problems associated with accumulated debris in their nets, 69% had experienced contamination of their catch by debris, and 92% had experienced problems due to snagging their gear on debris on the seabed The estimated cost for each boat per year due to these impacts was estimated to range from 7,000- 35,000 Euro (Hall, 2000).

One of the most substantial costs of marine debris to the fishing industry is the loss of revenue due to ghost fishing – when lost, abandoned or discarded fishing gear continues to catch fish long after it originally became marine litter, threatening fish stocks (UNEP, 2005). For example, a study in Oman estimated that the cost of fish trapped in ghost nets was approximately 108 Euro per trap after 3 months, and 95 Euro per trap after 6

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months (Al-Masroori et al., 2004). Gilardi et al. (2010) assessed the ability of derelict gill nets to ghost fish in Puget Sound, USA, and performed a cost-benefit analysis which concluded that entanglement of Dungeness crab by a single study net could cost the commercial fishery 14,742 Euro, compared to 1018 Euro, the cost of removing the net and so preventing it from ghost fishing. Losses to fishermen in the EU as a consequence of ghost fishing are yet to be established.

Marine litter also presents a significant navigational hazard for shipping, with an increasing number of coast guard rescues sent to vessels with fouled propellers. For example, in the UK, there were 286 such rescues in 2008, at a cost of up to 2.1 million Euro (Mouat et al., 2010).

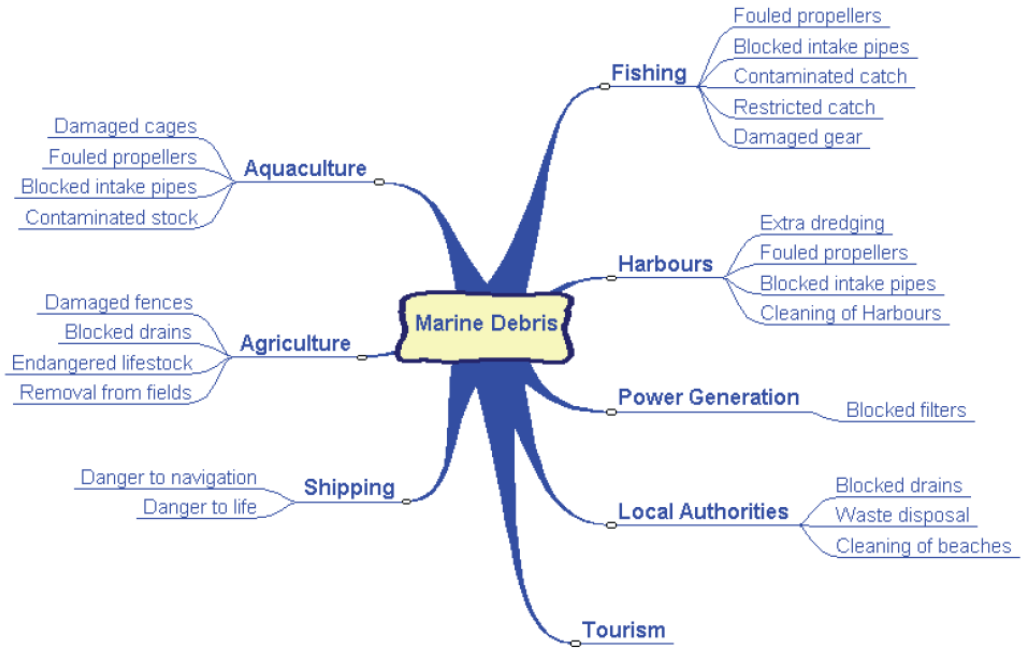

Figure 4.7 Summary of socio-economic impacts of marine litter (Galgani et al., 2010)

4.2.2 Costs of clean-ups and aesthetic impacts – losses to tourism

In order for beaches and harbours to remain clean, safe and attractive for users, local authorities incur significant costs to remove marine litter. For example it has been reported that the cost to UK port authorities for debris removal amounts to approximately 2.25 million Euro per year (Mouat et al., 2010).

The aesthetic impact of marine litter is readily apparent. This can affect the public's perception of the quality of the environment and attractiveness of the coastline. This can lead to loss of income to coastal tourism, and those that rely on income from maritime activities such as sport fishing, submarine tours, turtle and whale watching trips, snorkelling, and scuba diving. Beach clean ups and the removal of debris from coastal zones can be very costly to municipalities. For example, Belgium and the Netherlands spend approximately 10.24 million Euro per year on removing beach litter, and the cost of removing plastic bags alone from UK beaches has been estimated at 340,000 Euro a year (Marine Conservation Society, 2005). The cost of clean-ups in the UK has increased by 38% over the last 10 years to approximately 17.72 million Euro annually.

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5 REGIONAL DIFFERENCES ACROSS EUROPE

5.1 North East Atlantic

5.1.1 Regional governance – OSPAR

Assessment of marine litter in the North East Atlantic Sea is led by the OSPAR Convention; which covers Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, and Wider Atlantic. Regular assessments take place due to well-organised and intensive monitoring activities on reference beaches. The summary below is primarily based on key high level regional assessment and reports, including the OSPAR (2007) *Pilot Project on Monitoring Marine Beach Litter*, the OSPAR (2009) *Marine Litter in the North-East Atlantic Region: Assessment and priorities for response*, and the UNEP (2009) *Marine Litter: A Global Challenge* which reviews and summarises data from each of the Regional Seas. These reports should be referred to directly for more detailed information.

Most available information comes from beach monitoring of litter. Outside the OSPAR programme, monitoring is also undertaken by local authorities and NGOs, but with little harmonisation between countries (UNEP, 2009). There are relatively few monitoring programmes to assess floating litter and litter on the seabed. The OSPAR (2007) monitoring programme showed that from 2001-2006 although there was no significant increase or decrease in the amount of beach litter in the NE Atlantic, there were significant differences in spatial distribution with least abundance in the Iberian Coast and highest abundance in the Northern North Sea.

5.1.2 Marine litter distribution and effects

OSPAR's (2007) assessment documented an average of 542 items of marine litter of varying sizes per 100m of beach. Surveys of 1km stretches were made for larger items (>50cm in any direction), but included some items smaller than this. Here an average of 67 items was recorded. Figure 5.1, below shows the number of items found in the different regions of the NE Atlantic, apparently highlighting a significantly greater quantity found on beaches in northern regions, although no formal statistical evidence is presented by OSPAR.

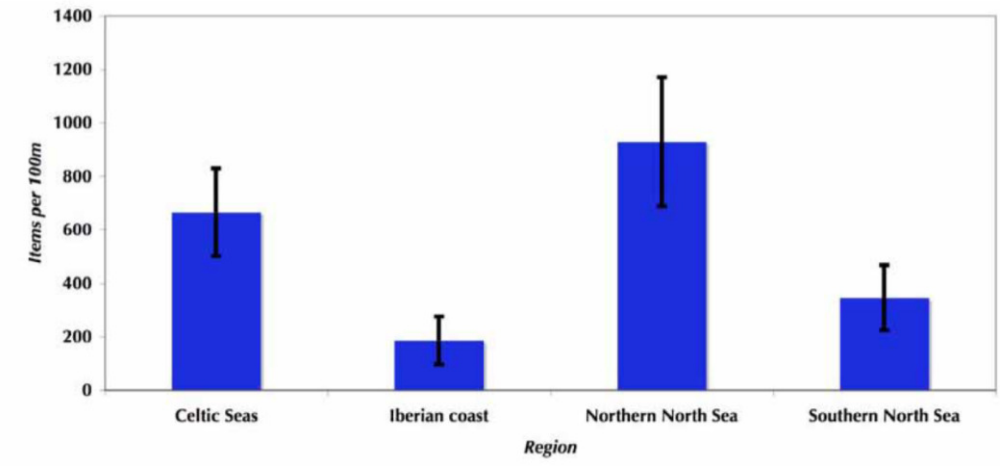

Figure 5.1 Average number of marine litter items per 100 meters on the reference beaches. Source: OSPAR Commission 2007

Small plastic/polystyrene pieces were the most common type of marine litter recorded on all reference beaches, followed by rope/cord/net pieces (Figure 5.2). Similar results can also been seen in Figure 4 presented earlier in Section 2, where plastic or polystyrene represented 75% of items (OSPAR, 2007). The relative proportion of plastic and polystyrene increased from 68% in 2001 to 78% in 2006. Thompson et al.

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(2004) have also found that microplastic fragments and fibres have accumulated in surface waters to the north of Scotland and are widespread on shorelines in the NE Atlantic (Browne et al. 2011, Thompson et al. 2004).

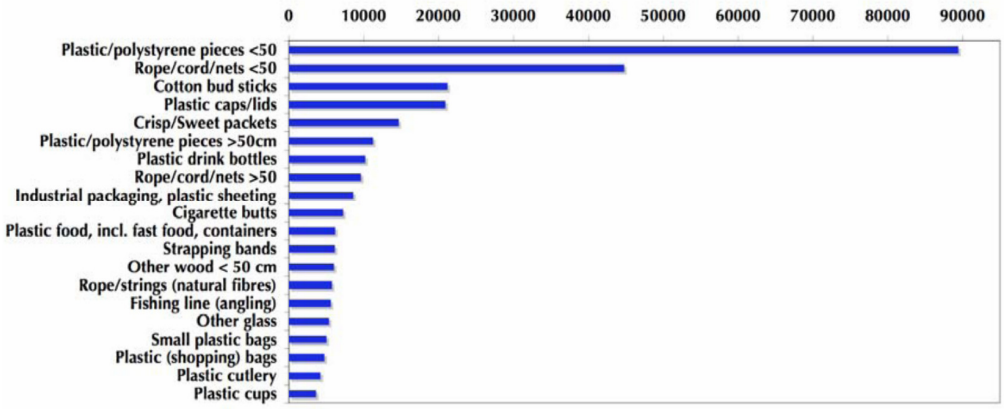

Figure 5.2 Most common (total numbers) items on reference beaches. Source: OSPAR Commission 2007.

Limited information is available on the quantities and composition of litter on the seabed in the EU. However the available data on marine litter from continental shelves and slopes along European Seas including the North Sea, Celtic Sea, and Bay of Biscay indicate that amounts vary considerably, from 0 to 101,000 items/km^2 (Galgani et al., 2000). Surveys in Belgian waters using a neuston net (which "catches" small particles as well) found 3.9 items/km^2 (Claessens et al. 2012). The majority of items were plastic, including fishing gear which was common. A number of "Fishing for Litter" projects, such as "Save the North Sea" provide more localised data on seabed litter. For example, the proportion of plastic can vary from 55% in Celtic Seas to 38% in the Greater North Sea. It has also been reported that heavier materials such as metal (23 and 13%), rubber (25 and 9%) and wood (10 and 11%) represented a greater proportion of items compared to litter recorded from beaches (Save the North Sea, 2004).

5.1.3 Causes: Sources and processes

OSPAR (2007) indicates that marine litter in the NE Atlantic can be traced most often to tourism, fishing related activities and sanitary waste. Further, the number of fishing-related items increased significantly on reference beaches during the period from 2001-2006, while no trends were present for any of the other sources – tourism, shipping, sanitary, and galley waste. Similarly, the MCS UK Beachwatch (2007) survey indicated that marine litter can be traced most often to recreational beach users (35%), and fishing (14%), whilst 42% remains non-sourced. A more extensive discussion is also provided in OSPAR 2009 and UNEP 2009.

5.1.4 Ecological Impacts

As outlined in Section 4, marine litter has a range of impacts, including damage to: wildlife, ecosystems, the aesthetic quality of beaches, recreational and fishing interests, and may also present risks to health and property (Hall, 2000). Incidents involving marine litter are very common in the North Sea, affecting wildlife including seals, whales turtles, and seabirds either through entanglement by rope and fishing gear or by ingestion (UNEP, 2009). There is also evidence that invasive species have been transported to the region by marine litter. For example, the exotic barnacle species *Eliminius modestus* has been found on plastic on the shoreline in the Shetland Islands (UNEP, 2009). There is some excellent quantitative data on the environmental impact of marine litter from the Save the North Sea project and Ecological Quality Objective (EcoQO) on plastic particles in the stomachs of fulmars. This indicates that 94% of fulmars in the North Sea have on average 34 pieces and 0.30 gram mass of plastic in their stomachs (Figure 4.6).

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5.1.5 Socio Economic Impacts

There is clear evidence of socio economic impacts in the region with costs to the fishing industry through loss of fishing opportunities due to time spent cleaning nets, propellers and blocked water intakes. For example, it has been reported to cost the Scottish fishing industry around 12 million Euro per year (KIMO 2008) through the loss of fishing time and potentially costly repairs due to the need to remove debris from fishing gear, propellers and water intake pipes (Brink et al. 2009). In the Shetland Isles, UK, 92 % of fishermen reported that they experienced recurring problems associated with accumulated debris in their nets, 69% had experienced contamination of their catch by debris, and 92% had experienced problems due to snagging their gear on debris on the seabed. The estimated cost for each boat per year due to these impacts was estimated to range from 7,000- 35,000 Euro (Hall, 2000). Marine litter also presents a significant navigational hazard for shipping in the OSPAR region, with an increasing number of coast guard rescues sent to vessels with fouled propellers. For example, in the UK, there were 286 such recues in 2008, at a cost of up to 2.1 million Euro (Mouat et al., 2010). A more extensive discussion is also provided in OSPAR 2009 and UNEP 2009.

5.2 Baltic Sea

5.2.1 Regional governance – HELCOM

The Baltic Sea is represented by the Helsinki Commission (HELCOM) which works to protect the marine environment in this region. To date, marine litter has not been regarded as a major problem and there is a lack of comprehensive and systematic assessment or monitoring of marine litter in this region. As such, there is a lack of comparable and reliable data. This section primarily summarises information in the HELCOM (2007) *Marine Litter in the Baltic Sea Region: Assessment and priorities for response* and UNEP's (2009) *Marine Litter: A Global Challenge* which reviews and summarises data from each of the Regional Seas.

5.2.2 Marine litter distribution and effects

No statistically-based monitoring of the quantities of marine litter in the Baltic Sea region has been carried out, and there is no common method of reporting, which makes formal comparison difficult. Some information is available from NGOs (WWF and Ocean Conservancy) and municipalities regarding amounts of litter on beaches along the Baltic coast. For example, the WWF collects information via the NatureWatch Baltic network which produces a yearly report of number of litter items per 500m of coastline (Figure 5.3). However, this information is not necessarily representative of the general state of litter in the Baltic Sea region.

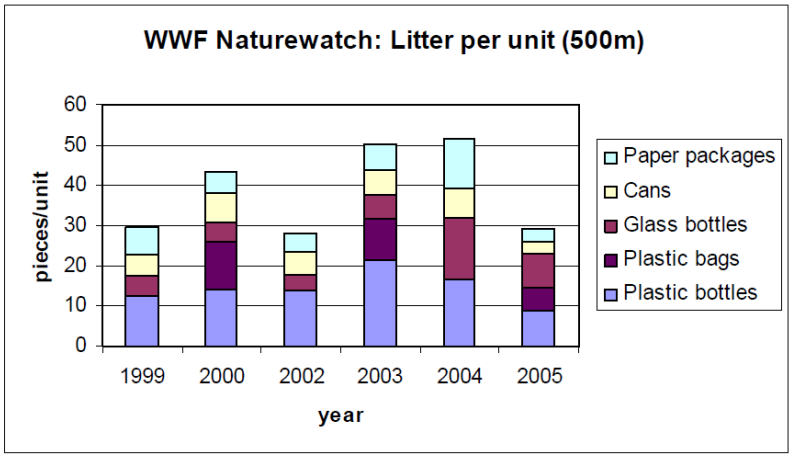

Figure 5.3 Averages of different types of Litter found on beaches within WWF Naturewatch Baltic

Available information on the Baltic region suggests that the amount of litter found is neither increasing nor decreasing over time. Greater quantities are found near particular point sources, such as shipping routes, rivers, and public beaches (HELCOM, 2007). The highest quantities reported range from 700 to 1200 items per 100m coastline, which is similar to beaches in the northern North Sea (NE Atlantic Region). However, typical

amounts of litter were much lower ranging from 6 to 16 pieces per 100m of beach (HELCOM, 2007). As such, litter does not appear to be generally as abundant in the Baltic Sea as in the NE Atlantic.
The most common types of litter in the Baltic Sea were from land-based tourism and recreation (HELCOM, 2007; UNEP, 2009). Plastic represents the most abundant material, making up 30-60% of litter in terms of items and weight (HELCOM, 2007). Other materials, such as fishing-related litter, wood, food waste, sanitary and sewage-related litter, clothing and rubber are common, but quantitative data are not presented.
Galgani et al. (2000) also provide data for quantities of litter found on the seabed in the western Baltic Sea. Findings indicate 1.26+/- 0.82 items of litter per hectare, which is comparable with data from the North Sea.

5.2.3 Causes: sources and processes

There is little information available regarding the sources of marine litter in the Baltic region. The majority of marine litter in the Baltic is attributable to shoreline and recreational activities (HELCOM, 2007, UNEP, 2009). HELCOM (2007) also lists fishing in rivers and intentional dumping as major land-based sources of litter. In terms of sea-based sources, commercial shipping, recreational fishing boats and pleasure craft are considered important, but no data are presented (UNEP, 2009). Of the non-peer reviewed data available, a Finish graduate level study (Tuomisto 1994), reported in HELCOM 2007, indicated that in the Gulf of Bothnia and in Åland the majority of items could be identified as originating from cruise liners and recreational boating. In the western Gulf of Finland litter was mainly from cargo ships. Forty per cent of the litter was from Russia, Estonia, Latvia, and Lithuania, and 21% was Polish origin. In the eastern Gulf of Finland the majority of litter also came from the shipping industry. Litter from fishing activities was abundant throughout the Baltic Sea, particularly lost nets. The Swedish Board of Fisheries has surveyed the problem of lost fishing nets and in 2004 24km of net was found (HELCOM 2007). Similarly, it has been estimated that in 2005-2008 the number of cod gillnets lost by EU vessels amounted from 5500 to 10000 annually (WWF Poland 2011).

5.2.4 Impacts

There is little information about the ecological or socio-economic effects of marine litter, other than individual examples. For example, in the West Coast of Sweden it was estimated that beach cleaning costs in Bohuslän were at least 1 125 000 € in 1997, and Poland reported the costs for beach cleaning and removal of litter from harbour waters to be 570 000 € for 2006.

5.3 Mediterranean

5.3.1 Regional governance – UNEP/MAP/MEDPOL

The legal and institutional framework for the protection of the marine and coastal environment of the Mediterranean Sea is provided by the Barcelona Convention, adopted by 22 countries of the region. Marine litter has been an issue of concern in the Mediterranean since the 1970s and the 'Protocol on Land Based Sources and Activities' adopted in 1980 explicitly recognizes the importance of dealing with the problem of marine litter, while other protocols have also direct or indirect implications for marine litter management. The most recent assessment of marine litter in the Mediterranean Sea, to date, was carried out in 2008 by the Mediterranean Action Plan (UNEP/MAP-MEDPOL) in close collaboration with MIO-ECSDE, HELMEPA and Clean up Greece. This section primarily summarises information in UNEP MAP/MED POL's (2009) *Results of the assessment of the status of marine litter in the Mediterranean* and UNEP's (2009) *Marine Litter: A Global Challenge*. A large number of international organisations and NGOs also conduct surveys and beach cleans-ups providing data on marine litter in the Mediterranean Sea.

5.3.2 Marine litter distribution and effects

A relatively reliable source of information regarding the amounts and types of litter can be obtained from NGOs. However, initiatives are typically conducted with different measures and standards (e.g. litter types are classified differently if at all and there is inconsistency in recording litter quantity as number of items vs. weight) making synthesis of results difficult. Information, such as length of the coast cleaned is sometimes absent and data on marine litter are restricted mainly to parts of the north Mediterranean (UNEP MAP, 2009).
Data from the Mediterranean International Coastal Clean-up (ICC) (2002-2006) indicate that the most common type of beach litter is cigarette filters, followed by cigar tips (Table 5.1, Figure 5.4). Plastics, aluminium, and glass are also common. In terms of floating litter, data vary greatly. An average of 2.1 items/km^2 have been

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reported with concentrations ranging from 0.08 to 71 items per nautical mile (UNEP/MAP 2009). Plastics account for around 83%, while all other categories (textiles, paper, metal, wood) constitute the remaining 17% (UNEP/MAP, 2009).

According to recent studies micro-litter has become an emerging threat in the Mediterranean environment, with micro-debris floating in the Mediterranean Sea reaching maximum levels of 892.000 particles/km^2. Recently, Collignon et al. (2012) determined neustonic microplastic and zooplankton abundance in the North Western Mediterranean Sea and showed that the estimated mean abundance of microplastics was of the same order of magnitude as that found for the North Pacific Gyre (0.334 particles/m^2), underscoring the high level of this emerging threat. In addition, another study indicated in the Venice Lagoon provided useful initial insights into the presence of microplastics in sediments, which have a widespread distribution and with most abundant polymers polyethylene and polypropylene (Vianello et al. 2013).

5.3.3 Causes: sources and processes

According to data from the Mediterranean ICC (2002-2006), the majority of marine litter represents land-based as opposed to sea-based origin (Figure 5.5). More specifically, beach litter reflects shoreline and recreational activities and smoking-related activities. Smoking-related activities accounts for 40% of marine litter, which is substantially higher than the global average (Figure 5.5).

5.3.4 Impacts

There are limited data available on the ecological impact of litter on marine wildlife in the Mediterranean. Data on the loggerhead turtle, *Caretta caretta*, indicate a high frequency of occurrence of debris in their stomachs in the Mediterranean (UNEP MAP, 2009). The loggerhead, widely considered one of the emblematic animals of the Mediterranean, is classified as 'vulnerable' by the International Union for the Conservation of Nature (IUCN), and so attracts many conservation efforts. The impacts of marine litter at the surface and seabed of the Mediterranean on other wildlife are poorly documented beyond anecdotal accounts of fish and larger invertebrates 'necklaced' with debris (Galil, 2006).

Figure 5.4 Cigarette butts are an abundant litter item on Mediterranean beaches. © Clean Up Greece

UNEP/MAP (2009) consider the main causes of marine litter on shorelines are recreational activities and poor solid waste management. For example, the inadvertent release of litter from coastal landfills, by beach users (Figure 5.4), and illegal dumping of domestic and industrial waste. Litter on the shoreline is also highly related to tourism and the Mediterranean is one of the largest tourist regions in the world (UNEP MAP, 2009, Table 5.1, Figure 5.5).

Socio-economic impacts are not extensively described, but will include clean-up costs, losses to tourism, and losses to the fishing industry through ghost fishing, damage to boats and propellers, and blocked water intakes. However, there are no reliable data on these costs to quantify such impact in the Mediterranean (UNEP MAP, 2009).

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Table 5.1. Top 12' marine litter items in Mediterranean ICC campaigns (2002-2006) in UNEP MAP, 2009

Item	Counts	%
Cigarettes/Cigarette filters	222,563	27
Cigar tips	86,146	10
Plastic bottles 2 lt or less	81,238	9.8
Plastic bags	70,912	8.5
Aluminium beverage cans	63,282	7.6
Caps/lids	60,920	7.3
Beverages bottles (glass)	48,085	5.8
Cups/plates/forks/knives/spoons	32,037	3.8
Tobacco packaging/wrappers	23,648	2.8
Food wrappers/containers	21,029	2.5
Straws/stirrers	17,184	2.1
Pull tabs	15,488	1.9

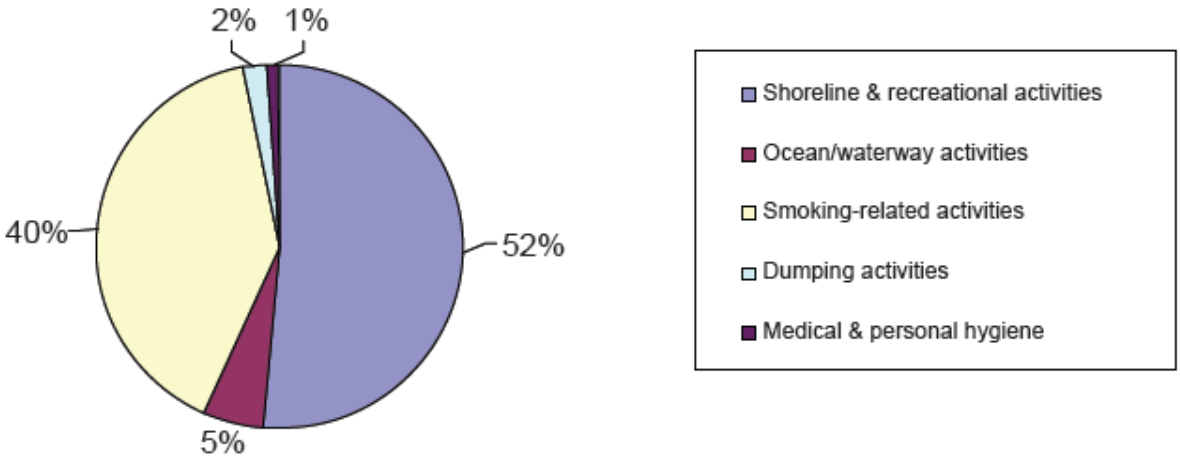

Figure 5.5 Sources of marine litter from Mediterranean ICC campaigns (2002 - 2006) Source: Ocean Conservancy, ICC Annual Reports, 2002-2006.

5.4 Black Sea

5.4.1 Regional governance – the Black Sea Commission/Bucharest Convention

The Black Sea is represented by the Black Sea Commission (BSC) or Bucharest Convention which works to protect the marine environment in this region. However, there is limited assessment of marine litter in the Black Sea, and a lack of comprehensive and systematic monitoring. As such, there is a lack of comparable and reliable data. This section primarily summarises information in BSC's (2007) *Marine Litter in the Black Sea Region: A Review of the Problem* and UNEP's (2009) *Marine Litter: A Global Challenge* which reviews and summarises data from each of the Regional Seas.

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5.4.2 Marine litter distribution and effects

There are very limited data regarding the quantities and composition of marine litter in the Black Sea. BSC (2007) reports that some governmental and private institutions and NGOs in Bulgaria, Romania, Russia, Turkey and Ukraine have conducted marine litter research using different approaches and methods, including aerial surveys. National reviews are scarce and there is no aggregated information available. UNEP (2009) presents some of the results of local surveys, stating that vessel-based transect surveys estimated between 6.6 and 65.7 items/km^2 of floating plastic litter, and beach surveys along the Turkish Black Sea coast recorded between 58 and 1,395kg litter per km. Local surveys and studies (BSC 2007, UNEP 2009, Topcu et al. 2012) state municipal waste/sewage and badly managed landfills as the most important sources of marine litter, followed by marine transport and ports and recreational activities. In contrast, a recent study by ARCADIS (2013) concluded from items found at beaches near Constanta, Romania, that recreational and tourism activities (both land- and sea-based) represent the most important source, with a huge amount of litter originating from recreational fishing (45%), followed by household and sanitary sources. ARCADIS 2013, also consider shipping/ports to represent only a minor source (8%).

UNEP (2009) also report on a series of underwater surveys of marine litter. These revealed glass to be the most abundant (31%) material, followed by plastic (25%) and metal (21%). Data from the beaches of Crimea, Ukraine indicated a predominance of plastics (80-98%). In terms of items, plastic bottles, bags, packaging, and cigarette butts are the most abundant (BSC, 2007).

5.4.3 Causes: sources and processes

Solid waste management is one of the major environmental problems in the Black Sea region (Celik, 2002) and is a likely source of marine litter. Although very few studies of its extensiveness and sources have been made, illegal marine dumping has been known in all Black Sea coastal states for many years. For example, on the southern coast of the Black Sea, municipal and industrial solid wastes, mixed with hospital and hazardous wastes, are dumped on nearby lowlands and river valleys, directly adjacent to the coast, or at sea (Berkun *et al.*, 2005, See Figure 5.6). In addition, the narrowness of some strips of the Georgian and Turkish coasts leads to the erosion of landfill contents into the sea (UNEP, 2009). Illegal, unreported and unregulated (IUU) fishing in the Black and Azov Seas is also considered an important source of marine litter due to discarded and abandoned nets (UNEP, 2009).

Figure 5.6 Rubbish from dumps often reaches the sea and represents a particular problem in some European countries including regions of the Black Sea. © Levan Kherkheulidze/UNEP.

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5.4.4 Impacts

In some areas, the high concentrations of fixed and floating illegal, unreported and unregulated fishing gear has resulted in the reduction of habitat space, obstacles for migration and an increase in incidental mortality (by-catch) of cetaceans, fishes and crustaceans (BSC, 2007; UNEP, 2009). Although no special research on abandoned nets has been conducted in the Black Sea region, the problem of 'ghost' fishing undoubtedly exists, at least in the shelf area. Ingestion and entanglement also present an important threat. Materials including coal slag, wood and paper, and cherry stones have been collected from the stomachs of the Black Sea common dolphins (*Delphinus delphis*) (Kleinenberg, 1956). Further, in the Spring of 1991, 194 dead dolphins and harbour porpoises (*Phocoena phocoena*), 18,424 turbot (*Psetta maeotica*), 143 sturgeon (*Acipenser* spp.), 401 spiny dogfish (*Squalus acanthias*) and 1,359 rays (*Raja clavata* and *Dasyatis pastinaca*) were found entangled in bottom-set gillnets in Ukrainian waters (Birkun, 2002). In April 2002, 35 harbour porpoises were recorded as by-catch in the abandoned illegal gill and trammel nets in the Exclusive Economic Zone of Romania (Radu *et al.*, 2003).

5.5 Similarities and differences between the regional seas

Across the four regional seas within Europe it is apparent that there is a lack of robust data on the quantities, types and temporal trends in marine litter. Available data are predominantly from sandy beaches, even here the quality of information and our ability to compare either within or among regions is limited; for sea-surface and subtidal the data are exceptionally limited (UNEP, 2009). The data on microplastics are also very limited. To our knowledge, there are no such data for the North East Atlantic (sea surface and shoreline), Mediterranean (sea surface), Baltic (limited data from water column) and the Black sea.

In addition to the general lack of data; the problem of comparability among and within regions is compounded since data available are often collected using different methods for counting and categorization of items. The Atlantic is the only region where there is good historical data as a result of harmonisation via OSPAR protocols. These are voluntary and could be much more widely adopted. While the Atlantic region has much more data than other regions within Europe there are data gaps here too, for example with very limited data from Portugal and Denmark (UNEP 2009). Our ability to detect temporal trends is also hampered by a lack of regular monitoring in many locations. There are currently intensive efforts to harmonise methods to monitor marine litter at a European level via MSFD Task Group 10 and it is hoped that protocols will become available during 2013.

In terms of limitations in our ability to reduce marine litter the need for a regime shift on our approach and some associated solutions are discussed in Section 4. In addition there is widespread consensus across the regional seas that available legislation to tackle marine litter needs to be much better enforced. This is especially the case with respect to regulation of illegal dumping both on land and at sea. Increasing relevant infrastructure at a range of levels, from litter bins on beaches and port reception facilities to waste collection sorting and recycling, is also essential together with improved management of existing facilities in particular landfills (UNEP, 2009, STAP 2011).

There is a general lack of systematic and comprehensive regional measurement across all regions. However, the NE Atlantic OSPAR Convention leads the way in several respects. OSPAR's regular assessments due to well-organised and intensive monitoring activities (on reference beaches at least) could inform the practice in the other regional seas which could benefit from a similar approach. The four regions are similar in that the predominance of monitoring and assessment of marine litter occurs on beaches as opposed to at sea. In addition, monitoring of marine litter is undertaken by NGOs in all regions, for example the Ocean Conservancy's International Coastal Clean-up is implemented across each region.

In all regions marine litter predominantly consists of plastic and originates from land-based sources, including shoreline and recreational activities. In the Mediterranean, smoking-related activities are a substantial factor, higher than the global average. Litter does not seem to be generally as abundant in the Baltic Sea as other regions.

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Ecological and socio-economic impacts of marine litter exist in all regions, however there is relatively little data available, particularly in the Baltic, Mediterranean, and Black Sea. Information often represents small scale studies in a particular area, or anecdotal reports.

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6 RESULTS FROM NATIONAL SURVEY

6.1 Response to questionnaire

In order to obtain information at a national level on quantities, typologies and distribution of marine litter a specific sheet format was sent to partners to provide available and relevant data. The returns provided by partners varied in the quality of information provided. Some appeared quite comprehensive whilst others were clearly incomplete and lacked essential details. This might be a reflection of different structure and coordination for marine litter survey activities between countries. Very little information was supplied on specific sources of litter. This was not surprising as the identification of sources requires the interpretation of relevant data that in most of the cases is not available or the level of detail of items did not allow it. Moreover, partners were not expected to analyse or assess such type of data.

Table 6.1 summarises the coverage of MARLISCO contributions by MSFD regions on the national survey task 1.1. In some instances national survey information was not provided by MARLISCO partners, but Cefas addressed some of the most important gaps, in liaison with the MSFD GES TSG10 on marine litter. Cefas also included information on survey activities from some countries that were not MARLISCO partners (*).

Table 6.1. MSFD regions and contributions to T1.1 national survey by partner

Region	MSFD region	Country	MARLISCO partner and/or T1.1 contributor
NEA	Greater North Sea	Netherlands	EUCC (P2), Cefas (P3 & TSG10)
NEA	Greater North Sea inc. the English Channel; and Celtic Seas	UK	Cefas (P3- TSG10)
NEA	Greater North Sea	Belgium	Cefas (P3)
NEA	Bay of Biscay and the Iberian Coast; and Greater North Sea inc. English Channel	France	MerTerre (P7)
NEA	Celtic Seas	Ireland	NUIC-UCC (P9)
NEA	Greater North Sea	Germany	Kusten Union (P11), Cefas (P3 & TSG10)
NEA	Bay of Biscay and the Iberian Coast	Portugal	FFCT UNL (P15)
NEA	Greater North Sea incl. the Kattegat	Denmark	KIMO (P18)
NEA	Bay of Biscay and the Iberian Coast	Spain*	Cefas (P3 and TSG10)
Med	Western Mediterranean Sea	France	MerTerre (P7)
Med	Western Mediterranean Sea, and Adriatic Sea	Italy	Prov. Ter (P1)
Med	Adriatic Sea	Slovenia	RRC Koper (P8)
Med	Aegean-Levantine Sea	Cyprus	ISOTECH (P12)
Med	Ionian Sea and the Central Mediterranean Sea, and Aegean-Levantine Sea	Greece	MIO-ECSDE (P16)
Med	Aegean-Levantine Sea	Turkey	TUDAV (P17)

Table 6.1. MSFD regions and contributions to T1.1 national survey by partner

This project has received funding from the European Union's Seventh Framework Programme (FP7 2007-2013) under grant agreement n° 289042.

Region	MSFD region	Country	MARLISCO partner and/or T1.1 contributor
Baltic	Baltic Sea	Denmark	KIMO (P18)
Baltic	Baltic Sea	Germany	Kusten Union (P11), Cefas (P3 & TSG10)
Baltic	Baltic Sea	Sweden*	Cefas (P3 & TGS10)
Baltic	Baltic Sea	Poland*	Cefas (P3 & TG10)
Black Sea	Black Sea	Bulgaria	UBBSLA (P13)
Black Sea	Black Sea	Romania	Mare Nostrum (P10)
Black Sea	Black Sea	Turkey	TUDAV (P17)

Some of the challenges found while conducting task 1.1 national survey were as follows:

- The timing of national assessments under the MSFD overlapped with the deliverable time line of this project, so MARLISCO could not count on the availability of results from ongoing assessments.
- Information that Member States provided under the MSFD was rather limited or not available during the period T1.1 survey was conducted.
- In many cases information used for national initial assessments to address MSFD or regional assessments requests was not considered fully representative of the current state of understanding of distribution, trends and sources.
- Analysis of the returns has shown a large disparity in the apparent availability of data and information.
- There were insufficient, similar data from adjacent countries to provide GIS-based maps of distribution.
- There were very few returns describing specific sources.
- While some countries found the exercise useful others found it too demanding and complex, needing more time and effort to access to all relevant information and clarify issues on availability of information and data.

A summary of the national surveys outcome is presented in Table 6.2. It provides an overview of marine litter surveys activities at a national level for each MSFD region that exist as part of official monitoring, NGOs or local authorities, or R&D activities, indicating the environmental compartments included. It also provides a note reference number to follow specific detail on the national surveys for marine litter. Annexes provide further details on such surveys and points of contact.

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Table 6.2 National marine litter survey activities in the marine environment compartments by MSFD regions

			Compartments					Type of Survey Activity			
Region	MSFD region	Country	Beach/ shoreline	Seafloor	Water	Biota/ Impacts	Microlitter	Monitoring	NGOs or Local Authorities	R&D	Note reference
NEA	Greater North Sea incl. the Kattegat	Denmark	X	X	X	X	X	X	X	X	1
NEA	Greater North Sea	Netherlands	X	X	X	X	X	X	X	X	2
NEA	Greater North Sea	Belgium	X	X	X	X	X	X	X	X	3
NEA	Greater North Sea	Germany	X	X	X	X	X	X	X	X	4
NEA	Greater North Sea inc. the English Channel; and Celtic Seas	UK	X	X	X	X	X	X	X	X	5
NEA	Celtic Seas	Ireland	X	X				X	X		6
NEA	Bay of Biscay and the Iberian Coast; and Greater North Sea inc. English Channel	France	X	X	X	X	X	X	X	X	7
NEA	Bay of Biscay and the Iberian Coast	Portugal	X	X	X	X	X	X	X	X	8
NEA	Bay of Biscay and the Iberian Coast	Spain	X					X	X		9
Med	Western Mediterranean Sea	France	X	X	X	X	X	X	X	X	10
Med	Western Mediterranean Sea, and Adriatic Sea	Italy	X	X	X	X		X	X		11

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			Compartments					Type of Survey Activity			
Region	MSFD region	Country	Beach/ shoreline	Seafloor	Water	Biota/ Impacts	Microlitter	Monitoring	NGOs or Local Authorities	R&D	Note reference
Med	Ionian Sea and the Central Mediterranean Sea, and Aegean-Levantine Sea	Greece	X	X	X	X			X	X	12
Med	Adriatic Sea	Slovenia	X		X	X		X		X	13
Med	Aegean-Levantine Sea	Cyprus	X						X	X	14
Med	Aegean-Levantine Sea	Turkey		X	X					X	15
Baltic	Baltic Sea	Denmark	X	X				X	X	X	16
Baltic	Baltic Sea	Germany	X	X	X		X	X			17
Baltic	Baltic Sea	Sweden	X	X			X		X	X	18
Baltic	Baltic Sea	Poland				X			X		19
Black Sea	Black Sea	Bulgaria	X						X		20
Black Sea	Black Sea	Romania	X						X		21
Black Sea	Black Sea	Turkey	X	X	X					X	22

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Notes for Table 6.2

North-East Atlantic Ocean

1, Denmark (Greater North Sea incl. the Kattegat): Monitoring marine litter using surveys for all components (beach/shoreline, water column, sea floor, and biota/impacts) and microlitter (Danish Ministry of the Environment, Nature Agency). NGOs or local authorities' activities include surveys in shoreline (coastal municipalities, and Danish harbours), in water (Fishing for Litter). R&D activities include surveys in biota for impacts as Fulmars through EU project INTERREG as part of the wider North Sea survey, and surveys in water for the Nordic waters with special emphasis in microlitter by Aarhus University.

2, Netherlands (Greater North Sea): Monitoring marine litter surveys exist for all marine compartments (beach/shoreline, water column, sea floor, and biota/impacts) and microlitter (Dutch Ministry of Infrastructure and the Environment). NGO surveys include beach surveys by 'Coastwatch' and at shoreline by River Litter Foundation, Fishing for Litter in seabed mainly. R&D surveys include all components, being also the initiators of Fulmar surveys for impacts in biota (IMARES) and involving all countries in the NEA OSPAR region.

3, Belgium (Greater North Sea): Monitoring marine litter surveys include beach OSPAR surveys, as well as water and seabed, and impacts surveys. R&D activities include surveys for all compartments and microlitter (University of Gent). NGOs activities include beach/shoreline surveys (Coastwatch).

4, Germany (Greater North Sea): Monitoring marine litter surveys include all compartments and microlitter (UBA, the German Federal Environment Agency). R&D surveys also include all compartments and microlitter by research institutes, universities and consultancies.

5, UK (Greater North Sea incl. English Channel, and Celtic Seas): Monitoring marine litter surveys exist for all marine compartments (beach/shoreline, water column, sea floor, and biota/impacts) and microlitter (by Defra and devolved administrations). Beach survey monitoring and clean up campaigns is done by the NGO Marine Society Conservation (MSC), and in Northern Ireland by the NGO Tidy up Northern Ireland. R&D surveys include all marine compartments and microplastics (Defra, Cefas, and UoP).

6, Ireland (Celtic Seas): Monitoring marine litter OSPAR surveys include beach and seabed compartments (Marine Institute). NGOs or local authorities' activities include surveys in the shoreline (Coast watch and Clean coast).

7, France (Bay of Biscay and the Iberian Coast; and Greater North Sea inc. English Channel): Monitoring marine litter surveys include all marine compartments (beach/shoreline, water column, sea floor, and biota/impacts) and microlitter (Cedre). In addition seabed monitoring programme is undertaken by IFREMER. NGOs or local authorities' activities include a wide range of surveys from beach/shoreline, water column and impacts (CCRM). R&D activities include surveys in all compartments and microplastics (IFREMER, and Universities).

8, Portugal (Bay of Biscay and the Iberian Coast): Monitoring marine litter OSPAR surveys for beach. NGOs or local authorities' activities include surveys on beach/shoreline and biota. R&D activities include surveys on beach/ shoreline, water, seabed, and impacts on Biota (FCT, Madeira University, and Madeira whale museum)

9, Spain (Bay of Biscay and the Iberian Coast): Monitoring marine litter surveys included beach as part of the OSPAR pilot project (IEO), and NGOs activities continue with beach/shoreline surveys (Ollalomar, Azterkosta, SEO).

Mediterranean Sea

10, France (Western Med.): Monitoring marine litter using surveys for all components and for microlitter (Cedre). In addition, beach surveys (MedTerre) in collaboration with NGOs or local authorities (Surfrider). R&D activities include surveys on biota for impacts (RTMMF, CRMM).

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11, Italy (Western Med. and Adriatic Sea): Monitoring marine litter survey include seabed surveys in the Adriatic and North Tyrrhenian Sea, and surveys for impacts in biota on stranded sea turtles and marine mammals in Italian coast (Italian Ministry of the Environment, and recovery centers). NGOs or local authorities' activities include surveys on beach/shoreline, water, seabed (GIONHA and CIMA).

12, Greece (Central Med., Ionian Sea, and Aegean-Levantine Sea): Marine litter surveys include beach/shoreline and water surveys as part of NGOs activities (HELMEPA, MESDOS, MIO-ESDE). R&D activities also include surveys in seabed and biota for impacts (Helenic Research foundation, University of Athens, and University of Patras).

13, Slovenia (Adriatic Sea): Monitoring marine litter surveys include beach/shoreline and water compartments (Ministry of The Environment and Spatial Planning, Republic of Slovenia).

14, Cyprus (Aegean-Levantine Sea): Marine litter surveys include beach/shoreline surveys as part of R&D activities (ISOTECH), and as part of NGOs or local authorities' activities (AKTI, 'Seabed Cleaner', or Limassol Municipality.

15, Turkey (Aegean Sea): Marine litter surveys include seabed and water surveys as part of R&D activities (TUDAV - Turkish Marine Science Foundation).

Baltic Sea

16, Denmark (Baltic Sea): Monitoring marine litter surveys include beach/shoreline and seabed compartments (Danish Nature Agency). NGOs activities include beach surveys (Keep Denmark Clean, WWF, Ocean Conservancy), and R&D activities also include seabed surveys (Danish Ministry of Nature and DTU Aqua).

17, Germany (Baltic Sea): Monitoring marine litter includes surveys for beach/shoreline, water, seabed, and for microlitter (UBA), and as part of NGOs activities beach/shoreline surveys (NABU)

18, Sweden (Baltic Sea): Marine litter surveys include beach/shoreline compartments as part of NGOs activities (Keep Sweden Tidy, WWF and Ocean Conservancy). R&D activities include surveys on seabed, and for microplastics (N-research and KIMO Sweden)

19, Poland (Baltic Sea): Marine litter surveys include water and seabed compartment as part of NGOs activities (WWF Poland- collecting Ghost nets)

Black Sea

20, Bulgaria (Black Sea): Marine litter surveys include the beach/shoreline compartment as part of NGOs or local authorities (UBBSLA).

21, Romania (Black Sea): Marine litter surveys include the beach/shoreline compartment as part of NGOs or local authorities (Mare Nostrum, 'Lets do it Romania' - World Clean up).

22, Turkey (Black Sea): Marine litter surveys include the beach/shoreline and seafloor compartments as part of R&D activities (Turkish Marine Research Foundation, and Karadeniz Technical University).

In the NE Atlantic official monitoring programmes include surveys for all environmental compartments with only a few exceptions (such as Ireland, Portugal, and Spain). In the case of Portugal, R&D and NGOs activities include surveys in environmental compartments that are not included under the monitoring programmes. In the Baltic, official monitoring programmes do not include all the environmental compartments, but R&D and NGOs activities include surveys in most of the remaining compartments.

In the Mediterranean, only France includes all the environmental compartments under their official monitoring programmes. NGOs/Local authorities and R&D activities include also surveys for beach and biota in France. In

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Italy, official monitoring include surveys in seabed and in biota, with additional contributions from NGOs, and local authorities for water, seabed, and beach surveys. In other countries of the Mediterranean, survey activities are mostly included as part of NGOs/local authorities and at some extent under R&D activities. In the Black Sea, Bulgaria and Romania NGOs activities include beech litter surveys.

6.2 Mapping outputs

A mapping output has been also generated by Cefas under WP1 to display in the Marlisco Webportal (http://dev.marlisco.eu/) to show summarised information on marine litter survey activities from official monitoring, NGOs and local authorities, and R&D activities. The mapping output will be incorporated into the Marlisco Webportal as part of WP3 implementation. It has been built to offer options for selection to view national and regional information in a geographical context providing details on the type of surveys and environmental components for marine litter that are listed in the Annexes. The mapping output also contains information on specific links to find sources of data or detailed information as well as providing relevant points of contact.

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7 FUTURE STEPS AND POTENTIAL SOLUTIONS

7.1 Global perspective

It is apparent that the reduction of marine litter is linked to the effectiveness of overall waste management and the effectiveness of existing legal and non-legal mechanisms regulating or otherwise influencing human activities that result in marine litter. These aspects are examined in more detail in report D1.3 'Review of existing policies that directly or indirectly may be applied to mitigate the impact, and identify potential policy gaps' (Kershaw et al 2013).

From the perspective of MARLISCO it is important to recognise that there is no single solution to the problem of marine litter; it cannot simply be achieved by replacing plastic bags with paper ones or by introducing biodegradable polymers. The problems are broad and require a range of measures applied along the entire supply chain. In addition it is essential to recognise that solutions are context specific and will vary between regions within the EU according to material use, behaviour, waste management practices and infrastructure. Hence to be effective it is essential that measures are considered, developed, implemented and their effectiveness monitored on a regional basis. Steps to reduce the accumulation of marine litter have recently been discussed in STAP (2011) and a summary of this discussion is given below.

A key challenge in addressing the problems associated with accumulation of litter in the ocean is in broadening the range of available management measures beyond improvement in waste management practices (DG Environment 2011; UNEP 2009). At present these are predominantly 'end of pipe' responses, rather than preventative. The most commonly used approaches vary regionally, but include notices about the problems of dumping and littering, improved reuse, recycling and recovery (under strictly controlled conditions) provision of litter bins on beaches, port reception for waste from ships, and extensive clean-up campaigns on shorelines and at sea. Plastics are a major component of marine litter and the plastics industry has undertaken several initiatives to support consumer's education on the end-of-life of products and recycling programs as a solution (see for example http://marinedebrissolutions.com/), but such measures are more relevant to highly developed nations with sufficient economic resources. It is becoming increasingly clear that a paradigm shift is required in the way we address this global problem. It is important to recognise there is no single solution to the problem of marine litter and that measures to reduce marine litter are context specific, varying regionally and possibly also over time (e.g. seasonally). As part of the MARLISCO project various examples of best practice have been reviewed and summarised (these will be presented in a guide "Analysis of the Processes and Solutions of the 72 Best Practice Examples" and on the MARLISCO webportal). The DG ENV Pilot projects '4 Seas', 'Antilitter Instruments: Feasibility study of instruments to prevent littering', and 'Plastics Packaging Loopholes' propose a mixture of measures to improve marine litter issues from different perspectives targetting important materials and sources of litter, and they identify individual behaviour, people's attitude and perspective as major influencial factors.

From a life-cycle perspective, the linear use of resources from production to a short-lived single-use stage to disposal is a central underlying cause of the accumulation of waste (Thompson *et al*. 2009b; WRAP 2006). Recognition that marine debris is not merely a waste management issue is fundamental to addressing the underlying causes of marine litter. As such, addressing the marine litter problem through a complete life-cycle approach is one of the potential testing grounds for the green economy and the circular economy (European Commission 2012). These promote approaches using fewer resources per unit of economic output, reducing environmental impact of any resources that are used or economic activities that are undertaken, designing products that are durable and repairable, and re-using material from products at the end of their lifetime. Applied to plastics, for example this means promoting structural economic changes that would reduce plastics consumption, increase production of environmentally friendlier materials, increase recycling and reuse, promote investments in alternative conversion technologies and new materials and products, and support an enabling environment including capacity building, new regulations and standards (Thompson *et al.* 2009b). Such benefits can only be realized working in partnership with industry. The benefits of collaboration with the private sector are recognized by both the Congressionally mandated US Commission on Ocean Policy (US Commission on Ocean Policy 2004), and industry (APR 2011) and acknowledged within the European Union (DG Environment 2011).

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A solutions based framework to the problems of marine litter has recently been introduced (STAP 2011) and is focused on plastic debris. This framework is illustrated below indicating the relevant stakeholder dialogue and facilitation linking industry, society and policy in order to achieve solutions (Figure 7.1) and discussed more fully in STAP (2011).

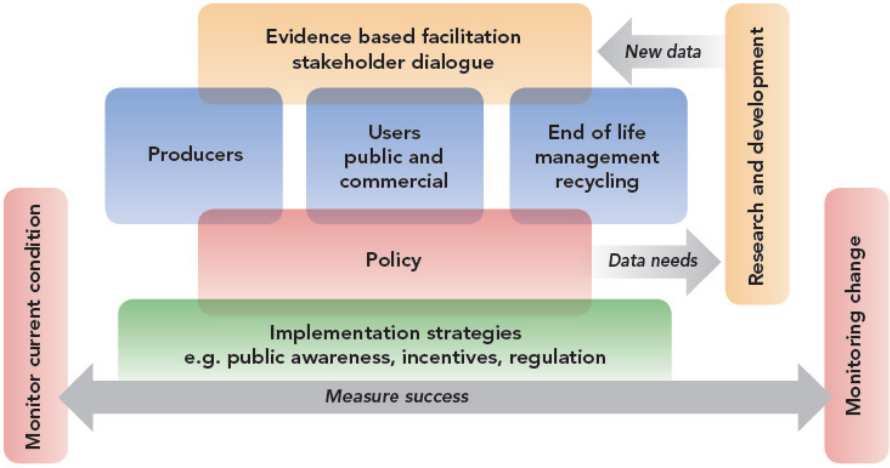

Figure 7.1 A framework describing key stages to tackle specific marine debris priorities on a regional basis.

The combination of strategies outlined in the STAP publication include: the three R's – *reduce, reuse, recycle* are widely advocated to reduce the quantities of waste and especially plastics packaging waste (Figure 7.2 a-c). To be effective, it will be essential to consider the interconnectivity between these approaches together with a fourth 'R', *redesign*. This includes both molecular redesign via green chemistry approaches, as well as product redesign with greater resource efficiency and environmental sustainability as an emerging and potentially very important strategy. For items that cannot be designed for re-use or recycling, a fifth R *energy recovery* can be considered. Hence, the three R's become five: 'reduce, reuse, recycle, redesign and recover' (Examples of all of these approaches are expanded in relation to marine litter in STAP 2011).

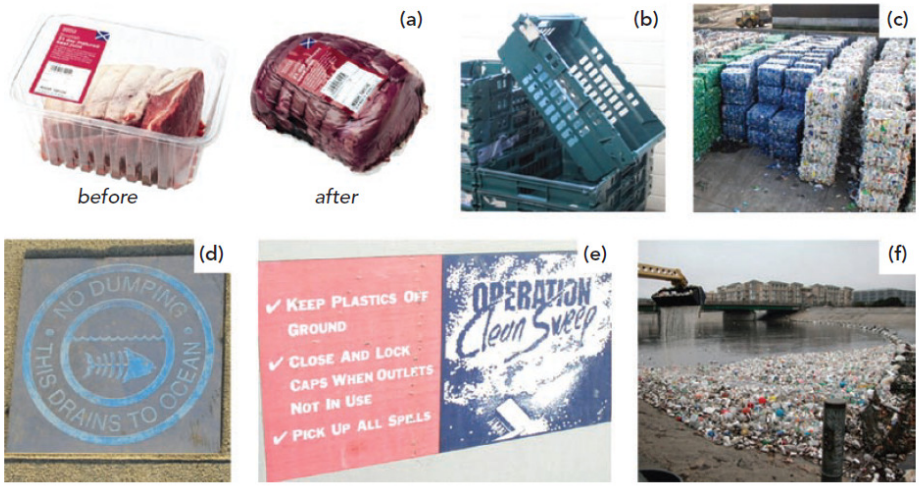

Figure 7.2 Solutions to marine litter include: (a) measures to reduce the production of new plastics from oil, here an example showing how small changes in product packing reduced the weight of packaging required by 70% while (b)

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re-useable plastic packing crates have reduced the packaging consumption of the same retailer by an estimated 30,000 tonnes per annum; (c) recycling, here bales of used plastic bottles have been sorted prior to recycling into new items, such as plastic packaging or textiles. Measures to reduce the quantity of plastic debris in the natural environment include: (d) educational signage to reduce contamination via storm drains and (e) via industrial spillage together with (f) booms to intercept and facilitate the removal of riverine debris (photographs a and b, and associated usage statistics) courtesy of Marks and Spencer PLC; (c) courtesy of P. Davidson, WRAP; (d and e and f) courtesy of C. Moore, Algalita Marine Research Foundation) (Source: Thompson et al. 2009a)

7.2 EC-sponsored initiatives

The EC has been very active in seeking solutions to the reduction in marine litter, supported by the development and implementation of the MSFD, but also recognising that several existing European and International policies and legal instruments are directly of indirectly relevant. These are summarised in a separate MARLSCO report (D1.3, Kershaw et al., 2013) and were the subject of a Commission Staff Briefing Paper published in October 2012 (EC SWD(2012) 365). The latter concluded that: '*There is a lack of knowledge on the amounts, sources pathways and distribution trends and impacts of marine litter, due to limited systematic regional measurements*.'

The report referred to three Pilot Projects which were commissioned by DGENV on various aspects of marine litter. The results of the three related projects have been integrated and are available to download (http://ec.europa.eu/environment/marine/pdf/Integration%20of%20results%20from%20three%20Marine%20Litter%20Studies.pdf).The integrated report noted that there were significant regional differences in the sources, types and quantities of litter. The authors noted that factors affecting behaviour also varied and tended to be specific to particular contexts. They concluded that these differences meant that it would be difficult to recommend a single set of measures that were equally applicable and would be cost-effective throughout the EU. From an examination of published information, and from the survey based on national partners, the authors of the present MARLISCO report would broadly concur with many of the findings from the Pilot Studies, whilst being cautious about conclusions based on some of the methods and data used in the DGENV-funded studies.

7.3 Marine litter as a wicked problem

The concept of 'wicked 'problems was initiated in the 1970s, mainly in an urban planning context (Rittel & Webber, 1973). Since then there has been a recognition that the concept has a much wider application, including for environmental management, and the approach has been further extended to produce a range of tools and terminology (Horn & Webber, 2007). The nature of the complex issues surrounding the aspiration to reduce of marine litter justifies the label of a 'wicked' problem.

'Wicked' problems can be characterised by:

- Having many social and ecological interconnections,
- Having multiple actors and perspectives,
- Having the potential for unintended consequences from any actions,
- Being constrained (political, cultural/social, economic, time),
- Having many uncertainties
- Capable of multiple partial 'solutions', none of which with of itself solves the issue.

In contrast the solution to a 'tame' problem (Conklin, 2008) will tend to follow a linear path, characterised by:

- Having a well-defined and stable problem description;
- Having a well-defined stopping point, when the 'solution' is reached;
- Having a solution that can be objectively evaluated as correct or incorrect;
- Belonging to a class of similar problems which can be solved in a similar manner.

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8 BASIC TYPES OF MARINE LITTER SURVEYS:

8.1 *'Facts & Figures'*

Information on the quantities of plastic in the marine environment, and on the potential for this debris to cause harm to humans and wildlife is complex and will vary in time and space. Some statements about quantities of debris and effects that are currently in circulation (via media, websites, etc) are misleading, and not supported by published scientific evidence. Unfortunately, this tendency to keep myths in circulation, and give them apparent credibility, extends to the website set up by the EC to describe Descriptor 10 under the MSFD (http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm). Several of the 'Facts & Figures' as presented on the EC website are not supported by reliable peer-reviewed evidence and are very misleading. For a more nuanced description of the issue we refer readers to the excellent work of the NOAA Marine Debris Programme (http://marinedebris.noaa.gov/info/faqs.html#3).

A request was made by the Advisory Board for WP1 to provide a definitive list of reliable 'Facts & Figures'. The desire for more certainty is understandable, as it is preferable to base decisions on a strong evidence base. Unfortunately, this desire is based on a false premise that the required information exists. What we can state for certain is:

- there are many different sources of litter, both from land-base and sea-based activities;
- there is very little information on the *quantities* of litter entering the ocean from any of these sources individually or collectively;
- there is evidence that the relative importance of different sources varies over a range of space- and time-scales, according to human population distribution, land-use, coastal tourism, cultural practises, distribution of fisheries and aquaculture, intensity of shipping, ocean circulation and wind patterns, seasonal/inter-year variations in human pressures and natural processes ;
- there is no reliable basis for assuming 80% of litter originates from land ;
- many of the conclusions about sources, categories and quantities of litter entering the ocean originates from beach litter surveys. Although these data are very useful, this tends to overshadow the relative lack of information of quantities, categories and sources of litter in the water column and on the seabed for most of the territories of EU Member States ;
- significant ambiguity can be introduced by a lack of attention to the methods used for sampling and analysis. For example, beach surveys usually quote number of items (with cigarette ends often most numerous) but this is not easy to compare with a large fishing net weighing many kg in terms of the potential for social, economic or ecological harm (see also comment below on comparing plankton and plastic abundance).

8.2 *Popular misconceptions*

It is apparent from reports in the media, and from conversations with people from many walks of life, that there is widespread misunderstanding about the nature of the marine litter issue and the extent to which it is perceived as a 'problem' which someone should be doing something to prevent and reduce. We thought it worth providing answers to some examples of popular misconceptions relating to marine litter.

There is an island of marine litter the size of Texas in the Pacific Ocean created by a gyre

This statement is very inaccurate. Firstly, there is not an island of litter in the sense that most of us would recognise an island, that is to say there is not a solid mass that one could walk on or that would support terrestrial plants and animals. There are certainly substantial accumulations of marine litter at the centre of oceanic gyres where ocean currents converge and lead to accumulation of buoyant items (Goldstein et al. 2012; Law et al. 2010). However it is difficult to give a meaningful estimate of size since in reality there is litter in most locations in the ocean, it becomes concentrated in gyres but it is difficult to define the boundaries. So gyres are concentrations of litter that represent part of a continuum of density within the ocean. This concept is illustrated

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in sampling data from the North Atlantic and Caribbean from 1986 to 2008 (Figure 8.1) which finds the highest concentrations (> 200 000 pieces per square kilometre) occurred in the convergence zones far from land, but drawing a boundary on this patch would be problematic (Law et al. 2010) unless it were done on the basis of a boundary delineating a particular concentration of debris in the water.

Some parts of the ocean are like a plastic soup

The gyres described above have given rise to the widespread use of terms like 'plastic soup', 'garbage patch' and 'ocean landfill' (Kershaw et al., 2011). Much of the plastic debris in the ocean consists of fragments that are very small in size, but the terms above are misleading and not particularly helpful as descriptors of the problem. The size of these areas is impossible to define since they represent part of a gradient in the quantities of litter. Since litter is found in a range of marine habitats (seabed, sea surface, and shoreline) worldwide, it is not appropriate to define the spatial scale of contamination unless this is done in parallel with information on relative abundance (see Figure 8.1).

Plastic litter releases toxic chemicals to wildlife

Some plastics contain additive chemicals incorporated during manufacture to achieve specific functionality in the products they are used to make. These include flame retardants, plasticisers and anti-microbial agents (Andrady & Neal 2009). While these chemicals are *potentially* harmful they would not be expected to present a hazard in an intact item of plastic. However, there is concern that as plastics degrade and fragment chemicals may be released to surrounding water bodies or to organisms that ingest plastic (Oehlmann et al. 2009; Teuten et al. 2009). For example, there is evidence that water leaching from landfill sites is contaminated with these chemicals and could reach concentrations that are harmful to aquatic organisms. There is also evidence that some marine organisms contain chemicals that are used in plastics (Fossi et al. 2012; Tanaka et al. 2013). However, it is not clear how these organisms have acquired the chemicals and as yet there is no evidence to confirm the extent of harm by release of chemicals from plastic debris in the ocean that plastic debris in the ocean, or when ingested, will release chemicals in sufficient concentrations to cause harm.

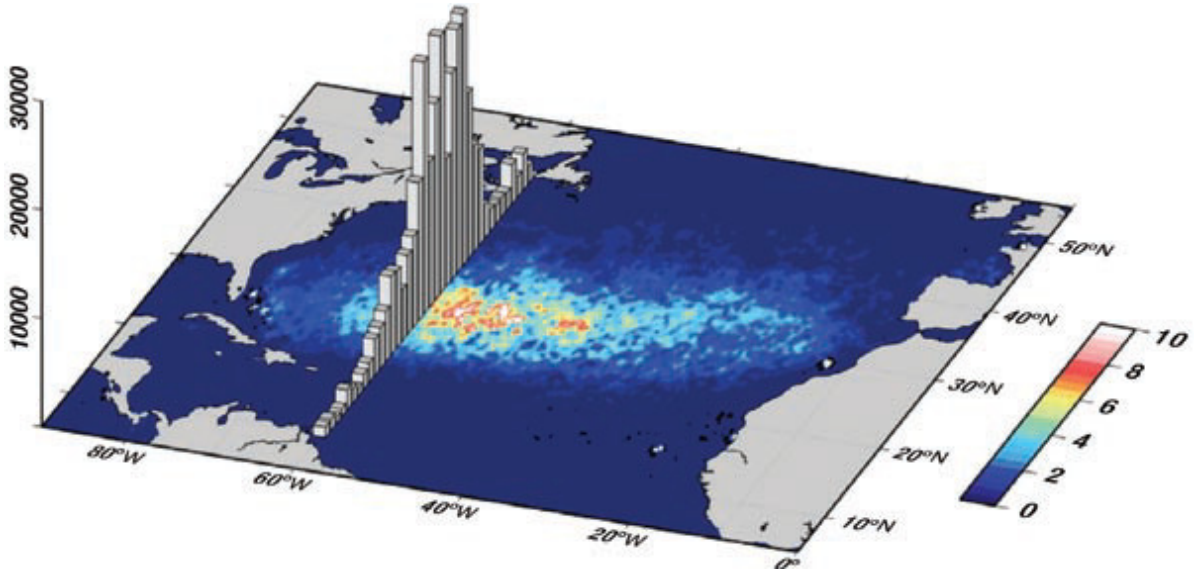

Figure 8.1 Average plastic concentration as a function of latitude (bars, units of pieces km-2), and modelled concentration (colour shading), of initially homogeneous surface tracer after 10-year model integration. The highest plastic concentrations were observed in subtropical latitudes (22-38°N) where model tracer concentration is also a maximum (see Law et al. 2010 for details).

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Plastic debris acts like a sponge mopping up harmful chemicals from the ocean

In addition to chemicals incorporated during manufacture it has been shown that plastic debris can absorb and concentrate contaminants such as persistent organic pollutants (POPs) from the water column and there is concern that these chemicals *could* be released to organisms that ingest plastic (Teuten 2007, 2009; Mato, 2001). While pops are potentially harmful there is no evidence to confirm that plastics transport POPs to organisms in sufficient quantities to cause harm (Gouin, 2011; Koelmans et al. 2013)

There is more plastic in the oceans that there is Plankton

Survey trawls have confirmed there are substantial quantities of plastic in the Pacific Gyre (Goldstein et al. 2012; Law et al. 2010). Plastic debris is frequently collected from surface waters using the same kind of nets as those used to collect plankton and sometimes it is collected and counted as part of routine plankton sampling. Hence some authors have used this paired data to make comparisons between the quantity of plastic and the quantity of plankton. This can help illustrate the quantity of debris in the oceans with some reports indicating five times more plastic than plankton (Moore et al. 2001). However, the statistics can be misleading. This is because planktonic organisms contain a lot of water and comparisons are made as dry weight. Hence substantial quantities of plankton can actually have very little mass when expressed as dry weight. By comparison plastic loses little weight as a consequence of drying. A more fundamental problem occurs when one tries to use the plastic to plankton ratio as an index of pollution; this is flawed because quantities of plankton vary substantially in time (for example seasonally) and in space between regions. So a high ratio of plastic to plankton could result from either their being a lot of plastic or there being very few planktonic organisms, or some combination of the two. Hence this is not a reliable index of contamination.

The solution to the problem of marine debris is to make all plastics biodegradable

Plastics have an important role in helping to reduce the human footprint on the planet. They are inexpensive, lightweight and versatile materials that can be used for a wide range of applications. In addition most plastics are very durable, this is an important asset when in service as packaging, as components in cars and aeroplanes and items in construction etc. However the longevity of plastics compared to many natural materials creates a problem for end of life disposal and is a major factor when considering the accumulation of plastic debris in the oceans. So at first inspection making polymers that degrade or biodegrade might seem like a good answer. However, it will be virtually impossible to design products which are stable and durable in every day usage but that will breakdown harmlessly and rapidly in a range of natural environments the moment the product ceases its useful life.

Redesign of plastics for biodegradability and compostability is underway and does show reduction potential for some selected applications (European Commission, 2011). The market penetration of such plastics is however still very small – 0.1 – 0.2 % of plastics in the European Union, according to the European Commission – and '*there is debate as to whether they actually degrade in natural habitats*' and '*also doubt as to whether they will degrade in the marine environment where heat and pressure conditions are significantly different*' (European Commission 2012; Song et al. 2009; O'Brine & Thompson, 2010). It is essential that new material that are intended to have enhanced environmental performance are fully tested from a life cycle perspective before they are released onto the market. The dangers of not doing so are already apparent from industry-centred responses such as development of 'oxo-degradable' plastic products which merely fragment at the end of their life time into numerous small but essentially no-degradable pieces, the environmental impact of which is not yet known (Roy et al. 2011). Finally it is important to recognise that recyclers are very wary about degradable plastics, as they are effectively a contaminant in conventional mixed plastics recyclable streams. More research is needed to assess the impact on both marine environments and on waste and recycling infrastructure before such degradable and bio-degradable plastics can be viewed as contributing to the reduction of marine debris.

So while degradable polymers offer some solutions in very specific applications they are unlikely to provide the scale of opportunity needed to resolve the problems of marine litter. Indeed they compromise the potential for end-of-life recycling, and it is turning end of-life items into new ones that offers the greatest potential to divert waste form the natural environment and waste streams in to new production via the concepts of a circular economy.

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Marine litter should not be prioritized – there are more important Environmental problems.
With many of the challenges facing the marine environment at the start of the 21st century there is a direct link between the requirements of the ever increasing, and from a per capita perspective ever demanding, human population and the associated impacts on the environment. However, in the views of the authors, the societal benefits that arise from many of the items that become marine litter could largely be realised without litter ending up in the oceans. It is increasingly being recognised by industry, academia, civil society and policymakers that to reduce the rate of accumulation of litter in the environment will require actions along the supply chain, by changing industrial production practices, waste management and individuals' behaviour (APR 2011; DG-Environment 2011a; DG-Environment 2011b; US-Commission-on-Ocean-Policy 2004). Such changes are embodied in the philosophy of a circular economy where end of life materials are recognised as potentially valuable raw materials rather than waste (McDonough & Braungart 2002). Such considerations are central to the aims of the EU Marine Strategy Framework Directive (MSFD) (Galgani et al. 2010) and the development and implementation of the Europe 2020 Strategy to promote Smart, Sustainable and Inclusive growth (European Commission 2012).

Marine litter is someone else's problem
There is a perception that litter comes from 'somewhere else', and that it is someone else producing the waste there it is not my responsibility. Within MARLISCO we would argue that because all of society uses and relies upon the items that become marine litter, it is everyone's problem and therefore we all need to make a contribution to reduce marine litter.

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9 CONCLUSIONS & RECOMMENDATIONS

It is evident from this report that Marine litter is widespread in Europe; it is present on shorelines, at the sea surface and water column and on the seabed. The litter is composed of various material types and shapes and it originates from a variety sources. However, it is apparent that plastic items present by far the most substantial category. Rope, netting and items of plastic packaging are particularly abundant. There are regional differences with for example cigarette butts being more common in the Mediterranean than elsewhere in Europe. This litter presents problems for wildlife including threats to endangered species and commercially important species. Marine litter also has a negative impact on our economy with losses to fishing, shipping, even agriculture and tourism as well as concerns for human health and safety.

Data on the abundance and types of debris are not sufficient to make robust regional comparisons. There is a chronic lack of data for some environmental compartments in particular the seafloor and to a lesser extent the sea surface. Data from shorelines are more abundant but lack consistency in monitoring approaches. Hence it is apparent that more regular and harmonised monitoring will be required in order to detect changes in relation to policy measures implemented for example in response to MSFD.

From the perspective of reducing inputs of litter to European seas it is apparent there is a need for greater enforcement of existing legislation and increased infrastructure to handle and manage waste. There is also a need for a substantive change in the way we use resources and produce waste and it is essential that as we move forward there is much greater focus on a circular economy where end-of-life materials are seen as inputs to new production rather that waste that creates a major disposal problem even in legitimate waste management or incineration facilities and also has considerable potential to accumulate in the natural environment.

There are many myths and preconceptions about marine litter, and these tend to be spread and given false authenticity by repeated use on websites and in the popular media, including some of the EC's own information sources. Those seeking solutions to this problem should appreciate that it is highly complex and no one 'solution' will be able to bring about the desired change in the situation. It should also be recognised that there are many actors with sometimes conflicting aspirations and different degrees of knowledge and insight. This can be classified as a 'wicked' problem and the approaches pioneered in engineering and the social sciences should be considered as an important component of a measured and adaptive management response.

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ANNEXES

Annex1_National Survey Activities in the NE Atlantic

Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
UK	Monitoring	All	Marine litter is monitored in the UK for all components, and is reported to OSPAR Commission for protecting and conserving the North-East Atlantic and its resources. Defra and the Devolved Administrations are committed to gaining a better understanding of issues relating to marine litter and are engaged in a number of projects and initiatives to support this objective.	OSPAR Commission 2010. Quality Status Report. Chapter 9. http://qsr2010.ospar.org/en/ch09_12.html	Department for Environment, Food and Rural Affairs (Defra), www.defra.gov.uk, Marine Scotland, www.scotland.gov.uk, *Environment Dept, North Ireland Executive,* www.northernireland.gov.uk, *and Wales government,* www.wales.gov.uk
UK	Monitoring	Seafloor	Monitoring programmes IBTS (International Bottom Trawl Surveys) and CSEMP (Clean Seas Environmental Monitoring programme) have collected macro litter on the seafloor since 1992 in the UK.	OSPAR Commission 2010. Quality Status Report. Chapter 9. http://qsr2010.ospar.org/en/ch09_12.html	Defra www.defra.gov.uk, and devolved administrations (as above), Cefas
UK	Monitoring	Impacts in Biota	Surveys for plastic particles in seabird stomachs are collected in UK (except North Ireland)as part of the Fullmar EcoQO project led by Netherlands	http://qsr2010.ospar.org/media/assessments/p00406_supplements/p00406_suppl_9_plastic_particles.pdf	Defra` www.defra.gov.uk, IMARES, Jan.vanfraneker@wur.nl
UK	Monitoring	Beach/ shoreline	OSPAR beach litter monitoring programme in England, Scotland and Wales by the Marine Conservation Society (MCS) for over the last 10 years. In Northern Ireland Tidy Northern Ireland have begun to collect litter for the OSPAR programme.	http://qsr2010.ospar.org/media/assessments/p00386_Marine_Litter_in_the_North-East_Atlantic_with_addendum.pdf	Defra www.defra.gov.uk MSC, Tidy Northern Ireland
UK	NGOs/ Local authorities	Beach/ shoreline	Marine Conservation Society (MCS) carries out Beachwatch surveys around the UK. The MCS monitor over 300 beaches annually and on a voluntary basis. The also survey the 12 UK OSPAR beaches 4 times a year. In Northern Ireland Tidy Northern Ireland have begun to collect litter for the OSPAR programme.	http://www.mcsuk.org/beachwatch/	Marine Conservation Society, www.mcsuk.org. info@mcsuk.org tel. 01989 566017. *Tidy Northern Ireland, www.tidynorthernireland.org*

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
UK	NGOs/ Local authorities	Seabed and Water	Fishing for Litter surveys at different sites around the UK	http://www.kimointernational.org/FishingforLitter.aspx	KIMO UK Co-ordinator, Tom Piper KIMO UK, c/o Aberdeenshire Council, Aboyne Area Office, Bellwood Road, Aboyne AB34 5HG, Email: tom.piper@kimo.shetland.org
UK	R&D	Microlitter	Cefas has collected microplastics with a Manta trawl during a one off survey in 2011.		Cefas, thomas.maes@cefas.co.uk
UK	R&D	Microlitter	Plastics in the Marine Environment- research projects at University of Plymouth	http://www1.plymouth.ac.uk/research/mberc/Research/Marine%20pollution/Pages/Plastics.aspx	Richard Thompson, School of Marine Science and Engineering (Faculty of Science and Technology), Davy Building, Drake Circus, Plymouth, Devon, PL4 8AA. Email: R.C.Thompson@plymouth.ac.uk
UK	R&D	water and seafloor	Defra R&D project ME5415 Developing a fit for purpose Marine Litter Monitoring programme. The research will develop a cost effective monitoring programme for determining trends over time in relation to MSFD reporting. Specifically looking at amount and composition of litter in the water column, including floating and suspended litter, and accumulation on the sea floor. Nov 2010 to March 2013.Macro (with an element of cost benefit analysis for micro plastics and manta trawling).		Thomas Maes (Cefas), Cefas, Pakefield Rd, Lowestoft, Suffolk NR330HT

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
UK	R&D	all	Defra R&D project ME5416 Micro plastics and harm. This research aims to establish the extent to which micro plastic debris might cause harm to organisms in the marine environment. The plan of work and the objectives below have been specifically tailored to inform UK policy in relation to the European Union Marine Strategy Framework Directive. The project has five specific objectives: 1. To establish whether plastic micro particles sorb contaminants present in the marine environment, which contaminants are of concern, and are they made bioavailable at levels which may cause significant 'harm' above background concentrations. 2. To establish whether common chemical additives in plastics persist after ageing in the marine environment and whether they are made bioavailable on ingestion and as such have the potential to cause significant 'harm'. 3. To establish whether and how micro plastics are passed on through food web interactions and what the implications are for populations and ecosystems. 4. Research to determine the extent to which the physical presence of micro plastics can cause significant 'harm' and in what quantities. 5. To establish whether new 'biodegradable plastics' differ in their potential 'harm' impacts. Harm micro plastics. April 2011 to March 2014		Dr Richard Thompson, University of Plymouth , Drake Circus , Plymouth Devon ,PL4 8AA
UK	R&D	water	Defra R&D project ME3108, using the CPR to look at spatial and temporal variation in micro plastics. PhD project at UoP to look at spatial and temporal variation in micro plastics using the CPR sampling route. PhD student Saeed Sadri, in his preliminary investigations has looked at waters around the UK including North sea, Irish sea, English channel and the North Atlantic. He focused on a subset of samples recently processed by SAHFOS analysts (2009) which were marked by them as "plastic contaminated". In total he has examined 70 samples from 8 different CPR routes and found 108 synthetic pieces and 35 were conclusively identified as plastic. The most common types being Polyester and Polyethylene terephtalate (PET) comprising 44% of the samples followed by Nylon 22% , Acrylic 11% and Polyethylene 6%. The abundance of plastics for each route was standardised and ranged from 0.005 to 0.08 per cubic meter of water with the northern North Sea showing the highest and the North Atlantic showing the lowest. Harm micro plastics. November 2011 to November 2013.		Dr Richard Thompson and Mr Saeed Sadri, University of Plymouth , Drake Circus , Plymouth Devon, PL4 8AA
UK	R&D	Impacts in Biota	Defra R&D project ME5209 Investigating the presence of plastics in Fulmars. Funding Jan Van Franeker to compile data on UK fulmars; researching the incidence of plastic present in fulmar stomachs. Macro plastics. July 2010 to December 2012		Defra, www.defra.gov.uk, IMARES van Franeker - jan.vanfraneker@wur.nl

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
UK	R&D	water	Defra R&D project MB0111 Cetacean Stranding. Cetacean Stranding project to determine cause of death of cetaceans stranded around the UK coastline. As an element of the project we are looking into whether plastic is found within the stomachs of stranded cetaceans and turtles. Macro. April 2011 to June 2014.		Carole Kelly Defra contact Project run by Institute of Zoology UK, Defra, Smith Square, London, SW1P 3JR
UK	R&D	water	Fishing for Litter in the South West of the UK. To implement a second part of the pilot project to determine the success over time of the programme. Macro 2009 to 2014.		Carly Brooks John Mouat (KIMO), Defra, Smith Square, London, SW1P 3JR
Portugal	Monitoring	Beach/ shoreline	OSPAR Beach surveys. Beach litter monitoring of 66 stretches of 100 meters and 57 stretches of 1 km (for items > 50 cm). Data available corresponds to Iberian Coast, which includes 7 Portuguese beaches plus 2 Spanish beaches). 2002-2006	OSPAR (2007). OSPAR Pilot Project on Monitoring Marine Beach Litter - Monitoring of marine litter in the OSPAR region, OSPAR Commission, Biodiversity Series. OSPAR Pilot project on Monitoring Beach litter. Quality Status Report 2010. http://qsr2010.ospar.org/media/assessments/p00306_Litter_Report.pdf ; http://www.ospar.org/html_documents/ospar/html/marine_litter_unep_ospar.pdf ; http://qsr2010.ospar.org/en/index.html ; www.unep.org/regionalseas/marinelitter	psobral@fct.unl.pt
Portugal	Monitoring	Impacts on Biota	Azores Cetacean Stranding Network (RACA) - Rede de Arrojamento de Cetáceos dos Açores (Azores Cetacean Stranding Network) has registered 6 cases of cetacean interaction with marine litter (5 entangled and 1 case of plastic ingestion). Only 3 of these records correspond to stranding. The other cetaceans were sighted off the coast of Azores.	http://servicos.sram.azores.gov.pt/doit/servicos.asp?id_dep=10&id_form=84	Email: info.dram@azores.gov.pt
Portugal	Monitoring	Water	Madeira Whale Museum Records during sea campaigns for nautical census, Madeira Whale Museum registered the distribution of marine litter in the water surface at Madeira Archipelago.	Madeira Whale Museum – Cetacea in Madeira Arhipelago (book) http://www.emecetus.com/downloads/LivroCetaceosMadeira.pdf,	http://www.museudabaleia.org/ ; Email: geral@museudabaleia.org
Portugal	Monitoring	Impacts on Biota	Madeira Whale Museum Records. Entanglement records at Madeira Whale Museum. Photos of marine life interaction with marine litter in Madeira Archipelago.		Email: geral@museudabaleia.org, Madeira Whale Museum http://www.museudabaleia.org/

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Portugal	NGOs/ Local Authorities	Beach/ shoreline	Santo André beach clean ups. Santo André beach clean ups occur once a year (June) at Santo André beach. Litter is collected and weighted.		Email: rnlsas@icnf.pt
Portugal	NGOs/ Local authorities	Beach/ shoreline	Program of coastal cleaning campaigns in Sesimbra includes several activities performed in different beaches, especially in areas with boat access only. Litter is collected and the bags (100L) counted.		Email:necaflr@gmail.com
Portugal	NGOs/ Local authorities	Beach/ shoreline	Clean up the World. Beach and seabed cleanup that occurs every year at Oeiras. Litter is collected and weighted.		Email: DAE@cm-oeiras.pt
Portugal	NGOs/ Local authorities	Beach/ shoreline	Madeira beach cleanups are regular and organised by municipalities.		Email: thd@uma.pt Dr. Thomas Dellinger (thd@uma.pt) (Madeira University)
Portugal	Local authorities and NGO	Beach/ shoreline	Coastwatch promotes active citizenship in school communities and allows significant coastal monitoring, including marine litter monitoring. In some cases, beach cleanups are associated to the coastwatch monitoring programme.	http://www.coastwatch-coastwatch.blogspot.pt/	Email: coastwatchnacional@gmail.com
Portugal	Local authorities and NGO	Beach/ shoreline	Brigada do Mar Project. Every year, Brigada do Mar perform beach cleanups during several days in May. The litter is collected and the bags counted.	http://brigadadomar.blogspot.pt/	Email: brigadadomar@gmail.com
Portugal	Local authorities and NGO	Impacts on Biota	Coastwatch surveys. Study of mortality of marine fauna at Alcobaça coast. Study of mortality of marine fauna at Alcobaça coast, performed during the Coastwatch Campaign. 2005-2011	Quaresma, S., Alves, S., Fernandes, S. (2012) Mortalidade de fauna marinha no litoral de Alcobaça, Município de Alcobaça. http://www.cm-alcobaca.pt/	Email: SofiaQuaresma@cm-alcobaca.pt
Portugal	Local authorities and NGO	Impacts on Biota	RIAS/ALDEIA survey records - Research and Recovery Center of Wild Animals. This center received animals from Algarve.	http://www.rias-aldeia.blogspot.pt/	Email: rias.aldeia@gmail.com
Portugal	Local authorities and NGO	Impacts on Biota	CRASSA survey records - Recovery Center of Wild animals of Santo André. This center receives animals essentially from southwest coast of Portugal.	http://quercuslitoralalentejano.blogs.sapo.pt/	Email: crassa_quercus@sapo.pt

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Portugal	R&D	Seafloor	Litter in submarine canyons of the west coast of Portugal. Litter abundance and composition were investigated using video footage and still images from 16 Remotely Operated Vehicle (ROV) dives in Lisbon, Setúbal, Cascais and Nazaré Canyons located west of Portugal. Litter was most abundant at sites closest to the coastline and population centres, suggesting the majority of the litter was land sourced. Plastic was the dominant type of debris, followed by fishing gear. Standardised mean abundance was 1100 litter items km−2, but was as high as 6600 litter items km−2 in canyons close to Lisbon. (05/2007-07/2007)	Mordecai, G., Tyler, P.A., Masson, D.G., Huvenne, V., 2011. Litter in submarine canyons of the west coast of Portugal. Deep-Sea Research II 58, 2489-2496. http://www.sciencedirect.com/science/article/pii/S0967064511002153	Email: pat8@noc.soton.ac.uk
Portugal	R&D	Impacts on Biota	Survey of production and dumping of wastes generated by the fishing fleet of the main ports of Madeira Islands on the marine environment. This work fits the wake of the growing concern shown by the international community in relation to the prevention of pollution of the marine environment and the management of waste generated by ships. It is intended to characterize the types of waste generated by fishing vessels of Madeira and understanding the behaviour patterns of the crews of these vessels on the management of waste that they produce during their fishing exits, as well as the existence of means for their proper disposal in the port. (Miranda, E., 2008)		Valter Miranda (madvalter@hotmail.com)
Portugal	R&D	Sea bed/seafloor benthic	Litter in submarine canyons of the west coast of Portugal (PROGRAMME HERMIONE), MACRO. Video footage from Remotely Operated Vehicle (ROV)	Mordecai, G., Tyler, P.A., Masson, D.G., Huvenne, V., 2011. Litter in submarine canyons of the west coast of Portugal. Deep-Sea Research II 58, 2489-2496	
Portugal	R&D	Beach/ shoreline	POIZON PROJECT -PTDC/MAR/102677/2008. Research project with a focus on stranded marine litter, especially microplastics, plastic pellets contamination and effects from ingestion of plastic microparticles. Beach litter sampling -10 locations.	Frias et al. (2013). Local marine litter survey - A case study in Alcobaça municipality, Portugal. J.Int. Coastal Zone Manag. 13(2):169-179. Mizukawa et al.(2013). Monitoring of a wide range of organic micropollutants on the Portuguese coastusing plastic resin pellets. Marine Pollution Bulletin, 70:296-302. http://www.aprh.pt/rgci/pdf/rgci-395_Frias.pdf http://www.sciencedirect.com/science/article/pii/S0025326X13000647	Email: psobral@fct.unl.pt
Portugal	R&D	Beach/ shoreline	Plastic marine debris on the Portuguese coastline: A matter of size? Beach litter sampling. 1 survey, 5 locations. 02/2010-03/2010.	Martins, J., Sobral, P. (2011). Plastic marine debris on the Portuguese coastline: A matter of size? Marine Pollution Bulletin 62, 2649-2653. http://www.sciencedirect.com/science/article/pii/S0025326X11005170	Email: psobral@fct.unl.pt

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Portugal	R&D	Seafloor	Abundance of litter on Condor seamount (Azores, Portugal, Northeast Atlantic). A total of 48 video transects deployed on the summit and the northern flank of Condor Seamount revealed 55 litter items. This seamount is located 17 km southwest of Faial Island, Azores Archipelago (Portugal). (2006-2011)	Pham,C.K.,e tal. 2013., Abundance of litter on Condor seamount (Azores, Portugal, Northeast Atlantic). Deep-Sea Res. II (2013). http://dx.doi.org/10.1016/j.dsr2.2013.01.011 i	Email: phamchristopher@uac.pt
Netherlands	Monitoring	Beach/ shoreline	OSPAR Beach survey from 2001.	Marine Litter in the North East Atlantic Region. OSPAR commission 2009. http://qsr2010.ospar.org/media/assessments/p00386_Marine_Litter_in_the_North-East_Atlantic_with_addendum.pdf	lex.oosterbaan@rws.nl
Netherlands	Monitoring	Water column, sea bottom	Pilot (I)BTS Sea bottom litter. Monitoring litter in the water column and on the sea-floor through regular fish surveys in the North Sea. Macro. 2013.		RWS/ IMARES (Mr. Ralf van Hal). IMARES, PO.Box 68. 1970 AB, IJmuiden, NL. Ralf.vanhal@wur.nl
Netherlands	Monitoring	Impacts in Biota and microlitter	EcoQO Fulmar Monitoring micro litter 2012-2013		Mr. J.A. (Jan Andries) van Franeker. IMARES, PO.Box 167, 1790 AD, Texel, NL. jan.vanfraneker@wur.nl
Netherlands	NGOs/local authorities	Beach/ shoreline	Programme Coastwatch. Count of item nr within certain categories. 2009-present	http://coastwatch.nl/	lex.oosterbaan@rws.nl j.dagevos@noordzee.nl
Netherlands	NGOs/local authorities	Impacts on Biota	Other NGOs initiatives can be found under www.zwervendlangszee.nl	www.zwervendlangszee.nl	E-mail: info@zwervendlangszee.nl, Bezoekadres:Stationsplein 48b, 1948 LC Beverwijk
Netherlands	R&D	Riverine input	Mosa Pura – Along the River Meuse. Water column trawl, categorization according to OSPAR	River Litter Foundation. http://wastefreewaters.wordpress.com/	gijsbert.tweehuysen@zuyd.nl

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Netherlands	R&D	Impacts on Biota	Fulmar Litter EcoQO. Dissection. Data from the 80's but started annually in 1997. Official Programme:2002 - ongoing	Van Franeker JA & the SNS Fulmar Study Group 2011. Fulmar Litter EcoQo monitoring along Dutch and North Sea coasts. Port Reception Facilities. Results to 2009. IMARES report Nr C037/11. http://www.zeevogelgroep.nl/Downloads/DownloadsFraneker/Franeker2011_FulmarEcoQO-tm2009_IMARES-C037-11-final.pdf	IMARES, Jan.vanfraneker@wur.nl
Netherlands	R&D	Impacts on Biota/ microlitter	Effects of nanopolystyrene on the feeding behaviour of the blue mussel		A. Wegner,E. Besseling,E.M. Foekema,P. Kamermans,A.A. Koelmans 2012. Effects of nanopolystyrene on the feeding behavior of the blue mussel (Mytilus edulis L.). Environmental Toxicology and Chemistry. Volume 31, Issue 11, pages 2490–2497. http://onlinelibrary.wiley.com/doi/10.1002/etc.1984/abstract.
Netherlands	R&D	Impacts on Biota/microlitter	Effects of MP on fitness and PCB bioaccumulation by the lugworm A. Marina.		Wageningen University, PO.Box 47, 6700 AA Wageningen, NL.
Netherlands	R&D	Impacts on Biota/microlitter	Modelling effects of MP on PCB accumulation by A Marina		A.A. (Bert) Koelmans et al. (submitted for publication), Wageningen University, PO.Box 47, 6700 AA Wageningen, NL.

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Netherlands	R&D	impacts on Biota	Inventory of the presence of plastics in the digestive tract of North Sea fishes. Plastic debris can be found in seas and oceans all over the world. Ingestion of the smaller parts by marine birds, turtles and mammals has been reported by various researchers. Ingested plastic particles can potentially reduce food uptake, cause blockage of the digestive tract, and be a source of contaminants like PCB's (Derraik,2002). Of the Northern Fulmar in the North Sea, 95% has plastic in their stomach (Van Franeker et al., 2011). As for fish such data are not available, IMARES started an inventory in 2010 of the occurrence of plastics in the digestive track of North Sea fishes. To evaluate the likeliness of bioaccumulation of POPs through plastics, chemical analyses were performed on plastic debris collected from the water during the fishing trips. IMARES, part of Wageningen UR, Dept. Environment	http://documents.plant.wur.nl/imares/afval/vissen/plastics-fish-2011.pdf	Edwin.Foekema@wur.nl, IMARES (Wageningen UR), Dept. Environment, PO.Box 57, 1780 AB Den Helder, NL
Netherlands	R&D	Impacts on Biota, Microlitter	Microplastics research in sediments, biota and sewage water treatment plants. Microlitter, animals. 2012-2013.		Heather Leslie..IVM VU University, De Boelelaan 1087, 1081 HV Amsterdam, NL. heather.leslie@vu.nl
Netherlands	NGOs/local authorities	water, seafloor	Fishing for litter. Clearing the North Sea from litter by bringing ashore the litter that is gathered in fishermen's nets as part of fishing activities. Macro. 2003.	http://www.kimointernational.org/FFLNetherlands.aspx	Mr. B. Veerman. KIMO NL + BE. info@kimonederlandbelgie.org
Denmark	Monitoring	All	Monitoring marine litter in all environmental components		Danish Ministry of the Environment, nature Agency
Denmark	R&D	Microlitter	Marine Litter in the Nordic Waters; Compilation of knowledge concerning Marine litter in a Nordic perspective, especially micro-plastics. Micro litter. 01/01/2013 to 21/12/2014		Contact: Jakob Strand, Aarhus University (AU), Bioscience, Fredriksborgvej 399, 4000 Roskilde
Denmark	R&D	Beach/ shoreline	Jammerbugt Northwest Denmark. Investigations on the proportion of garbage used as nesting material in the Kittiwake colony at Bulbjerg in the Jammerbugt in Northwest Denmark. Observation/count in 1992 and repeated in 2005.	Plastic debris as nesting material in a Kittiwake-(Rissa tridactyla)-colony at the Jammerbugt, Northwest Denmark. Hartwig E, Clemens T, Heckroth M. 2007. Mar Pollut Bull 54(5):595-7. http://www.ncbi.nlm.nih.gov/pubmed/17391710	

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Denmark	R&D	Impacts on Biota	Monitoring plastics in Northern Fulmar 2011. Skagen as a part of wider North Sea survey	**Errore. Riferimento a collegamento ipertestuale non valido.**	John Pedersen. Skagen Uddannelsescenter SUC, Vestmolen 15, DK-9990 Skagen, Denmark; Jan.vanfraneker@wur.nl
Denmark	NGOs/local authorities	Beach/ shoreline	Denmark West Coast MACRO. Questionnaire sent to 11 west coast municipalities. 2007-2009 (To be repeated and updated). Annual.		rydm@varde.dk
Denmark	NGOs/local authorities	Water column	Save the North Sea – Fishing for Litter – Hvide Sand harbour MACRO	http://www.kimointernational.org/Save-the-North-Sea.aspx	posv@varde.dk
Denmark	NGOs/local authorities	Water column	Danish Harbours general survey – they asked members to estimate the amount of marine litter caught from the sea. As part of survey for Contents of fulmar stomachs. 1995 - 2007.		
Ireland	Monitoring	Seafloor	IBTS trawling surveys in Celtic Seas annually		david.stokes@marine.ie
Ireland	Monitoring	Shoreline and beach	Ospar beach monitoring		eugene.nixon@marine.ie, Marine Institute, Ireland.
Ireland	NGOs/local authorities	Shoreline and beach	Coastwatch surverys. Coastwatch Europe Methodology. Survey began in 1987 (28 years ago) but methodology has changed repeatedly. In 2012, 408 sites were surveyed. 1987-2012. (In September 1987 the first Coastwatch Survey took place in Ireland North and South, designed by Karin Dubsky of ICEG)	http://www.coastwatch.org/Coastwatch.org/Home.html	Karin Dubsky kdubsky@tcd.ie
Ireland	NGOs/local authorities	Shoreline and beach	Clean Coasts surveys. The Clean Coasts programme is run by AN TAISCE - The National Trust for Ireland, for the protection and enhancement of Ireland's coastline. It strives to improve the economic and aesthetic value of the coastline for community & visitors alike by involving local communities in beach management and encouraging them to be guardians of their coastline. Local communities collect and remove marine litter from beaches and coastal pathways and use Marine Litter Data Card.	http://www.cleancoastsireland.org/	afitzgerald@eeu.antaisce.org

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
France	Monitoring	All	National assessment of Marine litter. Cedre thematic reports for marine litter in seabed, shoreline/beach, water, impacts in biota and others. Cedre Reports: Déchets sur le littoral, Déchets en mer et sur le fond , Dechets marins, Impacts ecologuiques des deches marins, Derangement de la faune,	Cedre thematic reports for marine litter in seabed, shoreline/beach, water, impacts in biota and others. Cedre Reports: Déchets sur le littoral, Déchets en mer et sur le fond , Dechets marins, Impacts ecologuiques des deches marins, Derangement de la faune, . http://wwz.ifremer.fr/dcsmm/Le-Plan-d-Action-pour-le-Milieu-Marin/Evaluation-initiale/Contributions-thematiques	http://wwz.ifremer.fr/dcsmm/Le-Plan-d-Action-pour-le-Milieu-Marin/Evaluation-initiale/Contributions-thematiques
France	Monitoring	seabed	Assessment of litter on shelves	Annual assessment through IBTS surveys (data on irregular basis), Macro litter and micro litter. Bay of Biscay: 1994/1998/2010, Eastern channel: 1998/2010. Link: http://wwz.ifremer.fr	Contact: IFREMER; francois.galgani@ifremer.fr
France	NGOs/local authorities	Beaches	Assessment of micro plastics on the shoreline. Counts of industrial plastics pellets found in sands.	http://maldeseine.free.fr/	Laurent Colasse. SOS Mal de Seine. http://maldeseine.free.fr/
France	NGOs/local authorities	beach/ shoreline	Plastics in nests of Cormorants. Counts of plastics in nests, as an indicator for the Park management. Macro litter. plan. Annual assessment. Bernard Cadiou, Bretagne Vivante (NGO). Patrick Pouline, Parc Naturel Marin d'Iroise	http://www.ncbi.nlm.nih.gov/pubmed/17391710	www.bretagne-vivante.org/ and www.parc-marin-iroise.gouv.fr/
France	R&D	Impacts on Biota	CRMM (Center of research on Marine Mammals) surveys. The CRMM is a laboratory of the University of La Rochelle dedicated to monitoring marine mammal populations along the French coast. It has a programme since 1972 collecting stranding marine mammals and collecting results from autopsy analysis.	http://crmm.univ-lr.fr	CRMM, crmm@univ-lr.fr
Germany	Monitoring	Beach, surface/pelagic, benthic, microparticles	MSFD Litter for North Sea. Rubbish in the sea- a serious ecological, economical and easthetic problem (ABFÄLLE IM MEER -EIN GRAVIERENDES ÖKOLOGISCHES, ÖKONOMISCHES UND ÄSTHETISCHES PROBLEM)	ABFÄLLE IM MEER -EIN GRAVIERENDES ÖKOLOGISCHES, ÖKONOMISCHES UND ÄSTHETISCHES PROBLEM; Published by Umweltbundesamt Wörlitzer Platz 1 06844 Dessau-Roßlau.	Stefanie Werner Fachgebiet II 2.3 Umweltbundesamt Wörlitzer Platz 1 06844 Dessau-Roßlau E-Mail: pressestelle@uba.de Internet: www.umweltbundesamt.de

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Germany	Monitoring	Beach, surface/pelagic, benthic, microparticles. Litter in fulmars	MSFD report for the North Sea. Marine surface, pelagic, beach, benthic and microplastic Litter information as provided in the German Greater North Sea MSFD report. Additionally there is some information in litter in fulmars.	Umsetzung der Meeresstrategie-Rahmenrichtlinie. Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU) Referat WA I 5, Meeresumweltschutz, Internationales Recht des Schutzes der marinen Gewässer Robert-Schuman-Platz 3, 53175 Bonn	Heike Imhof. Umsetzung der Meeresstrategie-Rahmenrichtlinie. Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU) Referat WA I 5 Meeresumweltschutz, Internationales Recht des Schutzes der marinen Gewässer Robert-Schuman-Platz 3 53175 Bonn. www.umweltbundesamt.de
Germany	R&D	water	Determination of the importance of an Estuary as vector of introduction for marine litter in the NS ; quantitative and qualitative assessment of amounts of plastics being introduced. Mico- (Focus) and Macrolitter. 2011 onwards.		Bastian Schuchardt, schuchardt@bioconsult.de
Germany	R&D	Impacts in biota, microplastics	Occurrence of microparticles (microplastics) in lower saxonian coastal waters and in fish stomachs and seal faeces. Distribution of microparticles on vertical transects at selected beaches ; regional differences in the occurrence of microparticles in the drift lines of selected islands ; occurrence of microparticles in the Eulitoral and Sublitoral (in connection with different sediments); evolution of the occurrence of micro particles in vertical sediment pits in salt marshes and intertidal estuarine mudflats; amounts and potential sources of microplastics in the stomachs of selected fish species (e.g. herring, sprat) and seal faeces. Microlitter 2012		Prof. Dr. Gerd Liebezeit, Fa. MarChemConsult MarChemConsult@yahoo.de
Germany	R & D	ALL	UBA R&D (WP5) Development of concepts and methods for the compilation and assessment of selected anthropogenic pressures. Development of methods for statistical reliable trend analysis for the MSFD indicators under D10 starting with beach litter (using the OSPAR beach litter monitoring data sets) and floating litter (using data from aerial surveys of the institute ITAW); analysis of existing litter data from ITBS surveys and beam trawling operations ; fulmar monitoring and identification of indicator species (including also the Baltic); modelling of particle transport and accumulation areas; screening of footage of ghost nets on wrecks etc. Micro and macro. 2010-2013.		UBA contact point Stefanie Werner,

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Germany	R & D	Seafloor	R&D project by DeMarine, WIMO. 2012.		Uni Osnabrück, FTZ Westküste, Alfred-Wegener-Institut, Umweltbundesamt , Wörlitzer Platz 1, 06844 Dessau-Roßlau.
Germany	R&D	Microplastic	Distribution, convergence and polymere composition of microplastic particles < 5 mm using micro-FT-IR imaging. Micro 2012 to 2013.		Dr. Martin Löder, Dr. Gunnar Gerdts, Alfred-Wegener-Institut.
Germany	R&D	beach/ shoreline	Quantitative assessment of beach sediments for microplastic particles including granulate material. Micro. Coast of Lower Saxonian and Schleswig Holstein. 2009 to 2011 and 2012 to 2013.		Dr. Habil Karin Steinicke, Timmy Schwarz, University of Bremen
Belgium	Monitoring	Beach /shoreline, water, seafloor, impacts	Monitoring programmes Monitoring marine litter surveys in Belgium include beach OSPAR surveys, as well as water and seabed, and impacts surveys.		
Belgium	NGOs / local authorities	Beach/ shoreline, and water	NGOs 'Ocean Conservancy' activities include beach surveys and 'Fishing for litter' surveys in water (and seabed)		
Belgium	R&D	microlitter	Research projects on Microlitter		University of Gent
Spain	Monitoring	beach/ shoreline	OSPAR beach litter surveys. OSPAR Pilot Project on Monitoring Beach Litter in the north Spanish coast.	QSR 2010, http://qsr2010.ospar.org/media/assessments/p00386_Marine_Litter_in_the_North-East_Atlantic_with_addendum.pdf	
Spain	NGOs	beach/ shoreline	After the finalization of the OSPAR Pilot project on Monitoring beach litter, ONG Ollalomar, in collaboration with the ministry of environment and other regional and local authorities continue beach litter surveys. North coast of Spain	www.ollalomar.org	www.ollalomar.org

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Spain	NGOs	beach/ shoreline	AZTERKOSTA marine litter surveys since 1992 and educational activities. Coastwatch surveys	http://www.ingurumena.ejgv.euskadi.net/r49-5913/es/contenidos/informacion/azterkosta/es_9733/presentacion.html	http://www.ingurumena.ejgv.euskadi.net/r49-5913/es/contenidos/informacion/azterkosta/es_9733/presentacion.html
Spain	NGOs	Impacts on Biota	The Spanish Society of Ornitology (Sociedad Española de Ornitología, SEO) has elaborated a report about "Marine birds" with a view to an initial step to develop an indicator.	http://www.seo.org/	http://www.seo.org/
NEA countries	Monitoring	ALL	OSPAR Assessment on Marine Litter in 2009, and Quality Status for marine litter by OSPAR in 2010.	Marine Litter in the North East Atlantic Region. OSPAR commission 2009. http://qsr2010.ospar.org/media/assessments/p00386_Marine_Litter_in_the_North-East_Atlantic_with_addendum.pdf; OSPAR Commission 2010. Quality Status Report. Chapter 9. http://qsr2010.ospar.org/en/ch09_12.html	www.ospar.org
EU countries	Monitoring	ALL	MSFD Assessment	Marine Litter - Technical Recommendations for the Implementation of MSFD Requirements. MSFD GES Technical Subgroups on Marine Litter. European Commission 2011. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/22826/2/msfd_ges_tsg_marine_litter_report_eur_25009_en_online_version.pdf	
EU countries	R&D	Other sources of information on Marine litter survey activities	MICRO. Research in occurrence, fate and impact of microplastics. 2012-2014.		Dick Vethaak/ Myra van der Meulen (Deltares), INTERREG project together with Cefas, ILVO, IFREMER. Deltares, Rotterdamseweg 185, Delft, NL. Dick.vethaak@deltares.nl
EU countries	R&D	Other sources of information on Marine litter survey activities	MARELITT. Pilot project for the evaluation of marine litter removal projects in Europe's four regional seas (from organisational, economic and environmental perspective). Jan 2013- Dec 2014.	http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/pdf/MARELITTproject%20leaflet.pdf	Monica Guarinoni. Milieu Ltd (and partners), 15 Rue Blanche, B-Brussels 1050, Belgium. marinelitter@milieu.be.

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
EU countries	R&D	Other sources of information on Marine litter survey activities	HERMIONE. Hotspot ecosystem research and man's impact on European seas, will provide clearer picture of the extent and severity of the ML problem and raise awareness through public campaigns	www.eu-hermione.net	
EU countries	R&D	Other sources of information on Marine litter survey activities	BIOCLEAN. Biotechnical solutions for the degradation of synthetic polymeric materials. Sep 2012- Sep 2018	www.biocleanproject.eu	Prof. Fabio Fava. Department of Civil, Chemical, Environmental, and Materials Engineering, Università di Bologna, Viale Risorgimento 2, Bologna, 40136 Italy. fabio.fava@unibo.it
EU countries	R&D	Other sources of information on Marine litter survey activities	ECsafeFOOD. Contaminants in seafood (also Microplastics) and their impact on public health; safety assessment, impact and public perception. Feb 2013- Feb 2017.	http://ec.europa.eu/research/bioeconomy/pdf/interim_catalogue_of_marine_projects-2012_en.pdf	Marques António. Instituto Nacional de Recursos Biologicos, I.P. (INRB), Av. De Brasilia, 1449-006 Lisboa, Portugal. amarques@ipimar.pt
EU countries	R&D	Other sources of information on Marine litter survey activities	CLEANSEA. Towards a clean, litter-free European Marine Environment through scientific evidence, innovative tools and good governance. 2013-2018	www.cleansea-project.eu	Heather Leslie. IVM VU University, De Boelelaan 1087, 1081 HV Amsterdam, NL. heather.leslie@vu.nl
EU countries	R&D	Other sources of information on Marine litter survey activities	RPA. Feasibility study of introducing instruments to prevent littering. 2012-2016	http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm	Dr. Jan Vernon. Risk & Policy Analysts Limited (RPA), Farthing Green House, 1 Beccles Road, Loddon, Norfolk, NR14 6LT, UK. www.rpaltd.co.uk
EU countries	R&D	Other sources of information on Marine litter survey activities	BIPRO. Pilot project. Study of the largest loopholes within the flow of packaging material. 2012-2016	htm / www.bipro.de ; http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en	BiPRO GmbH. BiPRO GmbH, Grauertstrasse 12, 81545 Munich, Germany. mail@bipro.com
EU countries	R&D	Other sources of information on Marine litter survey activities	ARCADIS. Pilot project 4 seas: case studies on the plastic cycle and its loopholes in the four European Regional Seas Areas. 2012-2016	http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm	Annemie Volckaert. Arcadis Belgium, Kortrijksesteenweg 302, 9000 Gent, Belgium. a.volckaert@arcadisbelgium.be

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Country in the NEA	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
EU countries (except Black Sea)	R&D	Other sources of information on Marine litter survey activities	STAGES. Synthesizing scientific knowledge to improve the understanding of GES, including the descriptor 10 on ML.	http://www.stagesproject.eu/	
EU countries (except NEA and Baltic)	R&D	Other sources of information on Marine litter survey activities	PERSEUS. Policy-oriented marine environmental research for Southern European seas, will provide clearer picture of the extent and severity of the ML problem and raise awareness through public campaigns. 2012-2015.	http://www.perseus-net.eu	PERSEUS. mpapath@hcmr.gr

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Annex2_National Survey Activities in the Baltic

Country in the Baltic	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Germany	Monitoring	Beach/ shoreline	Hohe Düne beach survey using OSPAR method since 2012	OSPAR Pilot project on Monitoring Beach litter Quality Status Report 2010, http://qsr2010.ospar.org/media/assessments/p00306_Litter_Report.pdf	NABU, http://www.nabu.de/en/, or mossbauer@eucc-d.de
Germany	Monitoring	Beach/ shoreline	Kägsdorf beach survey using OSPAR method since 2012	OSPAR Pilot project on Monitoring Beach litter Quality Status Report 2010, http://qsr2010.ospar.org/media/assessments/p00306_Litter_Report.pd f	NABU, http://www.nabu.de/en/ , or mossbauer@eucc-d.de
Germany	Monitoring	Beach/ shoreline	Warnemünde beach survey using OSPAR method since 2012	OSPAR Pilot project on Monitoring Beach litter Quality Status Report 2010, http://qsr2010.ospar.org/media/assessments/p00306_Litter_Report.pdf	NABU, http://www.nabu.de/en/ , or mossbauer@eucc-d.de
Germany	Monitoring	Beach/ shoreline	Coast Schleswig-Holstein beach transect survey	OSPAR Pilot project on Monitoring Beach litter Quality Status Report 2010, http://qsr2010.ospar.org/media/assessments/p00306_Litter_Report.pdf	NABU, http://www.nabu.de/en/ , david.fleet@nationalparkamt.de
Denmark	R&D	Seafloor	Seabed Trawling in the area of Bornholm collected marine debris in 2010/2011. DTU Aqua, National Institute of Aquatic Resources	Hansen, J. W., Andersen, J.H., Strand, J., Sørensen, T. K., 2011: Report 2.4 – Litter in the sea. National Centre for Environment and Energy, University of Aarhus. Report developed for the Ministry of Nature. http://www.aqua.dtu.dk/english; http://dce.au.dk/fileadmin/dce.au.dk/Udgivelser/Havstrategin otater/2-4_MSFD_notat_Affald_i_havet_final.pdf	DTU Aqua, http://www.aqua.dtu.dk/english

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Country in the Baltic	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Denmark	Monitoring	ALL	Danish marine strategic national assessments. Denmark is monitoring the work being carried out in international arenas concerning the North Sea, where the OSPAR Marine Convention has established an indicative regional environmental target for the contents. A number of general studies have described aspects of marine litter. Some of these studies are specific to the North Sea (excluding Kattegat). Monitoring has been initiated in connection with exploratory fishing, which will enable more specific knowledge to be acquired concerning the amounts, distribution and sources of marine litter.	Danish Ministry of the Environment- Nature Agency. Danish Marine Strategy - Summary of the Initial Assessment. http://www.naturstyrelsen.dk/NR/rdonlyres/90FEAE51-B533-4655-BDFA-C98EF6C34621/144093/TheDanishMarineStrategy.pdf;	Danish Nature Agency, http://www.naturstyrelsen.dk/International/English/
Denmark	Monitoring	ALL	Danish marine strategic national assessments. Denmark is monitoring the work being carried out in international arenas concerning the North Sea, where the OSPAR Marine Convention has established an indicative regional environmental target for the contents of micro-plastic in the stomach of washed-up petrels (northern fulmar).	Danish Ministry of the Environment- Nature Agency. Danish Marine Strategy - Good Environmental Status, Targets and Indicators. http://www.naturstyrelsen.dk/NR/rdonlyres/90FEAE51-B533-4655-BDFA-C98EF6C34621/144094/SummaryofInitialAssessment.pdf ;	Danish Nature Agency, http://www.naturstyrelsen.dk/International/English/
Denmark	NGOs	Beach/ shoreline	Keep Denmark Clean, beach clean ups.	Analyse Henkastet affald på de danske strande. Juni 2012. Hold Danmark Rent; Information on Keep Denmark Cleans http://www.holddanmarkrent.dk/article/aktiviteter_renstrand_11 ; http://www.holddanmarkrent.dk/files/Analyserapport_FINAL.pdf	http://www.holddanmarkrent.dk/
Denmark	R&D	Seafloor	Mapping surveys, Danish Ministry of Nature - Video trawl on seabed mapping surveys to register habitats and species was examined to also study marine litter		Danish Ministry of Nature, http://www.mim.dk/eng

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Country in the Baltic	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Estonia, Sweden, Finland, Latvia	R&D	Beach/ shoreline	Baltic Marine Litter project (MARLIN) focuses on activities to raise awareness on marine litter as well as increased knowledge on amounts, sources, types of litter and how to mitigate the negative effects of marine litter. MARLIN project implements this method in 25 key areas in Sweden, Finland, Estonia and Latvia (in total 150 litter assessments).	http://www.projectmarlin.eu/sa/node.asp?node=3010	Marek Press, Keep the Estonian Sea Tidy, press@datanet.ee, http://www.projectmarlin.eu/
Poland	NGO	Others	WWF Poland (2011) Ecological effects of ghost net retrieval in the Baltic Sea. Pilot project: Collecting ghost nets.	Survey and Monitoring of marine Litter. All survey teams have received training from Keep Sweden Tidy	http://www.wwf.pl
Sweden	R&D	Water	KIMO Sweden has given N-research microplastics pilot-study to assess the abundance of small, microscopic, plastic particles in Swedish west coast waters. N-research has taken water samples from nineteen locations, both planktonic and from benthic sediments, and conducted analyses		fredrik.noren@n-research.se
Sweden	NGOs	Beach/ shoreline	The Keep Sweden Tidy Foundation is a creator of public opinion that promotes recycling and combats litter through public awareness campaigns, awards and environmental education. The Foundation strives to influence people's attitudes and behaviour in order to encourage a sustainable development. Beach litter surveys are carried out with Keep Sweden Tidy's guidelines, which harmonize with UNEP/IOC Guidelines		http://www.keepswedentidy.org/sa/node.asp?node=2730

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Country in the Baltic	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Baltic	NGOs or local authorities	Beach/ shoreline	Naturewatch Baltic network (WWF) describes plastic bottles as the most common type (31-34%) of litter pieces found. Plastic bags were only registered in some years and constituted 19-27% of all litter, when reported	http://www.helcom.fi/publications/	
Baltic	NGOs or local authorities	Beach/ shoreline	Ocean Conservancy. International Coastal Clean up		http://www.oceanconservancy.org/our-work/international-coastal-cleanup/
Baltic	NGOs or local authorities	Impact on Biota	Pilot Project WWF 2000 - Collecting Ghost Nets in the Baltic Sea. The study concludes that estimated number of nets lost annually in Baltic fishing grounds gillnets and trawl nets) is significant and there is a need to carry out further actions aimed at minimizing this problem.	Ecological Effects of Ghost net retrieval in the Baltic Sea. Final report. WWF Poland, December 2011. http://meeting.helcom.fi/c/document_library/get_file?p_l_id=257503&folderId=1755644&name=DLFE-49571.pdf	WWF Poland, at: wwf.pl
Baltic	Monitoring	ALL	The Baltic Sea is represented by the Helsinki Commission (HELCOM) which works to protect the marine environment in this region. To date, marine litter has not been regarded as a major problem and there is a lack of comprehensive and systematic assessment or monitoring of marine litter in this region.	HELCOM (2007) Marine Litter in the Baltic Sea Region: Assessment and priorities for response. UNEP's (2009) Marine Litter: A Global Challenge. http://www.helcom.fi/stc/files/shipping/Assessment%20of%20the%20marine%20litter%20problem%20in%20the%20Baltic%202007.pdf ; http://www.unep.org/pdf/unep_marine_litter-a_global_challenge.pdf ; http://www.helcom.fi/publications/other_publications/en_GB/Outcome_Marine_Litter_Project/?u4.highlight=litter ý	

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Country in the Baltic	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Baltic	Monitoring	ALL	Marine litter assessment in the Baltic region. Helcom Assessment (Helsinki Commission)	Assessment of the Marine Litter problem in the Baltic region and priorities for response, 2007. http://www.helcom.fi/stc/files/shipping/Assessment%20of%20the%20marine%20litter%20problem%20in%20the%20Baltic%202007.pdf	http://www.helcom.fi/
EU	Monitoring	ALL	Marine Strategic Framework Directive Assessment	Marine Litter - Technical Recommendations for the Implementation of MSFD Requirements. MSFD GES Technical Subgroups on Marine Litter. European Commission 2011. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/22826/2/msfd_ges_tsg_marine_litter_report_eur_25009_en_online_version.pdf	georg.hanke@jrc.ec.europa.eu

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Annex3_National Survey Activities in the Mediterranean

Country in the Mediterranean	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Slovenia	Monitoring	Beach/ shoreline	MSFD Beach analysis, IRWS, Fiesa. 1350 m of Slovenian beach monitored for MSFD	Marine Litter - Technical Recommendations for the Implementation of MSFD Requirements. MSFD GES Technical Subgroups on Marine Litter. European Commission 2011. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/22826/2/msfd_ges_tsg_marine_litter_report_eur_25009_en_online_version.pdf	IWRS, andrea.palatinus@izvrs.si, Rebublic of Slovenia Ministry of the Environment and Spatial Planning
Slovenia	Monitoring	Beach/ shoreline	MSFD Beach analysis, IRWS. 16km Slovenian shoreline monitored for MSFD	Marine Litter - Technical Recommendations for the Implementation of MSFD Requirements. MSFD GES Technical Subgroups on Marine Litter. European Commission 2011. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/22826/2/msfd_ges_tsg_marine_litter_report_eur_25009_en_online_version.pdf	IWRS, andrea.palatinus@izvrs.si
Slovenia	Monitoring	Water	MSFD Floating litter analysis in Slovenian waters	Marine Litter - Technical Recommendations for the Implementation of MSFD Requirements. MSFD GES Technical Subgroups on Marine Litter. European Commission 2011. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/22826/2/msfd_ges_tsg_marine_litter_report_eur_25009_en_online_version.pdf	IWRS, andrea.palatinus@izvrs.si
Slovenia	R&D	Impacts in Biota	Ingestion of marine debris by loggerhead sea turtles in studied the foraging habitats of the Adriatic Sea. Marine debris ingestion-Adriatic Sea. Ministry of Science, Education and Sport of Croatia.	Lazar & Gracan 2011. Ingestion of marine debris by loggerhead sea turtles, Caretta caretta, in the Adriatic Sea. Mar Poll Bull 62, 43-47. http://www.ncbi.nlm.nih.gov/pubmed/21036372	Bojan.lazar@hpm.hr, University of Zagreb, Croatia.

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Country in the Mediterranean	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Cyprus	R&D	Beach/ shoreline	MED trust fund - IOC/FAO/UNEP study. Measurements of persistent litter on 13 beaches in the Mediterranean including 2 from Cyprus between 1988 and 1989 show that plastic items are the most abundant in the litter composition, followed by wood, metal and glass items.	Gabrielides, G.P., A. Golik, L. Loizides, M.G. Marino, F. Bingel and M.V. Torregrossa, 1991: Man-made garbage pollution on the Mediterranean coastline, Marine Pollution Bulletin, Vol. 23, pp. 437-441. http://www.sciencedirect.com/science/article/pii/0025326X91907133	ISOTECH, Demetra Orthodoxou, project@isotech.com.cy
Cyprus	R&D	Beach/ shoreline	MED trust fund - IOC/FAO/UNEP study. Measurements of persistent litter on 13 beaches in the Mediterranean including 2 from Cyprus between 1988 and 1989 show that plastic items are the most abundant in the litter composition, followed by wood, metal and glass items.	Gabrielides, G.P., A. Golik, L. Loizides, M.G. Marino, F. Bingel and M.V. Torregrossa, 1991: Man-made garbage pollution on the Mediterranean coastline, Marine Pollution Bulletin, Vol. 23, pp. 437-441. http://www.sciencedirect.com/science/article/pii/0025326X91907133	ISOTECH, Demetra Orthodoxou, project@isotech.com.cy
Cyprus	NGOs/ local authorities	Beach/ shoreline	Beach surveys by NGO AKTI project and research Centre. Kouklia survey		AKTI akti@akti.org.cy , ISOTECH, Demetra Orthodoxou, project@isotech.com.cy
Cyprus	NGOs/ local authorities	each/ shoreline	each surveys by NGO AKTI project and research Centre. Visual survey based on NALG protocol. Pyla survey		AKTI akti@akti.org.cy , ISOTECH, Demetra Orthodoxou, project@isotech.com.cy
Cyprus	NGOs/ local authorities	Beach /shoreline	Lymassol survey/ AKTI		AKTI akti@akti.org.cy , ISOTECH, Demetra Orthodoxou, project@isotech.com.cy
Cyprus	NGOs/ local authorities	Beach/ shoreline	Katharistes tou Vithou' or Seabed Cleaners diving beach surveys.		ISOTECH, Demetra Orthodoxou, project@isotech.com.cy
Cyprus	NGOs/ local authorities	Beach/ shoreline	Limassol Municipal Surveys		ISOTECH, Demetra Orthodoxou, project@isotech.com.cy
Greece	NGOs/ local authorities	Beach/ shoreline	Beach litter monitoring by the Hellenic Marine Environment Protection Association (HELMEPA), following method of international coastal clean up (ICC). HELMEPA was established in 1982, is Europe's first private sector voluntary marine environment protection	Assessment of the status of marine litter in the Mediterranean. UNEP, Mediterranean Action Plan, Athens. UNEP(DEPI)/MED WG.357/Inf.4, 12 April 2011. http://www.mio-ecsde.org/_uploaded_files/news/wg%20357%20inf	HELMEPA, http://www.helmepa.gr/en/index.php , MIO-ECSDE-Mediterranean Information Office for Environment, Culture

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Country in the Mediterranean	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
			association. HELMEPA's aims are to eliminate ship-generated marine pollution and enhance safety at sea. HELMEPA has also launched several environmental projects and public awareness campaigns.	%204%20assessment%20of%20status%20of%20marine%20litter.pdf	and Sustainable Development, Thomais Vlachogianni [vlachogianni@mio-ecsde.org]
Greece	NGOs/ local authorities	Beach/ shoreline	Beach litter monitoring by HELMEPA, following method of international coastal clean up (ICC),	Assessment of the status of marine litter in the Mediterranean. UNEP, Mediterranean Action Plan, Athens. UNEP(DEPI)/MED WG.357/Inf.4, 12 April 2011. http://www.mio-ecsde.org/_uploaded_files/news/wg%20357%20inf%204%20assessment%20of%20status%20of%20marine%20litter.pdf	HELMEPA, http://www.helmepa.gr/en/index.php , MIO-ECSDE-Mediterranean Information Office for Environment, Culture and Sustainable Development, Thomais Vlachogianni [vlachogianni@mio-ecsde.org]
Greece	NGOs/ local authorities	Beach/ shoreline	Beach litter monitoring by MESDOS, following method of international coastal clean up (ICC),	Composition of beach litter and the contribution of land based and marine based litter - sources, in 80 beaches from all over Greece. Thesis by Kordella S. http://www.medsoscleanup.gr/ , http://nemertes.lis.upatras.gr/jspui/?locale=en	MIO-ECSDE, Thomais Vlachogianni [vlachogianni@mio-ecsde.org]
Greece	NGOs/ local authorities	water	Beach litter monitoring by HELMEPA, following method of international coastal clean up (ICC),	Assessment of the status of marine litter in the Mediterranean. UNEP, Mediterranean Action Plan, Athens, 2011. http://www.mio-ecsde.org/_uploaded_files/news/wg%20357%20inf%204%20assessment%20of%20status%20of%20marine%20litter.pdf	HELMEPA, http://www.helmepa.gr/en/index.php , MIO-ECSDE-Mediterranean Information Office for Environment, Culture and Sustainable Development, Thomais Vlachogianni [vlachogianni@mio-ecsde.org]
Greece	R&D	seafloor	Benthic marine litter surveys- University of Patras. The types, abundance, distribution and sources of benthic marine litter found in four Greek Gulfs (Patras, Corinth, Echinades and Lakonikos) were studied using bottom trawl nets.	Koutsodendris et al 2008. Benthic marine litter in four Gulfs in Greece, Eastern Mediterranean, abundance, composition and source identification. www.sciencedirect.com/science/article/pii/S0272771407004696	Universtiy of Patras. A. Koutsodendris, koutsod@upatras.gr
Greece	R&D	seafloor	Marine Debris on seafloor, Western Greece. Marine litter on the seabed by Beam trawl in Gulf of Patras and Echinades	Stefatos A, et al. Marine Debris on the Sea floor of the Mediterranean Sea: Examples from Two Enclosed Gulfs in Western Greece. Marine Pollution Bulletin, 36 (5): 389-393, 1999. http://www.sciencedirect.com/science/article/pii/S0025326X98001416	Universtiy of Patras. A. Stefatos

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Country in the Mediterranean	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Greece	R&D	Impacts in Biota	Plastic debris ingested by deep-water fish- Ionian Sea-Cephalonian island	Anastasopoulou A, et al. 2013. Plastic debris ingested by deep-water fish of the Ionian Sea (Eastern Mediterranean). Deep Sea Research Part I: Oceanographic Research Papers, in the Press, http://www.sciencedirect.com/science/article/pii/S096706371300006X	Hellenic Centre for Marine Research, kanast@hcmr.gr
Greece	R&D	Impacts in Biota	Effect on the benthic megafauna. Research assessed the effect of marine litter on the fauna living in the seabed in the Saronikos Gulf. Coastal area influenced by fishing and high population & industry.	Katsanevakis S., et al. 2007. Effect of marine litter on the benthic megafauna of coastal soft bottoms: A manipulative field experiment. Marine Pollution Bulletin, 54: 771–778. http://www.sciencedirect.com/science/article/pii/S0025326X07000100 .	Email: stelios@katsanevakis.com
France	Monitoring	beach/ shoreline	OSPAR beach surveys, Merterre.	http://www.mer-terre.org/index.php	Mer-Terre, isabelle.poitou@mer-terre.org
France	Monitoring	beach/ shoreline	OSPAR beach surveys, Merterre.	http://www.mer-terre.org/index.php	Mer-Terre, isabelle.poitou@mer-terre.org
France	Monitoring	beach/ shoreline	OSPAR beach surveys, Merterre.	http://www.mer-terre.org/index.php	Mer-Terre, isabelle.poitou@mer-terre.org
France	Monitoring	beach/ shoreline	OSPAR beach surveys, Merterre.	http://www.mer-terre.org/index.php	Mer-Terre, isabelle.poitou@mer-terre.org
France	NGOs/ local authorities	Beach/ shoreline	Surfrider Surveys. Surfrider Foundation Europe is a non profit organization, dedicated to defending, saving, improving and managing in a sustainable manner the ocean, coastline, waves and the people who enjoy them. From its creation, efforts have been concentrated on coastal issues, but today our scope of interest and involvement is spreading to related areas of lakes and rivers.	Surfrider foundation Europe. Macro-waste in brief reports in collaboration with Merterre.	Mer-Terre, isabelle.poitou@mer-terre.org, Surfrider Foundation Europe www.surfrider.eu ,
France	R&D	Impact on Biota	CESTMed is part of the Network of French Mediterranean Marine Turtles (RTMMF) and of the French Mediterranean network for Sea Turtles, Marine Turtles Group (GTMF). A database has been created to collect the anatomical data collected from turtles and the results of laboratory tests (measurements, weight, autopsies,		CESTMED http://www.cestmed.org/index.php/fr/ , contact@cestmed.org

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Country in the Mediterranean	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
			stomach contents, blood, etc)		
France	R&D	Impact on Biota	The CRMM (Center of research on Marine Mammals) is a laboratory of the University of La Rochelle dedicated to monitoring marine mammal populations along the French coast. It has a programme since 1972 collecting stranding marine mammals and collecting results from autopsy analysis.		CRMM, crmm@univ-lr.fr
France	Monitoring	All	French National Assessment for Marine litter. National monitoring surveys are reported by Cedre as thematic reports for marine litter in seabed, shoreline/beach, water, impacts in biota and others.	Cedre thematic Reports - Dechets marins: Déchets sur le littoral, Déchets en mer et sur le fond, Impacts ecologuiques des deches marins, Derangement de la faune. http://wwz.ifremer.fr/dcsmm/Le-Plan-d-Action-pour-le-Milieu-Marin/Evaluation-initiale/Contributions-thematiques	l'Observatoire des Déchets en Milieux Aquatiques, Mer-Terre, isabelle.poitou@mer-terre.org; IFREMER
EU	Monitoring	All (shoreline/beach, seabed and water, others)	Marine Strategic Framework Directive Monitoring. Litter monitoring feeding into MSFD assessment for EU countries includes different monitoring activities in beach, seabed, in water and in biota. Details for each country are included in the overview of marine litter monitoring for Member States.	Marine Litter - Technical Recommendations for the Implementation of MSFD Requirements. MSFD GES Technical Subgroups on Marine Litter. European Commission 2011.	
Mediterranean	Monitoring	All (shoreline/beach, seafloor and water, impacts in biota)	Mediterranean Action Plan (MEDPOL) Assessment of Marine litter. Assessment made in 2011 with information collected from 14 Mediterranean countries, analysis of beach clean-up data, monitoring of litter floating by HELMEPA, and information from NGOS, IGOs, research institute and relevant authorities.	Assessment of the status of marine litter in the Mediterranean. UNEP, Mediterranean Action Plan, Athens. UNEP(DEPI)/MED WG.357/Inf.4, 12 April 2011. http://www.mio-ecsde.org/_uploaded_files/news/wg%20357%20inf%204%20assessment%20of%20status%20of%20marine%20litter.pdf	
Turkey	R&D	seafloor and water	RV YUNUS 2008 Cruise Aegean sea macro, Solid Marine Wastes present on the seabed and floating on the sea surface were investigated in the Aegean Sea.	A preliminary study of marine litter in the Aegean Sea. Topcu et al 2010. http://www.ciesm.org/online/archives/abstracts/pdf/39/PG_0804.pdf	TUDAV, edatopcu@istanbul.edu.tr
Italy	Monitoring	seafloor	Solemon surveys- Northen and Central Adriatic. Solemon project collected marine litter information in Central and Northern Adriatic from 2005-2011 using 'rapido' trawl surveys.		Provincia di Teramo, Luigi Alcaro [l.alcaro@provincia.teramo.it]

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Country in the Mediterranean	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Italy	Monitoring	seafloor	Grund programme surveys-North Tyrrhenian sea. Seabed monitoring for assessment of demersal resources from 1990 to 2003 collected information on seabed litter in the North Tyrrhenian Sea.		Provincia di Teramo, Luigi Alcaro [l.alcaro@provincia.teramo.it]
Italy	NGOs/ local authorities	Impact on Biota	CIMA research foundation as part of its social responsibility activities for the general interest of the country - has decided to publish an experimental platform sharing oriented, real-time, of geo-referenced information about sightings and reports of cetaceans and / or other marine animals (both at sea and beached).	http://www.cimafoundation.org/index.php?option=com_content&view=article&catid=126&id=850&Itemid=930&lang=en	
Italy	Monitoring	Impact on Biota	Recovery centres survey analysis. Sea turtles (Caretta caretta) stranded along Campania coast (Central Tyrrhenian sea), Tuscany coast (North Tyrrhenian sea), and along the Sardinia coast are analysed for stomach contents providing relevant information on impacts on litter in Sea turtles since 1996		Provincia di Teramo, Luigi Alcaro [l.alcaro@provincia.teramo.it]
Italy	Monitoring	Impact on Biota	Italian Ministry of the Environment. Monitoring of Cetaceans strandings on the Italian coast, provide information related to impacts of litter in stranded marine mammals	http://mammiferimarini.unipv.it/index_en.php	
Italy	NGOs/ local authorities	seafloor, water, beach/shoreline	Seabed Cleaning (GIONHA) surveys. Recreational and professional fishing and diving collecting litter. Bottom trawl fishing collecting litter on the seabed. Beach cleaning by volunteers, tourists and fishermen	www.gionha.eu	Governance and Integrated Observation of Marine Natural Habitat (GIONHA). www.gionha.eu

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SEVENTH FRAMEWORK PROGRAMME

Annex IV. National Survey Activitiesin the Black Sea

Country in the Black Sea	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Bulgaria	NGOs/Local authorities	beach/ shoreline	UBBSLA Bourgas Beach Survey		Union of Bulgarian Black Sea Local Authorities, UBBSLA. Mariana Kancheva. office@ubbsla.org
Bulgaria	NGOs/Local authorities	beach/ shoreline	UBBSLA Pomorie Beach Survey		Union of Bulgarian Black Sea Local Authorities, UBBSLA. Mariana Kancheva. office@ubbsla.org
Bulgaria	NGOs/Local authorities	beach/ shoreline	UBBSLA Sozopol Beach Survey		Union of Bulgarian Black Sea Local Authorities, UBBSLA. Mariana Kancheva. office@ubbsla.org
Romania	NGOs/Local authorities	beach/ shoreline	Coastwatch beach monitoring. Marine litter from land-base sources (tourism)-plastics, metals, glass, sanitary, household waste, building material		Andreea Ionascu - ONG Mare Nostrum [andreea_ionascu@marenostrum.ro]
Romania	NGOs/Local authorities	beach/ shoreline	'Lets do it Romania'- World Cleanup		http://letsdoitromania.ro
Turkey	R&D	seafloor	Marine debris is investigated in the Turkish seabed of the Black Sea. Turkish Marine Research Foundation	Topcu & Ozturk 2010. Abundance and composition of solid waste materials on the western part of the Turkish Black Sea seabed. Aquatic Ecosystem Health & Management, 13: 3, 301 — 306. http://www.tandfonline.com/doi/abs/10.1080/14634988.2010.503684	TUDAV (Turkish Marine Research Foundation), edatopcu@istanbul.edu.tr;

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Country in the Black Sea	Type of survey activity	Environmental Component	Description	Reference (report, publication)	point of contact
Turkey	R&D	Beach/shoreline	Marine Debris on sandy beaches of the SW Black Sea is investigated. Turkish Marine Research Foundation	Topçu, E.N., Tonay M.A., Dede A., Öztürk A.A., Öztürk B., 2012. Origin and abundance of marine litter along sandy beaches of the Turkish Western Black Sea Coast. Marine Environmental Research, 85: 21-28. http://www.sciencedirect.com/science/article/pii/S0141113612002243	TUDAV (Turkish Marine Research Foundation), edatopcu@istanbul.edu.tr

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Annex4_Questionnaire and guidance for collection of information on national surveys

MARLISCO WP1 – Revised Guidance Notes (6 Dec 2012) for partners providing data on distribution and sources of marine litter (tasks 1.1 & 1.2). Partner 3, PJ Kershaw, Cefas, 6 December 2012

Objectives

Task 1.1 To provide a review of sources, distributions & trends of marine litter, at a national and regional scale.

This is to provide information for use within MARLISCO, it is not intended to replicate work being carried out within the MSFD process. The information, or 'evidence base', will be made available to all MARLISCO partners to help support the various activities that are planned (e.g. WP6 Deliverable 6.1, education pack):

a) Distribution (spatial and time-series), quantities & types of marine litter (ML) in European Seas, by MSFD region & partner country. This should refer to the MSFD Initial Assessment *if* national information is available. But, we cannot wait for the IA results to appear and in any case we want to be able to use any reliable data that have been produced to establish regional of temporal trends.
b) Information on the type & relative importance of sources of marine litter, covering land- and sea-based and direct and indirect inputs. Some surveys may provide data on this, but in other cases you should look for additional information. This could include reports by national or regional bodies, or other organizations, covering sectors such as coastal tourism, shipping, fisheries or wastewater/sewage treatment. What estimates can we find about how much litter is entering the sea and by what routes?
c) Please provide examples of the impact of marine litter on the marine environment. This can include ecological (e.g. entangled wildlife), social (e.g. sewage-related waste on tourist beach) or economic (e.g. cost of rescuing sailors when propeller is fouled; loss of fishing days). We need images and numbers.

Task 1.2 to provide a summary of monitoring and assessment methods.

This will take account of the outputs from the MSFD Technical Support Group on marine litter, but we would also like to capture what methods are currently in use; for example, the International Coastal Clean-up, UNEP or OSPAR recommendations. A column on sampling methods has been added to the metadata template.

Methods

Metadata template

The Metadata template is provided so we can collect information, in a harmonized way, about monitoring activities of marine litter in the different environmental compartments (shoreline/beach, seabed, water column and others such as in biota). Information on surveys should be allocated to MSFD regions (NE Atlantic, Baltic, Mediterranean and Black Sea) and corresponding MSFD sub-regions where relevant (see Figure 1). We will also use it to collect information about sources of litter.

Please complete the template on sources and distribution of marine litter and load onto Basecamp site with filename: MARLISCO_WP1_T1-1_Sources&distributions_*partnername* The revised template contains an example data set. This form can also be used to indicate other relevant information; for example, studies of the impacts of litter on biota, using a link to a URL or attaching an additional file with self explanatory filename.

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Figure 1 MSFD sub-regions (EC DIKE, 2012)

Excel spreadsheet for litter data

If you have free access to survey/monitoring datasets, please enter these onto the Excel spreadsheet and load onto Basecamp site with filename: MARLISCO_WP1_T1-1_Litter-data_*partnername*. This will allow us to produce maps and other diagrams to a common format and, potentially, compile regional distribution maps where data are compatible. The name of the survey should match the entry on the metadata template so we can cross-reference the information.

Information on the availability of marine litter categories for macrolitter and microlitter (fragments of size below 5mm) is also requested. Please specify which categories have been used. Common formats are:

- Macro Litter categories (A to G): A: Plastic, B: sanitary waste, C: metals, D: Rubber, E: Glass/ Ceramics, F: Natural products, and G: miscellaneous.
- Micro litter categories (fragments <5mm) might include different criteria: a) size, b) color, c) form/shape, and d) polymer type.

Existing maps, images and other graphics

If you already have access to pre-prepared maps, images and other graphics then load onto the Basecamp site with self-explanatory filenames: e.g. MARLISCO_WP1_T1-1_litter-map-Adriatic_*partnername*

Scope

- To utilize existing regional assessments (Baltic, Black Sea, Mediterranean & NE Atlantic)
- Take account of MSFD initial assessments and utilize existing national assessments *if* these are available
- To utilize existing beach surveys, independent or through the International Coastal Clean-up
- To focus on sources of macroscopic debris (sea-based & land-based) and distributions, but consider potential sources and distributions of primary micro-plastics (industrial, consumer goods such as hand- & face-cleansers) and secondary (i.e. fragmented) micro-plastics
- Potential sources to include: coastal tourism, shipping, fisheries, waste management, plastics production, recycling, aquaculture
- To provide examples of the effects of ML on the marine environment (ecological, social or economic)

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- Where possible to estimate the quantities of litter in EU waters that enter the marine environment from outside the jurisdiction of EU Member States
- Consider the use of proxy data to estimate possible ranges of inputs (e.g. shipping densities, fishing effort, population densities, river flows, recycling rates, number of visitors to coast)

Marine Litter Categories and Subcategories

MACRO LITTER (size >5mm)			
A: Plastic	**B: Sanitary/Sewage**	**D: Rubber**	
A1. Bottle	B1. diapers	D1. Boots	
A2. Sheet	B2. sanitary towel/tampon	D2. Balloons	
A3. Bag	B3. Other	D3. bobbins (fishing)	
A4. Caps/ lids	**C: Metals**	D4. tyre	
A5.Fishingline (monofilament)	C1. Cans (food)	D5. other	
A6. Fishing line (entangled)	C2. Cans (beverage)	**E: Glass/ Ceramics**	
A7. Synthetic rope	C3. Fishing related	E1. Jar	
A8. Fishing net	C4. Drums	E2. Bottle	
A9. Cable ties	C5. appliances	E3. piece	
A10. Strapping band	C6. car parts	E4. other	
A11. crates and containers	C7. cables		
A12. other	C8. other	**Other related size category**	
F: Natural products	**G: Miscellaneous**	**A:** <5*5 cm = 25 m^2	
F1. Wood (processed)	G1. Clothing/ rags	**B:** <10*10 cm= 100 cm^2	
F2. Rope	G2. Shoes /	**C:** <20*20 cm= 400 cm^2	
F3. Paper/ cardboard	G3. other	**D**: <50*50 cm= 2500 cm^2	
F4. pallets		**E:** <100*100 cm= 10000 cm^2= 1 m^2	
F5. other		**F:** >100*100 cm = 10000 cm^2= 1 m^2	

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MARLISCO WP1 Task 1.1 – METADATA TEMPLATE – Distribution and Sources of Marine Litter
EXAMPLE

Partner	Cefas
Nation	UK
MSFDregion/sub-region*	NE Atlantic/Celtic Sea

*please complete a separate table for each region/sub-region

1. Distribution of marine litter by country and MSFD region/sub-region

METADATA on Surveys											
Matrices	Survey Name and/or Location (MACRO or MICRO <5mm litter)	Survey Time-scale mm/yyyy – mm/yyyy	Survey frequency (e.g. annual, monthly)	Categories of litter available (YES/NO)	Survey Method	Time-series available(YES/NO)	Distribution maps available (YES/NO)	Mass/ number/ volume of items	Geo-located data available (YES/NO)	Reference/URL and email as point of contact	Comments (e.g. additional information on survey)
Shoreline and beach											
Water column or surface floating	*RV Cefas Endeavour* cruise CEND/3-11. Celtic Sea, MICRO	02/2011 – 03/2011	3 surveys in 2 months, 151 locations	Yes. (size, form and colour)	Manta Trawl 330 µm mesh	NO	YES	Number (Item/km^2)	YES	Thomas.maes@cefas.co.uk Paper in preparation	
Seabed (seafloor-benthic	Cefas IBTS trawl survey. Celtic Sea, MACRO	1992 – 2012	2 surveys per year at fixed sampling stations	Yes. Main categories (A to G) and 40 subcategories.	Beam or Otter Trawl	YES	YES	Number (Item/km^2)	YES	Thomas.maes@cefas.co.uk paper in preparation	Cefas IBTS Extends into Greater North Sea sub-region
Other											
In Biota (ingested)											
Riverine inputs											
Sewage											

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EXAMPLE

2. Sources of marine litter

Sectors	Type[1]	Quantities[2]	references
Land-based[3]			
River inputs. Waste management – fly tipping and sewage overflows	Sewage-related, plastics	Proportions of each type in river water	Williams, A.T. & Simmons, S.L., 1999. Sources of riverine litter; the River Taff, South Wales UK. Water, Air & Soil Pollution, 112, 197-216.
Waste management sewage treatment	Sewage related, e.g cotton buds	Cotton buds on beaches in the Clyde 2003-2007	http://www.scotland.gov.uk/Publications/2011/03/16182005/40
Sea-based[4]			
Multiple-sources			
UK beach surveys	Categorized into plastic/other and by source	Items/km	http://chartingprogress.defra.gov.uk/clean-seas-litter

[1] Litter type – is information available of main types of litter?
[2] Number , volume of mass of items
[3] For example: coastal tourism, rivers, sewage/wastewater discharges, storm drain overflows, airborne (e.g. balloons), fishing from the beach, industrial discharges
[4] For example: shipping, commercial fisheries, other platforms, non-commercial/pleasure craft

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MARLISCO spatial and temporal data series on marine litter

EXAMPLE

Partner:	Cefas
Nation:	UK
MSFD region/sub-region	NE Atlantic/ Celtic Sea

	Survey Name and/or Location (MACRO or MICRO <5mm litter)	Survey Time-scale - mm/yyyy-mm/yyyy	Station/sample number or other identifier	sampling date dd/mm/yyyy	latitude	longitude	other positional data	Survey method	number of items	mass of items	volume of items	categories collected and % for macrolitter, or microlitter (<5mm), (see guidance note)						
Matrices									units	units	units							
Shoreline and Beach																		
Water column or surface floating	RV Cefas Endavour cruise CEN/3-11. Celtic Sea,MICRO	02/2011 - 03/2011	cruise station number					modified Manta trawl	items/ km^2			4.9-4.5mm %	5.4-2.8mm %	2.8-1mm %	1-0.97mm %	0.97-0.5mm %		
			CE0002	02/03/2011	51.2311	-4.40234		Manta trawl	12000			0	0	20	50	30	100	
			CE0003	02/03/2011	51.2425	-4.40189		Manta trawl	15500			0	0	14	53	33	100	
			CE0004	02/03/2011	51.2445	-4.40211		Manta trawl	11450			0	0	12	45	43	100	
			etc															
Seabed (seafloor-benthic)	Cefas IBTS trawl survey. Celtic Sea. Macro	09/2010 - 10/2010	cruise station number					Otter trawl	items/ km^2			A: % plastics	B: % sanitary	C: % Metals	D: % Rubber	E: % Glass	F: % Natural	G: % Miscellanous
			CE2701	14/09/2010	51.2238	-4.40235		Otter trawl	350			75	1	8	3	2	5	6
			CE2702	15/09/2010	51.2338	-4.40234		Otter trawl	270			65	3	4	8	5	6	9
			CE2703	15/09/2010	51.24117	-4.41341		Otter trawl	295			69	0	2	4	3	3	19
			etc															
Others																		
in Biota ingested or entangled																		
riverine inputs																		
sewage																		

MARLISCO
Stopping Marine Litter Together