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Nice, France, 27-28 April 2017

Agenda item 4. Regional Assessment of the Mediterranean Marine and Coastal Environment: the development of the Quality Status Report

Quality Status Report (QSR) Assessment Factsheets on Marine Litter

UNEP/MAP
Athens, 2017

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Introduction

1. The Integrated Monitoring and Assessment Programme (IMAP) including 23 Common Indicators and 4 Candidate Indicators was adopted at the 19th Meeting of the Parties to the Barcelona Convention (COP 19) in February 2016[1]. The 2017 Quality Status Report (QSR2017) will be the first report on the IMAP-based Ecological Objectives and related common indicators. The UNEP/MAP Programme of Work adopted at COP 19 has a specific Output 1.4.1 *"Periodic assessments based on DPSIR approach and published addressing inter alia status quality of marine and coastal environment, interaction between environment and development as well as scenarios and prospective development analysis in the long run. These assessments include climate change-related vulnerabilities and risks on the marine and coastal zone in their analysis, as well as knowledge gaps on marine pollution, ecosystem services, coastal degradation, cumulative impacts and impacts of consumption and production."* The specific activity for 2016-2017 is to "*Prepare and publish Quality Status Report (QSR) based on MAP EcAp-based EO and related common indicators"*

2. Since the adoption of the IMAP decision at COP19, and given the IMAP implementation is still at an early phase, the approach for the QSR2017 accommodates the short time availably for preparation of this report and data gaps on some of the IMAP indicators, and also considers the approach taken by other Regional Seas (such as OSPAR), and global work such as ongoing work of the Regional Process on a second World Ocean Assessment(s) and the process on implementing the 2030 Agenda, especially in relation to oceans related Sustainable Development Goals (SDGs). As countries are still in the process of revising their national monitoring programmes, it will not be possible to compile a full set of data for all IMAP indicators for the QSR2017. Therefore the approach for the QSR2017 is to use all indicator data available and to complement and address gaps with inputs from numerous sources. In the initial steps additional sources of information are identified and mapped, from other partners, the NAP reports, etc.

3. The QSR2017 report will be prepared as an online interactive report so that the report can be made widely available, be visually appealing, include graphics and animations (such as time series maps of concentrations), and in addition to the main section, can have links to case studies, from Contracting Parties and also partners), or links to other databases and information sources. A Summary Report will also be prepared and published. The QSR2017 will be presented to 20th Meeting of Contracting Parties to the Barcelona Convention in December 2017, with a recommendation for future assessments.

4. The current document presents the indicators for Ecological Objective 10. Marine Litter: Common Indicator 22: Trends in the amount of litter washed ashore and/or deposited on coastlines (including analysis of its composition, spatial distribution and, where possible, source); and Common Indicator 23: Trends in the amount of litter in the water column including microplastics and on the seafloor. As the Mediterranean Marine Litter monitoring database is still in development, and Contracting Parties are not yet submitting data to the UNEP/MAP Secretariat, this assessment is based on a number of recent reports and results from several projects and initiatives in the Mediterranean, and data provided. The main report used is the UNEP/MAP (2015) Marine Litter Assessment in the Mediterranean, which was reviewed and agreed upon during the MED POL Focal Points in June 2015.

5. These QSR assessment factsheets were first reviewed by the Meeting of the Ecosystem Approach Correspondence Group on Marine Litter Monitoring, held in Madrid, Spain, on the 28 February – 2 March 2017. Revised versions of these factsheets will be shared online with CORMON experts and the Marine Litter online working group for further review.

[1] UNEP(DEPI)/MED IG.22/28. Decision IG.22/7: Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria

6. Contracting Parties and participants are invited to contribute to this initial draft of the assessment factsheets through the following:

i. To review and comments for the further revision of the assessment factsheets
ii. To provide to the Secretariat any information, assessments or publications that can be included in the further revision of the assessment factsheets
iii. To propose, in addition to the regional level assessment factsheets proposals for case studies at the local, national or regional level for one or more indicator that can also be included in the QSR2017.

Ecological Objective EO10. Marine and coastal litter do not adversely affect the coastal and marine environment.

EO10: Common Indicator 22. Trends in the amount of litter washed ashore and/or deposited on coastlines (including analysis of its composition, spatial distribution and, where possible, source).

Content	Actions[2]	Guidance
General		
Reporter	Underline appropriate	UNEP/MAP/MED POL SPA/RAC REMPEC PAP/RAC Plan Bleu (BP)
Geographical scale of the assessment	Select as appropriate	Regional: Mediterranean Sea
Contributing countries	Text	Mediterranean assessment based on existing regional and national surveys, research and publications and as appropriate data from national monitoring programmes of the Contracting Parties.
Mid-Term Strategy (MTS) Core Theme	Select as appropriate	1-Land and Sea Based Pollution
Ecological Objective	Write the exact text, number	Ecological Objective 10 (EO10): Marine and coastal litter do not adversely affect the coastal and marine environment.
IMAP Common Indicator	Write the exact text, number	Common Indicator 22 (CI22): Trends in the amount of litter washed ashore and/or deposited on coastlines (including analysis of its composition, spatial distribution and, where possible, source).
Indicator Assessment Factsheet Code	Text	EO10CI22
Rationale/Methods		
Background (short)	Text (250 words)	Much of what we know on the presence of marine litter (abundance, distribution, origin) in the marine and coastal environment comes from information collected on marine litter stranded on beaches (Ryan et al., 2009). Beach marine litter has drawn a lot of attention and numerous surveys and corresponding campaigns have been organized. However, a comparison among all these different studies is made difficult as the majority of these studies use different sampling protocols, techniques and methods. As in all marine compartments, plastics are predominant among the collected marine litter items found stranded on beaches. Several NGOs have been very active in tackling the problem, increasing the environmental awareness of the citizens, along with engaging them in

[2] The Column of "Actions" will be removed from the final revised version of the assessment factsheet and is only kept in this document for information purposes.

Content	Actions[2]	Guidance
		marine litter related surveys, events and actions. Most of the available information on beach marine litter for the Mediterranean Sea comes from standing-stock surveys. Monitoring of marine litter found stranded along the coastline of the Mediterranean still remains a priority. Special attention should be drawn upon the quantification and characterization of litter pollution found on beaches along with providing comparable datasets to support national and regional assessment of beach marine litter (JRC, 2013). This is also the key to introduce and implement effective policy and management measures. An in depth and comprehensive understanding of the level of threat posed by marine litter to biota and ecosystems at regional should be based upon reliable, quality assured, homogenized and comparable datasets and all efforts should target towards that direction.
Background (*extended)*	Text (no limit), images, tables, references	Even the most remote parts of the Mediterranean are affected by marine litter. The findings of the "Assessment of the status of marine litter in the Mediterranean" (2009) undertaken by UNEP/MAP MED POL in collaboration with the Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSDE), the Hellenic Marine Environment Protection Association (HELMEPA), and Clean up Greece Environmental Organization, illustrate that although useful data on types and quantity of marine litter exists in the region, it is inconsistent and geographically restricted mainly to parts of the North Mediterranean. The economic values from coastal recreation are considerable (Ghermandi and Nunes, 2013). Clean seas and beaches are key to attract local and international tourism and are an integral part of the UN Environment / Mediterranean Action Plan Integrated Monitoring Assessment Programme and related Assessment Criteria (IMAP) and the European Marine Strategy Framework Directive (MSFD), in which marine litter is one of the key indicators to assess Good Environmental Status (GES) and the effectiveness of policy measures (Brouwer et al., 2017; Galgani et al., 2013). Beach marine litter have been argued to pose a significant cost on society, in particular in the way they affect coastal tourism and recreation (UNEP, 2009). The issue of marine litter and related information on the amounts and types in the Mediterranean is rather complicated, because most Contracting Parties have not yet implemented official monitoring programmes and, in these cases, it is addressed principally by scientific institutions and sub-regional and local authorities in most countries on the one hand and by competent NGOs on the other hand. Collection of information is a task that requires considerable human resources directly and indirectly related to the subject along with the sophisticated central coordination mechanism. A relatively systematic and reliable source for amounts and types of litter is usually the existing NGO initiatives in the region. NGO efforts are the most significant in terms of surveying and cleaning beaches and the sea and providing information on the volume and types of litter existing in the Mediterranean. Furthermore initiatives of varying importance are taken up by NGOs, local authorities and other partners at national and local level in almost all Mediterranean countries. Thousands of volunteers have been gathered in the Mediterranean countries with the purpose not only to clean the coasts, rivers and lakes in their local communities but also to raise awareness amongst students, citizens, and various stakeholders about the serious implications of marine litter and to inspire people to make a difference and improve their daily environmental conduct. Strandline surveys, cleaning, and regular surveys at sea are gradually being organized in many Mediterranean countries for the aim of providing information on temporal and spatial distribution. Various strategies based on the measurement of quantities or fluxes have been adopted for data collection purposes. However, most surveys are conducted by NGOs with a focus on cleaning. Moreover, small fragments measuring less than 2.5

Content	Actions[2]	Guidance
		cm, also referred to as meso-litter(versus macro-litter), are often buried and may not be targeted by clean-up campaigns or monitoring surveys. Stranding fluxes are therefore difficult to assess, and a decrease in litter amounts at sea will only serve to slow stranding rates. They can comprise a large proportion of the debris found on beaches and very high densities have been found in some areas. Standing stock evaluations of beach litter reflect the long-term balance between inputs, land-based sources or stranding, and outputs from export, burial, degradation and clean-ups. Recording the rate at which litter accumulates on beaches through regular surveys is currently the most commonly-used approach for assessing long-term accumulation patterns and cycles. One of the major problems that still occur for beach marine litter is due to the fact that each initiative is conducted with different data cards, standards, and measures (litter types are classified differently, if at all; in some cases litter is measured in items while in others by weight, etc.), while certain crucial information is completely lacking (length of coast cleaned, type of coast, proximity of coast to sources of litter, etc.) (UNEP/MAP, 2015).
Assessment methods	Text (200-300 words), images, formulae, URLs	The current assessment has been based on recent key assessments, reports and publications by UNEP/MAP, and other projects and initiatives. The UNEP/MAP (2015) Marine Litter Assessment in the Mediterranean report has been used as the main source for this indicator assessment factsheet. Strandline surveys, cleaning, and regular surveys at sea are gradually being organized in many Mediterranean countries for the aim of providing information on temporal and spatial distribution. Various strategies based on the measurement of quantities or fluxes have been adopted for data collection purposes. However, most surveys are conducted by NGOs with a focus on cleaning. Moreover, small fragments measuring less than 2.5 cm, also referred to as meso-litter (versus macro-litter), are often buried and may not be targeted by clean-up campaigns or monitoring surveys. Stranding fluxes are therefore difficult to assess, and a decrease in litter amounts at sea will only serve to slow stranding rates. They can comprise a large proportion of marine litter found on beaches and very high densities have been found in some areas. Moreover, more sophisticated strategies for monitoring beach marine litter can be also applied including the following aspects: selection of survey sites (100m stretch) and number of sites, frequency and timing of surveys, documentation and characterisation of sites, selection of sampling unit and unit for quantifying litter, collection and identification of litter items (survey forms, master list of items), size limit and classes of items, and removal and disposal of litter. The recruitment and training of the corresponding staff and groups of volunteers are a requirement for any long-term marine litter assessment (UNEP, 2009). Staff and volunteers should have a very good level of understanding on the context and purpose of the marine litter assessment programme. Quality assurance and quality control of the collected data should be also ensured, mainly addressed through a consistent way of collecting and characterizing data at regional level.

Results		
Results and Status, including trends (brief)	Text (500 words), images	 It is currently difficult to assess the impact of marine litter on beaches due to the spatial availability of data and information in the Mediterranean (with most data found on northern shores), and also a lack of comparability between data dues to differing methodologies used. Mediterranean NGOs have significantly contributed in providing data and information on the temporal and spatial distribution of marine litter found stranded on beaches through beach clean-up campaigns and dedicated monitoring surveys but still many of these are not comparable to give a complete picture at regional level. Also, little is known on the accumulation and loading rates and correspondingly stranding fluxes and rates are difficult to assess. Information is available on the main types of beach marine litter comprise of plastic, glass, paper, metal, polystyrene, cloth, rubber, fishing-related items, munitions, wood, smoking-related items, sanitary waste , and other un-identified items (Table 1). According to ICC 2014, the top items for the Mediterranean Sea are: cigarette butts, food wrappers, plastic bottles, caps, straws/stirrers, plastic grocery bags, glass bottles, other plastic bags, paper bags and beverage cans. Plastics are predominant of litter found on beaches accounting for over 80% of the recorded marine litter (UNEP/MAP, 2015). Within these marine litter types, specific items are found more frequently i.e. cigarette butts, food wrappers, plastic bottles, caps, straws and stirrers, grocery plastic bags, glass bottles, other plastic bags and cans. Most of the recorded marine litter items are derived from land-based sources (including poor waste management practices, recreational and tourism activities).

Table 1: Composition/ sources of marine litter in the Mediterranean (After Interwies et al., 2013)

Source (Literature)	Items/Consistency (beaches; top five)	Type of material	Sources
: IPA Adriatic DeFishGear (2016)	Items (top 5): -Plastic pieces 2.5 cm > < 50 cm : 19.89% -Polystyrene pieces 2.5 cm > < 50 cm: 11.93% -Cotton bud sticks: 9.17% -Plastic caps/lids from drinks: 6.67% -Cigarette butts and filters: 6.60%	Plastics: 91%	Recreational & tourism:40% Households(combined): 40% Coastal tourism: 32,3% Toilet/sanitary: 26,2% Household: 11,2% Waste collection: 6% Recreational: 5,6%
Öko-Institut (2012; figures mainly from UNEP, 2009)	-Cigarette butts: 29,1% - Caps/lids: 6,7% - Beverage cans: 6,3% - Beverage bottles (glass): 5,5% - Cigarette lighters: 5,2%	Beaches: 37-80% plastics Floating: 60-83% plastics Sea-floor: 36-90% plastics	Recreational/shoreline activities: >50%, Increase in tourism season
Ocean Conservancy/ ICC 2002-2006			Beach litter: recreational activities: 52% Smoking-related activities: 40% waterways activities: 5%
JRC IES (2011)		Beach:83% plastics/polystyrene	

Shoreline activities (including poor waste management practices, tourism and recreation), along with sea/waterway activities, smoking-related activities, dumping and improper disposal of medical/personal hygiene items are among the main beach marine litter sources (Table 1). Tourism has a significant share in the generation of beach marine litter. During the summer period population is almost doubled in the coastal areas of the Mediterranean Sea being directly linked with the increased waste generation reaching up to 75% of the annual waste production for some areas. In the same extent marine litter concentration has been found to double during summer.

Public and awareness, citizen engagement and participation are effectively contributing in tackling the problem of marine litter along the shorelines of the Mediterranean Sea.

Results and Status, including trends (extended)	Text(no limit), figures, tables	Strandline surveys, cleaning, and regular surveys at sea are gradually being organized in many Mediterranean countries for the aim of providing information on temporal and spatial distribution. Various strategies based on the measurement of quantities or fluxes have been adopted for data collection purposes. However, most surveys are conducted by NGOs with a focus on cleaning. Moreover, small fragments measuring less than 2.5 cm, also referred to as mesolitter (versus macro litter), are often buried and may not be targeted by clean-up campaigns or monitoring surveys. Stranding fluxes are therefore difficult to assess, and a decrease in litter amounts at sea will only serve to slow stranding rates. They can comprise a large proportion of the litter found on beaches and very high densities have been found in some areas.

Based on data provided by the Ocean Conservancy and processed and analyzed by HELMEPA from beach clean-ups in Mediterranean countries within the framework of the International Coastal Cleanup (ICC) campaign, the main types of litter found on Mediterranean beaches, are listed in Table 2 and Table 3 hereunder.

Table 2: Main types of marine litter in the (beach) Mediterranean (ICC after UNEP, 2011)

Plastics: bags, balloons, beverage bottles, caps/lids, food wrappers/ containers, six-pack holders, straws/stirrers, sheeting/tarps, tobacco packaging and lighters
Glass: beverage bottles, light bulbs
Paper and cardboard of all types
Metals: aluminium beverage cans, pull tabs, oil drums, aerosol containers, tin cans, scrap, household appliances, car parts
Polystyrene: cups/plates/cutlery, packaging, buoys
Cloth: clothing, furniture, shoes
Rubber: gloves, boots/soles, tires
Fishing related waste: abandoned/lost fishing nets/line and other gear
Munitions: shotgun shells/wadding
Wood: construction timber, crates and pallets, furniture, fragments of all the previous
Cigarette filters and cigar tips
Sanitary or sewage related litter: condoms, diapers, syringes, tampons
Other: rope, toys, strapping bands

Table 3: Top ten items in the Mediterranean Sea (International Coastal Clean-up, ICC, 2014). Total number is the number of items collected on 59.2 miles of beaches from 8 different countries.

	cigarette butts	**food wrappers**	**plastic bottles**	**caps**	**straws/ stirrers**	**Grocery bags (plast.)**	**glass bottles**	**other plastic bags**	**paper bags**	**cans**
Total collected number	98117	6796	11295	16490	24724	6350	3443	4706	2436	6405
number /100m	175	12	20	29	44	11	6	8	4	11

By far the most predominant type of marine litter in the Mediterranean is cigarette filters (closely followed by cigar tips), which constitute a concern to the region and can be found even in the most remote coastal areas. Thus, 4858 volunteers collected 95641 cigarette filters in 2013, which corresponds to almost 19.6 cigarette filters per volunteer, while the global average in 2006 was only 3.66 cigarette filters per volunteer. The degradation time for each type of litter is an important factor, as some may degrade fast, in the range of months or years, indicating more concern.

Table 4: Composition/ sources of marine litter in the Mediterranean (After Interwies et al., 2013)

Source (Literature)	Items/Consistency (beaches; top five)	Type of material	Sources
: IPA Adriatic DeFishGear (2016)	Items (top 5): -Plastic pieces 2.5 cm > < 50 cm : 19.89% -Polystyrene pieces 2.5 cm > < 50 cm: 11.93% -Cotton bud sticks: 9.17% -Plastic caps/lids from drinks: 6.67% -Cigarette butts and filters: 6.60%	Plastics: 91%	Recreational & tourism:40% Households(combined): 40% Coastal tourism: 32,3% Toilet/sanitary: 26,2% Household: 11,2% Waste collection: 6% Recreational: 5,6%
Öko-Institut (2012; figures mainly from UNEP, 2009)	-Cigarette butts: 29,1% - Caps/lids: 6,7% - Beverage cans: 6,3% - Beverage bottles (glass): 5,5% - Cigarette lighters: 5,2%	Beaches: 37-80% plastics Floating: 60-83% plastics Sea-floor: 36-90% plastics	Recreational/shoreline activities: >50%, Increase in tourism season
Ocean Conservancy/ ICC 2002-2006			Beach litter: recreational activities: 52% Smoking-related activities: 40% waterways activities: 5%
JRC IES (2011)		Beach:83% plastics/polystyrene	

A study primarily based on the analysis of data collected within the framework of the ICC campaigns in Mediterranean countries (http://www.oceanconservancy.org/our-work/international-coastal-cleanup/) provided a classification system (Table 5).

Table 5: Classification of marine litter by source (in accordance with Ocean Conservancy's ICC campaign – with minor adjustments).

Shoreline Sources (including poor waste management practices, tourism and Recreational Activities
Litter from land-based activities such as fast food consumption, beachgoers, picnics, sports and recreation, festivals, as well as litter washed from streets, parking lots and storm drains and as a result of poor waste disposal schemes and illegal dumping. Litter items classified in this category include plastic bags, balloons, beverage bottles (plastic & glass) and aluminium cans, caps/lids, clothing, cups/plates/forks/knives/spoons, food wrappers/containers, pull tabs, shotgun shells/wadding, six-pack holders, straws/stirrers and toys
Sea/Waterway Activities
Recreational fishing and boating, commercial fishing, cargo/military/passenger and cruise ship operations and offshore industries such as oil drilling. Litter items included bait containers, bleach/cleaner bottles, buoys/floats, crab/lobster/fish traps, crates, fishing nets and lines, fishing lures/light sticks, light bulbs/tubes, oil/lube tubes, pallets, plastic sheeting, rope and strapping bands.

Smoking-Related Activities	
Improper disposal of cigarette filters, cigar tips, lighters and tobacco product packaging is common on both land and sea.	
Dumping Activities	
Legal and illegal dumping of construction materials, large household items, etc. often results in coastal litter. Other litter items classified in this category include batteries, cars/car parts, tires and drums.	
Medical/Personal Hygiene	
This litter can result from people improperly disposing of waste in toilets and city streets. Since medical and personal hygiene litter often enters the waste stream through sewer systems, its presence on the beach can indicate the presence of other, unseen pollutants. Litter items classified in this category includes condoms, diapers, syringes and tampons.	

Marine litter from smoking related activities accounts for 40% of total marine litter in the same period and 53.5% of the top ten items counted in 2013. Although the number of litter items from smokers dropped significantly between 2004 and 2005, since 2005 it has been on the rise again. The figure in the Mediterranean is considerably higher than the global average, and constitutes a serious problem that has to be given priority in a Regional Strategy to address the issue.

Many studies dedicated to the local beaches surveys and litter collection provide information on litter and tourism. During summer season, the populations of seaside towns are sometimes double what they are in wintertime. In some tourist areas, more than 75% of the annual waste production is generated in summer season. According to statistics from holiday destinations in the Mediterranean (Bibione-Italy and Kos-Greece), tourists generate an average of 10% to 15% more waste than inhabitants. In the example of Kos Island, the tourism period is from April to October, with 70% of the total annual waste produced during this period (UNEP 2011).

Malta, where over 20% of the Global Net Production is generated from tourism, realized an increase of packaging (37% of municipal solid waste) in 2004 and introduced "bring-in sites" with 400 stations installed by 2006 (State of the Environment Report Malta, 2005, in UNEP 2011). Unfortunately, no new data regarding the results of the introduction is yet available, and the latest report from 2005 still shows an increasing waste production per capita and tourism.

Research funded by the Balearic Government in 2005 (Martinez-Ribes *et al.*, 2007) focused on the origin and abundance of beach litter in the Balearic Islands, including Mallorca, Menorca, and Ibiza, which are all main tourist destinations. This fundamental study shows similarities to other tourism areas and is therefore very helpful regarding the sources of littering, which are highly connected to tourism. Litter found in summertime is twice as much as in winter (Figure 1).

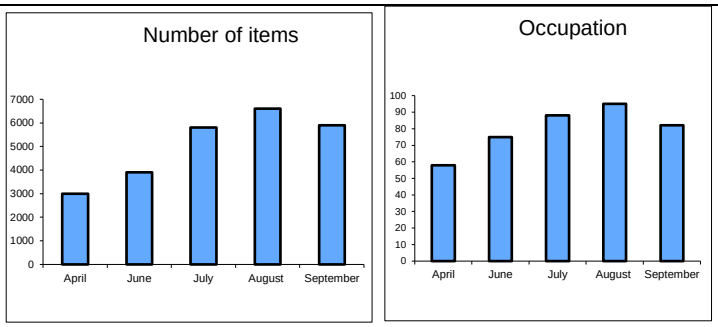


Figure 1: Monthly variation of litter items (A) and percentage of hotel occupation for the corresponding date (B) in the Balearic Islands (Source Martinez-Ribes et al., 2007).

In another example, Israel achieved good results with their pollution abatement Clean Coast Index, involving Municipalities and NGOs in beach clean-ups (Ministry of Environmental Protection, 2008). Although there is no data about the types and quantities of litter pollution in the coastal areas, the published index shows a 30% reduction of littered beaches. Raising public awareness with leaflets and competitions in tourism and public areas supported the strategy, and the ongoing efforts will be continued on a yearly basis to continue to tackle the litter problem on the shorelines of Israel. Moreover, data from a monitoring experiment on a sample of 52 beaches in France (Mer-terre.org) confirmed the existence of tourism and fishing related activities as main sources of litter.

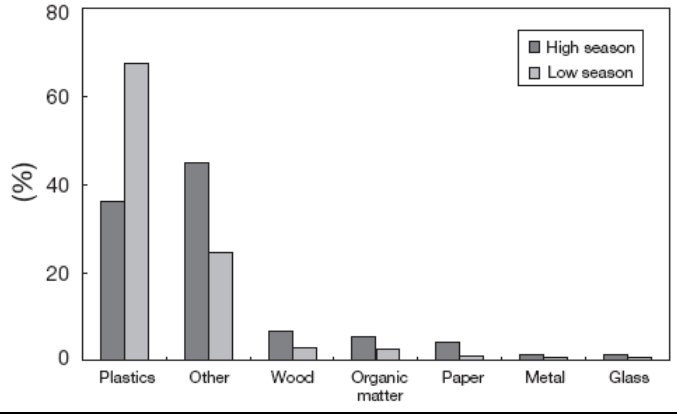
The IPA-Adriatic DeFishGear provides valuable data on beach litter from its one-year long surveys carried on beaches in the seven countries of the Adriatic-Ionian macroregion, namely Albania, Bosnia and Herzegovina, Croatia, Italy, Greece, Montenegro and Slovenia. More specifically 180 beach transects were surveyed in 31 locations, covering 32,200 m2 and extending over 18 km of coastline. The majority of litter items were artificial polymer materials accounting for 91.1% of all beach litter. Shoreline sources -including poor waste management practices, tourism and recreational activities- accounted for 33.4% of total litter items collected on beaches. When looking at the sea-based sources of litter (fisheries and aquaculture, shipping) these ranged from 1.54% to 14.84% between countries, with an average of 6.30% at regional level for beach litter.

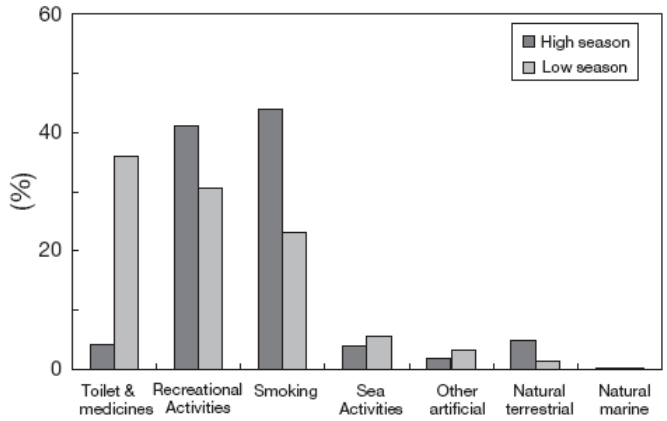
Standing stock evaluations of beach litter reflect the long-term balance between inputs, land-based sources or stranding, and outputs from export, burial, degradation and clean-ups. Recording the rate at which litter accumulates on beaches through regular surveys is currently the most commonly-used approach for assessing long-term accumulation patterns and cycles. The majority of studies performed to date have demonstrated densities in the 1 item/m^2 range but show a high variability in the density of litter depending the use or characteristics of each beach (UNEP/MAP, 2015). Plastic accounts for a large proportion of the litter found on beaches in many areas, although other specific types of plastic are widely-found in certain areas, according to type (Styrofoam, etc.) or use (fishing gear). For ICC (Table 6), cigarette butts, plastic bags, fishing equipment, and food and beverage packaging are the most commonly-found items, accounting for over 80% of litter stranded on beaches.

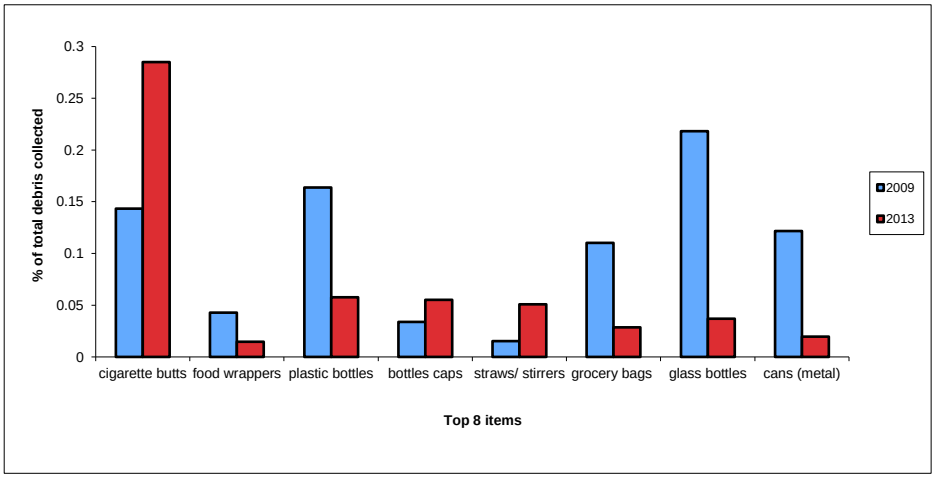
Table 6: Top ten items by country (International Coastal Clean-up, ICC 2014) expressed as number of items/100m of beach

	Number of items per 100 m									
COUNTRY	Cigarette butts	Food wrappers	Beverage bottles (plastic)	Bottle caps (plastic)	Straws Stirrers	Grocery bags (plastic)	Beverage bottles (glass)	Other plastic bags	Paper bags	Beverage cans
Croatia	1540	97	21	86	0	83	34	74	36	22
Egypt	1	2	40	18	1	15	33	6	0	6
Greece	116	6	11	15	13	4	3	3	2	5
Italy	0	0	2	0	0	4	14	0	0	7
Malta	0	15	22	40	13	0	7	3	0	0
Slovenia	21	5	3	6	6	1	1	2	0	2
Spain	79	9	15	23	57	13	5	9	4	8
Turkey	785	14	29	73	22	26	18	4	4	26

Data from *Clean up Greece* between 2004 and 2008 indicated however the importance plastic and paper abandoned and wind born on island beaches. On isolated beaches, other visible and larger sized litter items (metal, rubber, glass, and textile) have increased due to illegal dumping. The abundance, nature, and possible sources of litter on 32 beaches on the Balearic Islands (Mediterranean Sea) were investigated in 2005 (Figure 2). Mean summer abundance in the Balearics reached approximately 36 items per linear meter, with a corresponding weight of 32±25 g per m^{-1}, which is comparable to the results of other studies in the Mediterranean. Strong similarities between islands and a statistically significant seasonal evolution of litter composition and abundance were demonstrated. In summer (the high tourist season), litter contamination was double that in the low season and showed a heterogeneous nature associated with beach use. Again, cigarette butts were the most abundant item, accounting for up to 46% of the objects observed in the high tourist season. In contrast, plastics related to personal hygiene/medical items were predominant in wintertime (67%) was the most important litter by weight (75%). In both seasons, litter characteristics suggested a strong relationship with local land-based origins. While beach users were the main source of summer litter, low tourist season litter was primarily attributed to drainage and outfall systems.



		 **Figure 2:** Litter composition (A) and estimated origin (B) of the litter collected in low and high tourist season in Balearic Islands (source Martinez-ribes et al., 2007)
Conclusions		
Conclusions (brief)	Text (200 words)	Knowing the amounts of marine litter found stranded on beaches can help us assess the potential harm to the environment and would also increase our knowledge on sources (JRC, 2013), as currently there is limited data and great spatial variability on the amounts and composition of marine litter reflecting the different characteristics of the shorelines along the Mediterranean. Existing studies however indicate the main types of beach litter are of land-based origin, coming from poor waste management practices, recreational and tourism activities, household items and smoking related waste (Table 4). Moreover, it is difficult to draw conclusions regarding the overall increase or decrease of marine litter in the Mediterranean (UNEP/MAP, 2015). Assessments of the composition of beach litter in different regions of the Mediterranean Sea show that synthetic polymer materials (bottles, bags, caps/lids, fishing nets, and small pieces of unidentifiable plastic and polystyrene) make up the largest proportion of overall litter pollution.
Conclusions (extended)	Text (no limit)	. The amount of litter originating from recreational/tourism activities greatly increases during and after the tourism season. Smoking related wastes in general also seems to be a significant problem in the Mediterranean, as several surveys suggest (UNEP 2009). According to the analysis of data collected, shoreline and recreational activities were the main source every year of the last decade, until it was surpassed by smoking-related waste (UNEP, 2011). Moreover, the fishing industry is of significance (UNEP, 2013), as well as the shipping industry, especially off the African coast. National Case Studies may provide more detailed information on local constraints and effective factors on the distribution of litter. It is important to note, however, that volunteer groups should be informed about the necessity to submit standardized research data for statistical purposes. Clean up actions by NGOs are usually organized to raise awareness and not so much for data collection, and cleanup programmes should increase public knowledge of the scientific relevance of information and information sharing. However, interesting observations have been made on the proliferation of lighter marine litter items in the Mediterranean (plastics, aluminum and smoking-related litter), as opposed to heavier items from basic use (bottles, cans, see Figure 3) or litter from dumping activities (household appliances, construction materials, tires, etc.) This could

		be related to the efficiency of preventive action (easier collection, recycling, adoption and/or implementation of stricter legislation with regards to dumping activities, etc.) for larger items and the difficulty to manage inputs from sources such as the general public.  **Figure 3:** Changes in percentages of the top 8 items in the Mediterranean Sea between 2009 and 2013. Data from Ocean Coastal Cleanup on types of litter of 303522 items and 110698 items collected in 2009 and 2013 respectively on beaches from Greece, Turkey, Egypt and Spain (data from http://www.oceanconservancy.org/) Environmental awareness is also observed when this general public, conscious of the impact of their actions, do not use beaches as disposal sites for heavy garbage items as lightheartedly as they did in the past. The removal of these heavier items, combined with the persistent nature of plastics and other lighter marine litter items that can still be found in considerable numbers in the Mediterranean, has led to the changing nature of marine litter in the region.
Key messages	Text (2-3 sentences or maximum 50 words)	Information on beach marine litter exist but the picture is still fragmented and is geographically restricted to the northern part of the Mediterranean. Plastics are the major components with cigarette butts, food wrappers and plastic being the top marine litter items. Land-based sources are predominant but they have to be further specified. Tourism is directly affecting marine litter generation on beaches.
Knowledge gaps	Text (200-300 words)	Information on the distribution, quantities and identification of litter sources for beach marine litter needs to be further advanced. For the moment information and data are inconsistent for the Mediterranean. In that aspect, monitoring strategies should be encouraged at regional level based on harmonized and standardized monitoring and assessment methods. Mapping of the shorelines and coasts at basin scale where marine litter accumulates needs to be implemented. Accumulation and stranding fluxes needs to be evaluated along with information on corresponding loads and linkage with specific sources. Efforts should be enhanced towards engaging citizens, informing them about certain aspects and effects of marine litter found stranded on beaches, along with make responsible citizens (responsible consumption and littering behavior).. Harmonized beach clean-up campaign organized at basin scale should be organized based on a science-based protocol which will enable the collection of relevant scientific information.

List of references	Text (10 pt, Cambria style)	**References included in the UNEP/MAP (2015). Marine Litter Assessment in the Mediterranean 2015.** UN Environment / Mediterranean Action Plan. ISBN: 978-92-807-3564-2. • Arcadis (2014) Marine litter study to support the establishment of an initial headline reduction target- SFRA0025? European commission / DG ENV, project number BE0113.000668, 127 pages. • Galgani, F., Hanke, G., Werner, S., De Vrees, L. (2013). Marine litter within the European marine strategy framework directive. ICES J. Mar. Sci. 70 (6): 1055-1064. • Interwies E., Görlitz S., Stöfen A., Cools J., Van Breusegem W., Werner S., L. de Vrees (2013) Issue Paper to the "International Conference on Prevention and Management of Marine Litter in European Seas", Final Version, 16th May 2013 (http://www.marine-litter-conference-berlin.info/downloads.php), 111 pages. • JRC (2013). Guidance on Monitoring of Marine Litter in European Seas. • Martinez-Ribes L., Basterretxea G., Palmer M., J.Tintore (2007). Origin and abundance of beach debris in the Balearic Islands. Sci. Mar. 71: 305–314. • Ocean conservancy /International Coastal Cleanup (ICC, 2014), (http://www.oceanconservancy.org/) • Oko institut (G.Mehlhart & M. Blepp, 2012) Study on Land sourced Litter in the Marine Environment. Review of sources and literature Olko Institut report http://www.kunststoffverpackungen.de/show.php?ID=5262), 128 pages • UNEP (2009), Marine Litter A Global Challenge, Nairobi: UNEP. 232 pp. • UNEP (2011) Assessment of the status of marine Litter in the Mediterranean Sea. UNEP(DEPI)/MED WG.357/Inf.4 12 April 2011, 55 pages • UNEP (2013) Regional Plan on Marine litter Management in the Mediterranean in the Framework of Article 15 of the Land Based Sources Protocol (Decision IG.21/7). 18th Meeting of the Contracting Parties of the Barcelona Convention. **Additional references** Brouwer R., Hadzhiyska D., Ioakeimidis C., Ouderdorp H. (2017). The social costs for marine litter along the European coasts. Ocean & Coastal Management 138: 38-49. Ghermandi, A., Nunes, P.A.L.D. (2013). A global map of coastal recreation values: results from a spatially explicit meta-analysis. Ecol. Econ. 86: 1-15. Ryan P.G., Moore C.J., van Franeker J.A., Moloney C.L. (2009). Monitoring the abundance of plastic debris in the marine environment. Phil. Trans. R. Soc. B 364, 1999–2012 (doi:10.1098/rstb.2008.0207). Vlachogianni, Th., Zeri, Ch., Ronchi, F., Fortibuoni, T., Anastasopoulou, A., 2017. Marine Litter Assessment in the Adriatic and Ionian Seas. IPA-Adriatic DeFishGear Project, MIO-ECSDE, HCMR and ISPRA. pp. 180 (ISBN: 978-960-6793-25-7)

Ecological Objective EO10. Marine and coastal litter do not adversely affect the coastal and marine environment.

EO10: Common Indicator 23.Trends in the amount of litter in the water column including microplastics and on the seafloor.

Content	Actions[3]	Guidance
General		
Reporter	Underline appropriate	UNEP/MAP/MED POL SPA/RAC REMPEC PAP/RAC Plan Bleu (BP)
Geographical scale of the assessment	Select as appropriate	Mediterranean Sea
Contributing countries	Text	Mediterranean assessment based on existing regional and national surveys, research and publications and as appropriate data from national monitoring programmes of the Contracting Parties.
Mid-Term Strategy (MTS) Core Theme	Select as appropriate	1-Land and Sea Based Pollution
Ecological Objective	Write the exact text, number	Ecological Objective 10 (EO10): Marine and coastal litter do not adversely affect the coastal and marine environment
IMAP Common Indicator	Write the exact text, number	Common Indicator 23 (CI23): Trends in the amount of litter in the water column including microplastics and on the seafloor
Indicator Assessment Factsheet Code	Text	EO10CI23
Rationale/Methods		
Background (short)	Text (250 words)	The marine environment is directly linked to human life. Nowadays, marine litter is found widespread in the environment, from shallow water till the deep abyssal plains, posing one of the major threats for the marine environment. The Mediterranean Sea has been described as one of the areas most affected by marine litter in the world. Human activities generate considerable amounts of waste, and quantities are increasing, although they vary between countries. In addition, some of the largest amounts of Municipal Solid Waste (MSW), generated annually per person occur in the Mediterranean Sea (208 – 760 kg/year, http://atlas.d-waste.com/). Plastic, which is the main marine litter component, has now become ubiquitous and may comprise up to 90% for seafloor litter.

[3] The Column of "Actions" will be removed from the final revised version of the assessment factsheet and is only kept in this document for information purposes.

Content	Actions[3]	Guidance
		Surveys conducted to date in the Mediterranean Sea, show considerable spatial variability. Accumulation rates vary widely and are influenced by many factors, such as the presence of large cities, shore use, hydrodynamics, and maritime activities. Marine litter is even more abundant in enclosed areas, which has some of the highest densities of marine litter stranded on the sea floor, sometimes reaching over 100,000 items/km2 (Galgani et al., 2000). Moreover, the estimated plastic densities found floating in the Mediterranean Sea seems to be of the same range as in the five sub-tropical gyres. To date, the fate of this litter is still questionable and the identification of areas where litter permanently accumulate is a major challenge. Plastic densities on the deep sea floor did not change over the years (1994 – 2009) in the Gulf of Lion, but conversely the abundance of marine litter in deep waters was found to increase over the years in the Central Mediterranean (Koutsodendris et al., 2008; Ioakeimidis et al., 2014).
Background *extended*	Text (no limit), images, tables, references	The global amount of litter entering into the oceans has been calculated at between 4.8 and 12.7 million tons, only for plastics (Jambeck et al., 2015). Moreover, the deep-sea floor is probably the final global sink for marine litter mostly comprising of plastic. The Mediterranean Sea has been described as one of the areas most affected by marine litter in the world The geographical distribution of marine litter and plastic in particular, is highly impacted by hydrodynamics, geomorphology, and human factors. The Mediterranean geomorphology is very peculiar with not extensive shelves and deep-sea environments that can be influenced by the presence of coastal canyons. Continental shelves are proven accumulation zones, but they often gather smaller concentrations of marine litter than canyons; as litter is washed offshore by currents associated with offshore winds and river plumes. Most litter is comprised of high-density materials and hence sinks. Even low-density synthetic polymers such as polyethylene and polypropylene, may sink under the weight of fouling or additives. The fouling of litter by a wide variety of bacteria, algae, animals and fine-grained accumulated sediments, increases their weight and litter can sink to the seafloor. In the Mediterranean, plastic which is the main marine litter component, is ubiquitous in the marine environment and may comprise up to 90% of the recorded seafloor marine litter. Human activities generate considerable amounts of waste, and quantities are increasing, although they vary between countries. Some of the largest amounts of Municipal Solid Waste (MSW), generated annually per person occur in the Mediterranean Sea (208 – 760 kg/year, http://atlas.d-waste.com/) Important policy achievements have been expanded at regional level in the Mediterranean. United Nations Environment / Mediterranean Action Plan has adopted the Strategic Framework for Marine Litter Management in 2012 (Decision IG.20/10 - 17th Meeting of the Contracting Parties of the Barcelona Convention). Following, the Regional Plan on Marine Litter Management in the Mediterranean in the Framework of Article 15 of the Land Based Sources Protocol was adopted in 2013 (Decision IG.21/7 – 18th Meeting of the Contracting Parties of the Barcelona Convention), together with a decision (IG.22/10) in 2016 to support the implementation of the Marine Litter Regional Plan including Fishing-for-Litter Guidelines, an Assessment Report, Baselines Values, and Reduction Targets (19th Meeting of the Contracting Parties of the Barcelona Convention). In addition the Integrated Monitoring and Assessment Programme of the Mediterranean Sea Coast and Related Assessment Criteria adopted in 2016 (Decision IG.22/7 – 19th Meeting of the Contracting Parties of the Barcelona Convention) two common and one

Content	Actions[3]	Guidance
		candidate indicators on marine litter along with an Integrated Monitoring and Assessment Guidance document (UNEP(DEPI)/MED IG.22/Inf7 - 19th Meeting of the Contracting Parties of the Barcelona Convention). Floating litter comprises the mobile fraction of litter in the marine environment, as it is less dense than seawater. However, the buoyancy and density of plastics may change during their stay in the sea due to weathering and biofouling (Barnes et al., 2009). Polymers comprise the majority of floating marine litter, with figures reaching up to 100%. Although synthetic polymers are resistant to biological or chemical degradation processes, they can be physically degraded into smaller fragments and hence turn into micro litter, measuring less than 5 mm. The Mediterranean Sea is often referred to as one of the places with the highest concentrations of litter in the world. For floating litter, very high levels of plastic pollution are found, but densities are generally comparable to those being reported from many coastal areas worldwide (UNEP/MAP, 2015). A 30-year circulation model using various input scenarios showed the accumulation of floating litter in ocean gyres and closed seas, such as the Mediterranean Sea, made up 7-8% of the total litter expected to accumulate (Lebreton et al., 2012). There are several studies investigating the abundance of marine litter in the Mediterranean Sea. The abundance of floating microplastic fragments was investigated in the Mediterranean Sea by Kornilios et al., 1998; Collignon et al., 2012; Fossi et al., 2012; Collignon et al., 2014; de Lucia et al., 2014; Pedrotti et al., 2014; Cozar et al., 2015; Panti et al., 2015; Fossi et al., 2016 ; Ruiz-Orejón 2016 and Suaria et al., 2016. Few studies have been also published on the abundance of floating macro and mega litter in Mediterranean waters (Aliani et al., 2003; UNEP, 2009; Topcu et al., 2010, Gerigny et al., 2011, Suaria and Aliani, 2015). Information also exist on the abundance of seafloor marine litter for the Mediterranean Sea (Galil et al., 1995; Galgani et al., 1996, 2000; Ioakeimidis et al., 2014; Pham et al., 2014; Ramirez-Llodra et al., 2013). Floating litter can be transported by currents until they sink to the sea floor, are deposited on the shore, or are degraded over time. Litter that reaches the seafloor may have already been transported considerable distance, only sinking when weighted down by entanglement and fouling. The consequence is an accumulation of litter on specific seafloor locations in response to local sources and oceanographic conditions (Galgani et al., 2000; Keller et al., 2010; Watters et al., 2010; Ramirez-L lodra et al., 2013; Pham et al., 2013). Moreover, seafloor litter tends to become trapped in areas of low circulation. Once litter reaches the seafloor, it lies on the seafloor and it may even partly buried in areas of very high sedimentation rate (Ye and Andrady, 1991). In terms of data availability on marine litter lying on the seafloor of the Mediterranean, there are several studies investigating the abundance of marine litter (Galil et al., 1995; Galgani et al., 1996, 2000; Ioakeimidis et al., 2014; Pham et al., 2014; Ramirez-Llodra et al., 2013, Vlachogianni et al., 2017) but the information is still fragmented and geographically restricted to the northern Mediterranean. Litter that reaches the seafloor may have already been transported considerable distance, only sinking when weighted down by entanglement and fouling. The consequence is an accumulation of litter on specific seafloor locations in response to local sources and oceanographic conditions (Galgani et al., 2000; Keller et al., 2010; Watters et al., 2010; Ramirez-Llodra et al., 2013; Pham et al., 2013). Moreover, seafloor litter tends to become trapped in areas of low circulation like the enclosed and semi-

Content	Actions[3]	Guidance
		enclosed gulfs. Once litter reaches the seafloor, it lies on the seafloor and it may even partly buried in areas of very high sedimentation rate (Ye and Andrady, 1991). Marine litter and plastics in particular it was believed to last in the marine environment for decades or even hundreds of years when in surface (Gregory and Andrady, 2003), likely far longer when in deep sea (Barnes et al., 2009). However, recent studies (Ioakeimidis et al., 2016) have found that the degradation of plastics in the marine environment may occur much faster than it was expected. Surveys conducted to date show considerable spatial variability on marine litter abundance. Accumulation rates vary widely and are influenced by many factors, such as the presence of large cities, shore use, hydrodynamics, and maritime activities. They are higher in enclosed seas such as the Mediterranean basin, which has some of the highest densities of marine litter stranded on the sea floor, sometimes reaching over 100,000 items / km² (Galgani *et al.*, 2000). Plastic densities on the deep sea floor did not change between 1994 and 2009 in the Gulf of Lion (Galgani *et al.*, 2011). Conversely, the abundance of litter in deep waters, such as the central Mediterranean, was found to increase over the years (Koutsodendris *et al.*, 2008; Ioakeimidis *et al.*, 2014). In the Mediterranean, reports from Greece (Koutsodendris *et al.*, 2008; Ioakeimidis *et al.*, 2014) classify land-based sources (up to 69% of litter) and vessel-based sources (up to 26%) as the two predominant litter sources. In addition, litter items have variable floatability and hence variable dispersal potential.
Assessment methods	Text (200-300 words), images, formulae, URLs	The current assessment has been based on recent key assessments, reports and publications by UNEP/MAP, and other projects and initiatives. The UNEP/MAP (2015) Marine Litter Assessment in the Mediterranean report has been used as the main source for this indicator assessment factsheet. For the moment there is no reporting on UN Environment / Mediterranean Action Plan on floating and seafloor marine litter and the assessment is based on the available data and information from reports and scientific publications. Visual assessment of floating macro-litter particles include the use of research vessels, marine mammal surveys, commercial shipping carriers, and dedicated litter observations (UNEP/MAP, 2015). Aerial surveys have also being employed for larger items. For floating micro-litter particles the manta-trawl net system is used for sampling the surface layers of the seas. The net it pulls is made of thin mesh (normally with mesh size of 333μm) and the whole trawl is towed behind a vessel. Most of the data and information on seafloor marine litter are coming from general strategies for the investigation of seabed marine litter which are often similar to those used to assess the abundance and type of benthic species. Several approaches are applied in order to assess seafloor litter abundance and distribution: i) visual surveys with SCUBA in shallow waters; ii) opportunistic sampling using otter-trawls; and iii) observation tools (Remote Operated Vehicles - ROV etc.). The most common approaches to evaluate sea-floor litter distributions is the opportunistic sampling. This type of sampling is usually coupled with regular fisheries surveys and programmes on biodiversity, since methods for determining seafloor litter distributions (e.g. trawling, diving, video) are similar to those used for benthic and biodiversity assessments.

Content	Actions[3]	Guidance
		Monitoring programmes for demersal fish stocks, undertaken as part of the Mediterranean International Bottom Trawl Surveys (MEDITS), operate at large regional scale and provide data using a harmonized protocol, which may provide a consistent support for monitoring litter at Regional scale on a regular basis and within the Ecosytem Approach (EcAp) requirements. The use of observation tools i.e. Remote Operated Vehicles (ROVs) and Submersible Vehicles is a possible approach for deep-sea environments (Galgani et al. 1996; Pham et al., 2014). These methods unfortunately require considerable means but are of great use for areas that cannot be accessed with other ways. The use of observation tools helped scientists assess marine litter far beyond the commonly used fishing grounds (sandy bottoms) and the continental shelf, and extend the assessment of marine litter in bathyal and abyssal environments, reaching in depths up to 4km. Several approaches, protocols and units (items/km, items/km^2, kg/km^2, kg/h) have been used. However the expression of the abundance of marine litter found float at sea or lying on the seafloor in items per surface are (m2, km^2, ha2) coupled with information on weight seems to be the most appropriate. Nowadays the harmonization of all the sampling methodologies is among the top-priorities of the marine litter agenda.
Results		
Results and Status, including trends (brief)	Text (500 words), images	Marine litter are found floating at sea while seafloor is probably the final sink for most marine litter items after has been transported along considerable distances. The abundance of floating macro and mega litter in Mediterranean waters has been reported at quantities measuring over 2 cm range from 0 to over 600 items per square kilometer (Aliani et al., 2003; UNEP, 2009; Topcu et al., 2010, Gerigny et al., 2011, Suaria and Aliani, 2015) (Figures 1, 2). The 2015 UN Environment / Mediterranean Action Plan Marine Litter Assessment report states that approximately 0.5 billion litter items are currently lying on the Mediterranean Seafloor. Moreover, there is great variability in the abundance of seafloor marine litter items ranging from 0 to over 7,700 items per km² depending on the study area. Plastic is the major marine litter component, found widespread in the continental shelf of the Mediterranean, ranging up to 80% and 90% of the recorded marine litter items. Plastics are also predominant among floating marine litter items.

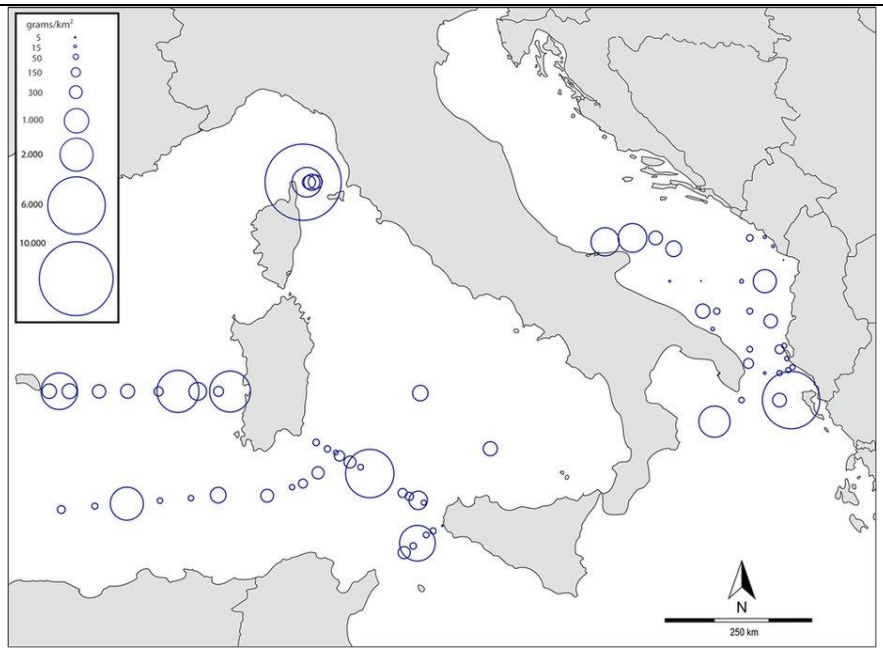


Figure 1: Map of the central-western Mediterranean Sea showing the distribution of plastic densities expressed as grams of plastic per km^2 (after Suaria et al., 2016)

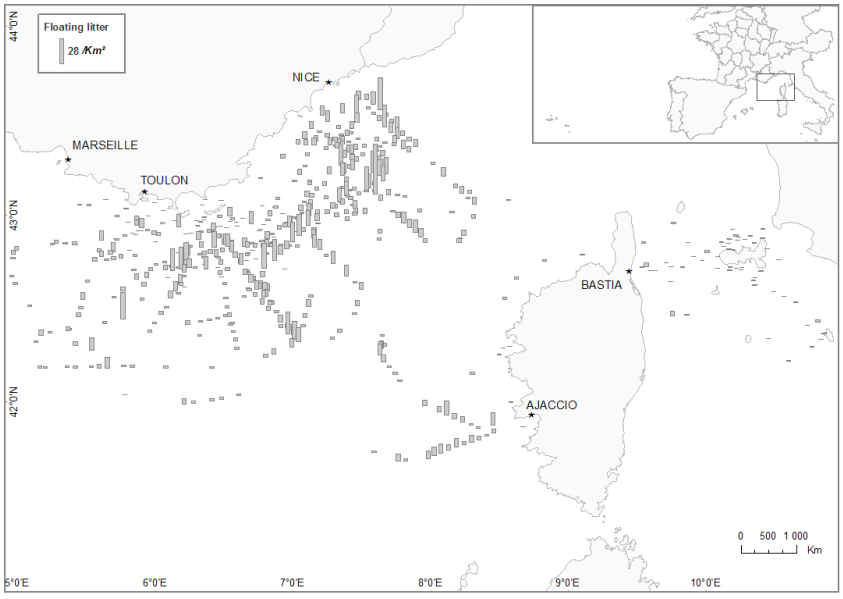
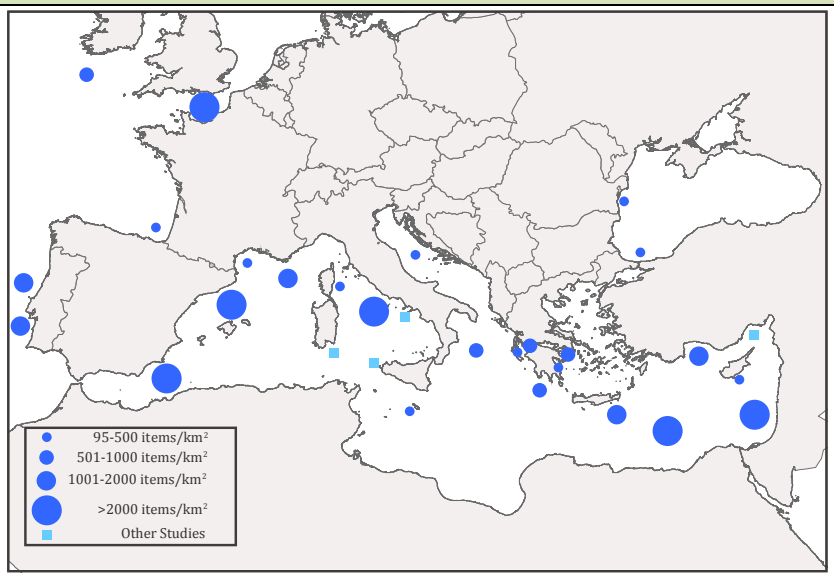
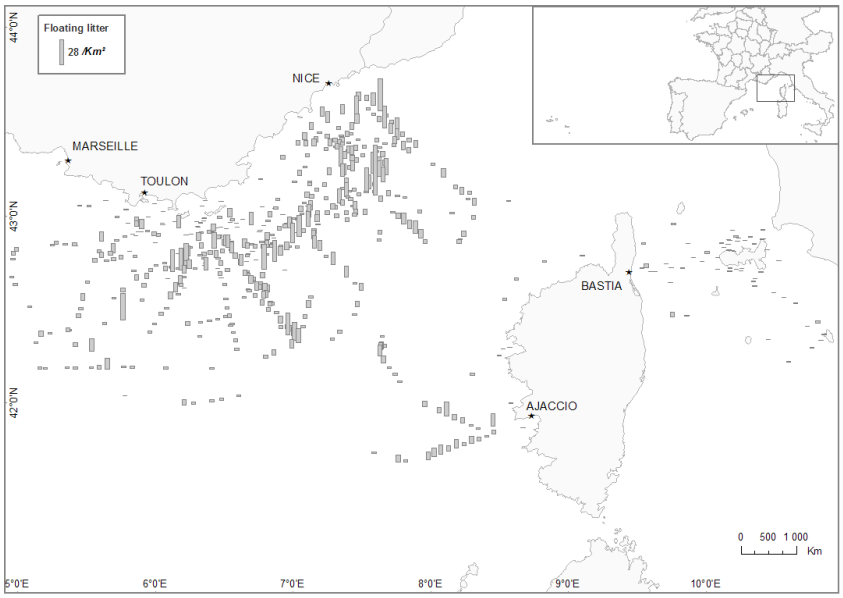


Figure 2: Distribution of floating litter in the northwestern Mediterranean Sea (2006-2008) (visual observations). IFREMER/SHOM map using data from the Ecocean/ParticipeFutur project for initial MSFD assessment (Gerigny et al., 2011).

We yet don't have a clear picture on the abundance (number and mass) of marine litter lying on the Mediterranean seafloor, from the shallow water till the deep abyssal plain (Figure 3). The information is only limited and fragmented as only few studies exist investigating marine litter on the Mediterranean seafloor. In addition, tThe geographical distribution of marine litter items is highly impacted by hydrodynamics, geomorphology, and human factors. Moreover, most of them are geographically restricted to the Northern part of the Mediterranean Sea.

Content	Actions[3]	Guidance
		 **Figure 3:** Seafloor marine litter distribution in the Mediterranean and other European Seas (Ioakeimdis, 2015). Most of the studies have been using traditional fish stock assessment methods i.e. otter trawlers, but recently new, costly and more sophisticated techniques have been also used. In addition to that, little is known on the existence and importance of the corresponding accumulation areas in the Mediterranean.
Results and Status, including trends (extended)	Text(no limit), figures, tables	The abundance of floating macro and mega litter in Mediterranean waters has been reported at quantities measuring over 2 cm range from 0 to over 600 items per square kilometer (Aliani et al., 2003; UNEP, 2009; Topcu et al., 2010, Gerigny et al., 2011, Suaria and Aliani, 2015). In the Ligurian Sea, data was collected through ship-based visual observations in 1997 and 2000. 15-25 items/km² were found in 1997, which decreased to 1.5-3 items in 2000 (Aliani et al., 2003). Data may also be obtained from NGOs. HELMEPA, a Greek organisation of maritime stakeholders, invited its member managing companies with ships traveling in or transiting the Mediterranean to implement a programme for the monitoring and recording of litter floating on the sea surface. During the period February – April 2008, 14 reports were received by HELMEPA member-vessels containing information on litter observations from various sea areas in the Mediterranean. In total, observations of 1,051.8 nautical miles (n.m.) of Mediterranean Sea resulted in the recording of 500.8 Kg of marine litter. The total length of observation for floating marine litter carried out by HELMEPA member vessels was 1,051.8 nautical miles (1,947 kilometers), corresponding to an observation area of around 172.8 km2. The width of observation depended on the weather conditions, the sea state, the position of the Observer, the use of binoculars, the freeboard and volume of marine litter, etc., and generally fluctuated between 22 and 150 meters. Observations were carried out mainly in the eastern Mediterranean (Aegean Sea, Libyan Sea and Eastern Mediterranean Levantine Sea), in the Alboran Sea between Spain and Morocco, and in the Adriatic Sea. The total of marine litter recorded was 366 items, corresponding to a concentration of one item per 3 n.m., or 2.1 items per km2. The concentration of marine litter ranged from 0.08 to 71 items/n.m. Relatively higher concentrations of marine litter were observed along routes close to coastal areas, while there were cases in which lengthy observations

Content	Actions[3]	Guidance
		(more than 120 n.m.) revealed no existence of marine litter. Plastics accounted for about 83.0% of marine litter items, while all other major categories accounted for about 17%, as the following graph shows. Based on weight extrapolations, the average quantity of marine litter was estimated to be 230.8 kg/km2 ranging from 0.002 to 2,627.0 kg/km2. Relatively heavy items such as steel drums, wooden pallets, and crates observed on the sea surface were responsible for the majority of marine litter in certain routes. In terms of the length of observation, the average weight was 0.47 kg/n.m. Litter was also quantified during marine mammal observation cruises in the northern western basin Mediterranean Sea in a 100 x 200 km offshore area between Marseille and Nice and in the Corsican channel. A maximum density of 55 items/km² was found, with a clearly discernible spatial variability relating to residual circulation and a Liguro-Provencal current vein routing litter to the West (Gerigny et al., 2012 and Figure 4).  **Figure 4:** Distribution of floating litter in the northwestern Mediterranean Sea (2006-2008) (visual observations). IFREMER/SHOM map using data from the Ecocean/ParticipeFutur project for initial MSFD assessment (Gerigny et al., 2011). A subsequent survey made in the Eastern Mediterranean (Topcu et al., 2010) reported densities of less than 2.5 items/ km2. More recently, results from Suaria and Aliani (2014), dedicated to the first large-scale survey of anthropogenic litter (>2 cm) in the central and western part of the Mediterranean Sea (Figure 5). Throughout the entire study area, densities ranged from 0 to 194.6 items/km^2, with a mean abundance of 24.9 items/km^2. The highest litter densities (>52 items/km2) were found in the Adriatic Sea and in the Algerian basin, while the lowest densities (<6.3 items/km2) were observed in the Central Tyrrhenian and in the Sicilian Sea. All of the other areas had mean densities ranging from 10.9 to 30.7 items/km^2.

Content	Actions[3]	Guidance

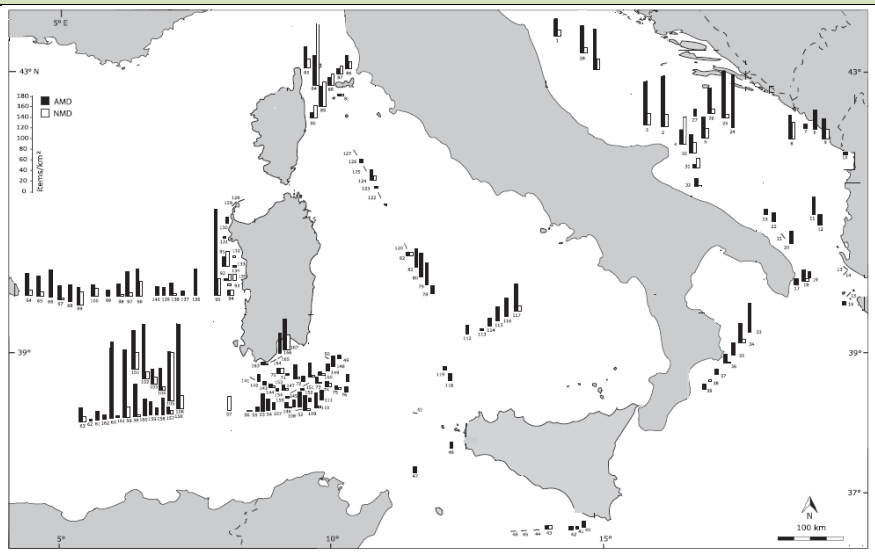


Figure 5: Anthropogenic (black bars) and Natural (white bars) Marine Litter densities (items/km2) in the Western, Adriatic and Northern Ionian basins of the Mediterranean Sea (From Suaria and Aliani, 2014)

Suaria et al. (2016) along with presenting their results (Figure 6) on the abundance of microplastic fragments in the central Mediterranean sea are also providing a detailed comparison table (Table 1) on floating microplastic concentrations based on the available studies performed in the Mediterranean Sea.

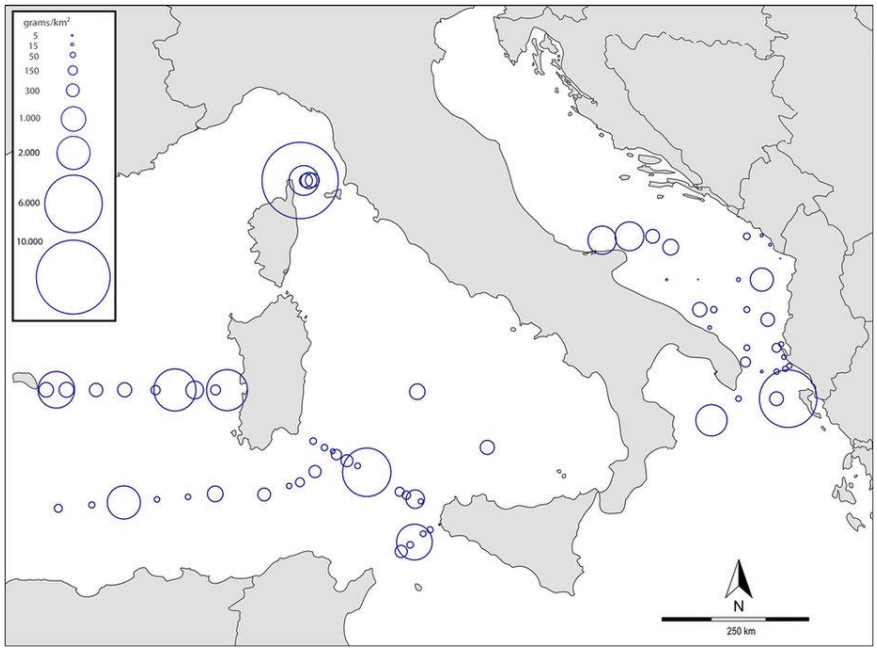


Figure 6: Map of the central-western Mediterranean Sea showing the distribution of plastic densities expressed as grams of plastic per km^2 (after Suaria et al., 2016)

Table 1: Floating microplastic concentrations in the Mediterranean Sea.

Study Area	Year	Net mesh	Samples	Mean Abundance	Reference
Cretan Sea	1997	500 µm	25	119 ± 250 g/km^2	Kornilios et al., 1998

Content	Actions[3]	Guidance

NW Med.	2010	333 μm	40	0.116 items/m^2 2020 g/km^2	Collignon et al., 2012
Ligurian/ Sardinian Sea	2011	200 μm	23	0.31 ± 1.0 items/m^2	Fossi et al., 2012
Bay of Calvi (Corsica)	2011-2012	200 μm	38	0.062 items/m^2	Collignon et al., 2014
W. Med.	2011-2012	333 μm	41	0.135 items/m^2 187 g/km^2	Faure et al., 2015
W. Sardinia	2012-2013	500 μm	30	0.15 items/m^3	de Lucia et al., 2014
Ligurian Sea	2013	333 μm	35	0.103 items/m^2	Pedrotti et al., 2014
NW Sardinia	2012-2013	200 μm	27	0.17 ± 0.32 items/m^3	Panti et al, 2015
Ligurian Sea	2011-2013	200 μm	70	0.31 ± 1.17 items/m^3	Fossi et al., 2016
Med.	2013	200 μm	39	0.243 items/m^2 423 g/km^2	Cózar et al., 2015
Central W Med.	2011-2013	333 μm	71	0.147 items/m^2 579.3 g/km^2	Ruiz-Orejón et al., 2016
W Med/ Adriatic	2013	200 μm	74	0.40 ± 0.74 items/m^2 1.00 ± 1.84 items/m^3 671.91 ± 1544.16 g/km^2	Suaria et al., 2016

In the Mediterranean Sea, no more than 15 studies exist (Fig. 7), dedicated on the assessment and accumulation of marine litter on the seafloor by using otter-trawl, with the corresponding cod-end mess size ranging from 10 mm to 15,000 mm. So far, in the Western Mediterranean Sea, the Gulf o Lions (1993-94: 633-1935 items/km2; 1996: 3900 items/km2; 1996-97: 143 items/km2), the Catalan Coast (2009: 7003±6010 items/km2; 2007-2010: 0.02-3264.6 kg/km2) and the Murcian Coast (4424±3743 items/km2) have been studied (Galgani et al., 1995; Galgani et al., 1996; Galgani et al., 2000; Sanchez et al., 2013; Ramirez-Llodra et al., 2013). In the Central Mediterranean Sea, data on seafloor marine litter exist for the areas of the E. Ionian Sea (2300 items/km2), the Corsica (1993-94: 633-1935 items/km2; 1998: 229 items/km2), the Adriatic Sea (1998: 378 items/km2; 2011-2012: 47.9±23.4-170.6±35.8 kg/km2) Tyrrhenian Sea (2009: 5950 items/km2) (Galgani et al., 1995; Galgani et al., 2000; Sanchez et al., 2013; Misfud et al., 2013; Strafella et al., 2015). The Eastern Mediterranean is the less studied among the three compartments (western, central, eastern Med.). Galil et al. (1995) assessed 200-8,500 items/km2 in several areas in the E. Mediterranean Sea. while more targeted studies have been conducted in the Saronikos Gulf (2013-2014: 1211±594 items/km2) Gulf of Patras (1997-98: 240 items/km2; 2000-2003: 313 items/km2; 2013-2014: 641±579 items/km2), the Gulf of Echinades (1997-98: 89-240 items/km2; 2000-2003: 313 items/km2; 2013-2014: 416±379 items/km2), the Gulfs of Corinth and the Lakonikos Gulf (165 items/km2), the Antalya (115-2,762 items/km2) and the Mersin (0.01-5.85 kg/h) bays (Galil et al., 1995; Stefatos et al., 1999; Koutsodendris et al., 2008; Guven et al., 2013; Eryasar et al., 2014).

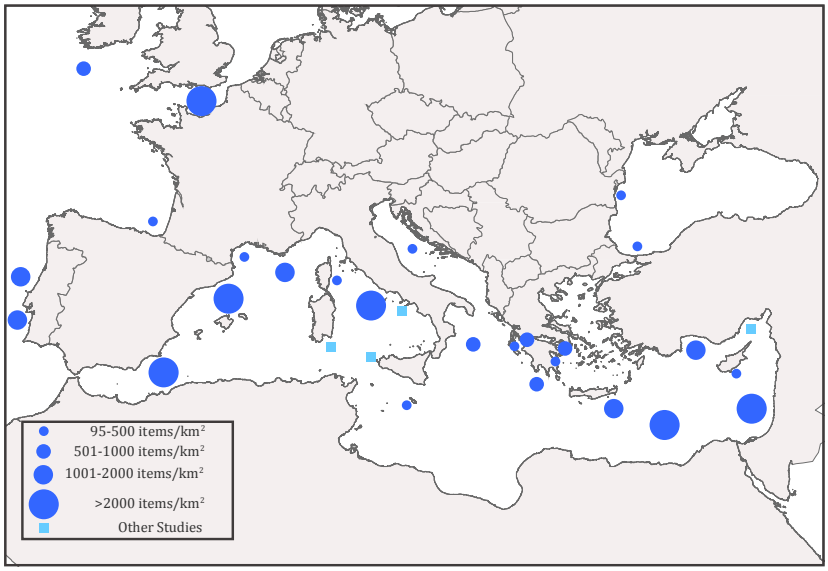


Figure 7: Seafloor marine litter distribution in the Mediterranean and other European Seas (Ioakeimdis, 2015).

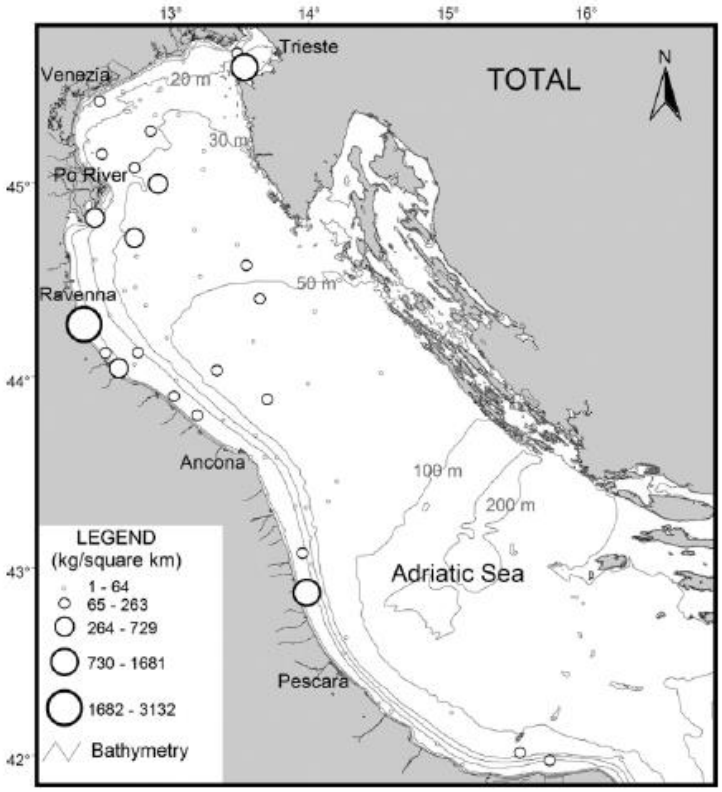
Counts from 7 surveys and 295 samples in the Mediterranean Sea and Black Sea (2,500,000 km², worldatlas.com) indicate an average density of 179 plastic items/ km² for all compartments, including shelves, slopes, canyons, and deep sea plains, in line with trawl data on 3 sites described by Pham et al., 2014. On the basis of this data, we can assume that approximately 0.5 billion litter items are currently lying on the Mediterranean Sea floor (UNEP/MAP, 2015).

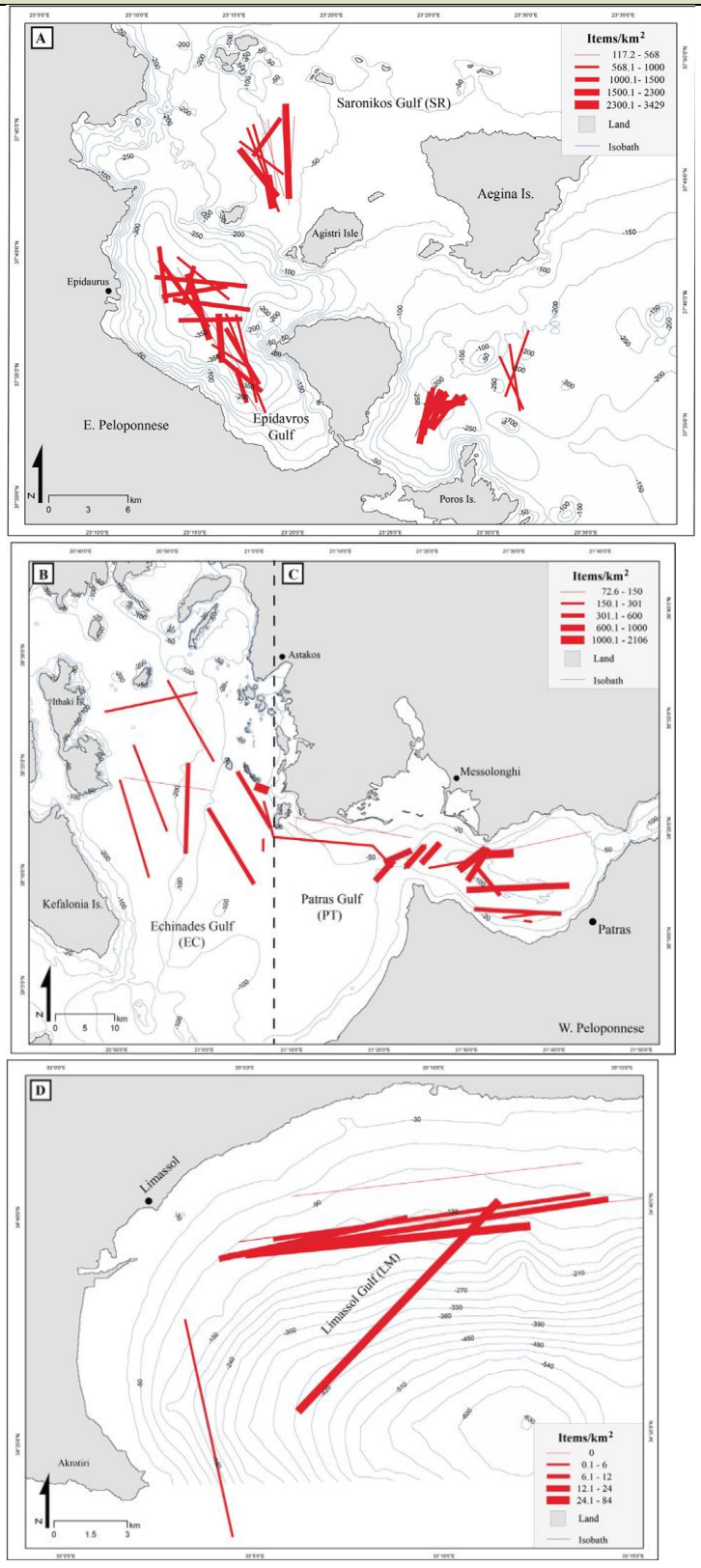
Plastics have been found widespread in the continental shelf of the Mediterranean, exceeding in some areas the 80% of the recorded marine (Table 2)

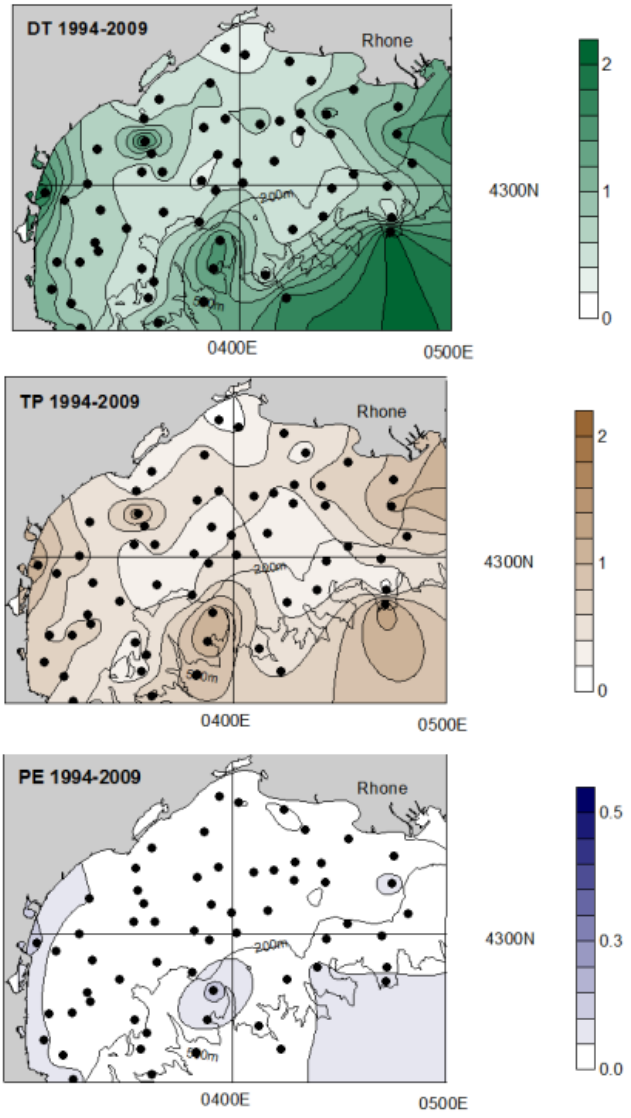
Table 2: Plastic abundance (%) in the Mediterranean Sea.

Stydy Area	**Plastic (%)**	**Reference**
Gulf of Lions (France)	64-77%	Galgani et al., 1995b; Galgani et al., 2000
Catalanian Provence (Spain)	60%	Sanchez et al.
Murcian Provence (Spain)	84%	Sanchez et al.
Central Med	87%	Sanchez et al., 2013
Corsica (France)	77%	Galgani et al., 1995
Maltese islands	47%	Misfud et al., 2013;
North-Central Adriatic Sea	24-62%	Strafella et al., 2015
Eastern Mediterranean Sea (Italy, Greece, Egypt, Cyprus, Israel).	36%	Galil et al. 1995
Gulf of Patras (Greece)	81%	Stefatos et al. 1999
Echinades Gulf (Greece)	56%,	Koutsodendris et al. 2008
Gulf of Patras (Greece)	60%	Ioakeimidis et al. 2014
Echinades Gulf (Greece)	67%	Ioakeimidis et al. 2014
Antalya (Turhey)	81%	Guven et al., 2013
Mersin (Turkey)	73%	Eryasar et al., 2014
Limassol Gulf (Cyprus)	59%	Ioakeimidis et al. 2014
Saronikos Gulf (Greece)	95%	Ioakeimidis et al. 2014
Argolikos Gulf (Greece)	75%	Ioakeimidis et al., 2015

In a study on 67 sites conducted in the Adriatic Sea using commercial trawl analysis of Marine litter sorted and classified in major categories confirmed that plastic is

Content	Actions[3]	Guidance
		dominant in terms of concentration by weight, followed by metal (UNEP/MAP, 2015). The highest concentration of litter was found close to the coast, likely as a consequence of high coastal urbanization, river inflow, and extensive navigation. Metals and Glass/Ceramics reached maximum values of 21.9% and of 22.4%, respectively in a study conducted in 4 study areas in the Eastern Mediterranean (Saronikos; Patras and Echinades Gulfs; Limassol Gulf) (Ioakeimidis et al., 2014). Mapping the litter in the sea floor allows for the precise determination of the accumulation areas (Figs 8-10).  **Figure 8:** Marine litter collected on seabed from the northern Adriatic (Solemon cruises, 2011-2012, Strafella et al., 2015).

Content	Actions[3]	Guidance
		

Content	Actions[3]	Guidance
		Figure 9: Marine Litter density (items/km^2) in Saronikos Gulf (Greece, Aegean Sea, A), Echinades Gulf (B), Gulf of Patras (Greece, Ionian Sea, C) and Limassol Gulf (Cyprus/ Levantine basin, D.) Line positioning corresponds to trawling transect; line thickness relates to marine litter density (After Ioakeimidis et al., 2014).  **Figure 10:** Mean annual litter densities on the sea floor from the Gulf of Lion for a period of 15 years of sampling (1994 –2009). Results are extrapolated densities expressed in items per hectare of the following categories: total Litter (DT), total plastics (TP) and fishing gears (PE). Data were from MEDITS cruises (Source: Galgani et al., 1996). Very limited studies in the Mediterranean have been investigating the presence of benthic litter in shallow waters. Only one study records marine litter in selected study areas in Greece (Saronikos Gulf, W. Crete, S. Peloponesse, Santorini isl., W. Greece), in depths ranging from the shoreline (0m) till the 25m (Katsanevakis & Katsarou, 2004). In the Saronikos Gulf were recorded 31,660 items/km2 (Plastics: 47%, Metals: 31%), W. Crete 18,944 items/km2 (Plastics: 45%, Metals: 28%), S.

Content	Actions[3]	Guidance
		Peloponesse 14,025 items/km2 (Plastics: 47%, Metals: 33%), Santorini isl. 9,133 items/km^2 (Plastics: 52%, Metals: 31%). The first assessment of marine litter in the deep-sea environment of the Mediterranean Sea was conducted back in 1995 by Galgani et al. (1996) in the marine Canyon of Marseille-Nice (1623 items/km2). Nowadays, in the Mediterranean Sea such data exist only for the Western (NW Mediterranean: 1935 items/km^2; French Mediterranean: 3 items/km^2) and the Central Mediterranean Sea (Tyrrhenian Sea: 30,000-120,000 items/km2), while no relevant data exist for the Eastern Mediterranean Sea (Galgani et al., 1996; Galgani et al., 2000; Bo et al., 2014; Fabri et al., 2014; Angiolillo et al., 2015). The distribution and abundance of large marine litter were investigated on the continental slope and bathyal plain of the northwestern Mediterranean Sea during annual cruises undertaken between 1994 and 2009 (Galgani et al., 2011). Different types of litter were enumerated, particularly pieces of plastic, plastic and glass bottles, metallic objects, glass, and diverse materials including fishing gear. The results showed considerable geographical variation, with concentrations ranging from 0 to 176 pieces of litter/ha. In most stations sampled, plastic bags accounted for a very high percentage (more than 70%) of total litter. In the Gulf of Lions, only small amounts of litter were collected on the continental shelf. Most of the litter was found in canyons descending from the continental slope and in the bathyal plain, with high amounts occurring to a depth of more than 500 m. Information regarding the abundance of small plastic particles accumulating in the deep-sea sediments is still very limited. However, plastic particles sized in the micrometer range have been found in deep-sea sediments ranging from 1000 to 5000m depth (Van Cauwenberghe et al., 2013; Woodall et al., 2014).
Conclusions		
Conclusions (brief)	Text (200 words)	Plastic is the main component of the floating marine litter and also lying on the Mediterranean seafloor, found from the shallow water and the continental shelf, till the deep abyssal plains. Regarding the marine litter (floating and on seafloor) that are accumulating in the basin, no safe conclusion can be drawn for the moment. Probably hydrodynamics and geomorphology favor the constant circulation. More consistent, interconnected and interlinked studies need to be promoted in order to have a better picture at basin scale. The comparability of the existing and future studies seems to be a key point towards an integrated assessment at basin scale. The Mediterranean sea is heavily impacted by floating marine litter items, giving concentrations comparable to those found in the 5 sub-tropical gyres. Moreover, the seafloor seems to be the final global sink for most marine litter items with densities ranging from 0 to over 7,700 items per km². The deep-sea canyons are of particular concern as they may act as a conduit for the transport of marine litter into the deep sea. As in any other marine litter cases, the human activities (fishing, urban development, and tourism) are primarily responsible for the increased abundance of marine litter items in the Mediterranean Sea.
Conclusions (extended)	Text (no limit)	Marine litter and mainly plastics are present in the Mediterranean basin from the shallow water, the continental shelf, till the abyssal plains, in all different sea compartments and basins and thus, posing an important problem for the marine environment. Unfortunately so far, we do not have a clear picture regarding the areas in the Mediterranean where the accumulation of marine litter and plastics is

Content	Actions[3]	Guidance
		significant although several ongoing studies try to give a clearer picture. The Eastern Mediterranean is certainly the least studied of the three compartments (western, central, eastern). The Mediterranean Sea is very peculiar as there are no areas where marine litter permanently accumulates. Instead, the constant circulation is favored. The picture is fragmented as only through nonrecurring studies information becomes available and this is not enough to drawn safe results or even to partially assess the situation. In addition information on floating and seafloor marine litter is only available for the northern part of the Mediterranean Sea. The combination of the last two points makes the assessment of floating and seafloor marine litter in regional scale almost impossible. Once floating litter has entered into the marine environment, the hydrographic characteristics of the basin may play an important role in its transport, accumulation, and distribution. Atlantic surface waters enter the Mediterranean Sea through the strait of Gibraltar and circulate anticlockwise in the whole Algero-Provencal Basin, forming the so-called Algerian Current, which flows until the Channel of Sardinia and most often leads to the generation of a series of anticyclonic eddies 50–100 km in diameter wandering in the middle basin (UNEP/MAP, 2015). Despite not being permanent, these mesoscale features could act as retention zones for floating litter and would help explain the high litter densities found in the central Algerian basin at around 80 nautical miles from the nearest shore. For the southern Adriatic Sea, it should be noticed that about one-third of the total mean annual river discharge into the whole Mediterranean basin flows into this basin, particularly from the Po River in the northern basin and the Albanian rivers (UNEP, 2012). The highest densities found in the Adriatic Sea and along the North-western African coast are related to some of the heaviest densities in coastal population of the entire Mediterranean basin (UNEP/MAP 2015). The Adriatic Sea has more than 3.5 million people along its shores, which along with fisheries and tourism seems to be the most significant sources for floating marine litter in the region. In addition the significant cyclonic gyres which are found in the central and southern Adriatic Sea (Suaria and Aliani, 2014), are favoring the retention of floating marine litter in the middle of the basin. This is also the Case in the Northeastern part of the Aegean Sea, where densities of floating litter are higher due to circulating waters and Black sea/Mediterranean sea water exchanges. Coastal population is an important aspect also for the north African countries in particular also have the highest rates of growth in coastal population densities, including touristic densities. Algeria, for instance, has a coastal population that has increased by 112% in the last 30 years, and it currently represents one of the most densely populated coastlines in the whole basin (UNEP, 2009). In addition, it should be noted that in some countries appropriate recycling facilities have not been fully implemented yet, and the cost of proper solid waste disposal is still often beyond their financial capacity (UNEP, 2009). Suaria and Aliani (2014), demonstrated that 78% of all sighted objects were of anthropogenic origin, 95.6% of which were petrochemical derivatives (i.e. plastic and Styrofoam). The authors then evaluated the number of macro-litter items currently floating on the surface of the whole Mediterranean basin to be more than 62 million. As for anthropogenic litter accumulating in oceans gyres and convergence zones, the existence of Floating Marine Litter accumulation zones is a stimulating hypothesis, as their presence was supported recently (Mansui et al., 2015). The existence of one or more ‘‘Mediterranean Garbage Patches’’ should be investigated in more detail, as

Content	Actions[3]	Guidance
		there are no permanent hydrodynamic structures in the Mediterranean Sea where local drivers may have a greater effect on litter distribution (CIESM, 2014). The deep-sea floor is probably the final global sink for marine litter and there are several areas in the Mediterranean for which marine litter have been recorded in densities exceeding 1000 items/km^2 (i.e. Gulf of Lions, Catalan Coast, Murcian Coast, Corsica, Saronikos Gulf, Antalya Coast). However, long-term data is scarce for the Mediterranean Sea. Density of litter collected on the sea floor between 1994 and 2014 in the Gulf of Lion (France), does not clearly show any significant trends with regards to variations in marine litter quantities (Galgani, 2015). In another example in Greece (Gulf of Patras, Echinades Gulf) albeit the increase of marine litter abundance plastic percentage seems to remain stable over the years. In much deeper marine environments, Galgani et al. (2000) observed decreasing trends in deep sea pollution over time off the European coast, with extremely variable distribution and litter aggregation in submarine canyons. The abundance of plastic litter is very location-dependent, with mean values ranging from 0 to over 7,700 items per km². Mediterranean sites tend to show the highest densities, due to the combination of a populated coastline, coastal shipping, limited tidal flows, and a closed basin with exchanges limited to Gibraltar. In general, bottom litter tends to become trapped in areas with low circulation, where sediments accumulate. Only a few studies have focused on litter located at depths of over 500 m in the Mediterranean (Galil, 1995; Galgani et al., 1996, 2000, 2004; Pham et al., 2014; Ramirez-Llodra et al., 2013). Submarine canyons may act as a conduit for the transport of marine litter into the deep sea. Higher bottom densities are also found in particular areas, such as around rocks and wrecks, and in depressions and channels. In some areas, local water movements carry litter away from the coast to accumulate in high sedimentation zones. The distal deltas of rivers may also fan out into deeper waters, creating high accumulation areas. A wide variety of human activities, such as fishing, urban development, and tourism, contribute to these patterns of seabed litter distribution. Fishing litter, including ghost nets, prevails in commercial fishing zones and can constitute a considerable share of total litter. It has been estimated that 640,000 tons of ghost nets are scattered overall in the world oceans, representing 10% of all marine litter (UNEP, 2009) More generally, accumulation trends in the deep sea are of particular concern, as plastic longevity increases in deep waters and most polymers degrade slowly in areas devoid of light and with lower oxygen content.
Key messages	Text (3-6 sentences or maximum 200 words)	The abundance of floating litter in Mediterranean waters has been reported at quantities measuring over 2 cm range from 0 to over 600 items per square kilometer (Aliani et al., 2003; UNEP, 2009; Topcu et al., 2010, Gerigny et al., 2011, Suaria and Aliani, 2015). The 2015 UN Environment / Mediterranean Action Plan Marine Litter Assessment report states that approximately 0.5 billion litter items are currently lying on the Mediterranean Seafloor. Moreover, there is great variability in the abundance of seafloor marine litter items ranging from from 0 to over 7,700 items per km² depending on the study area. However, the information on floating and seafloor marine litter in the Mediterranean is fragmented and is spatially restricted mainly to its northern part. To this extent, no basin-scale conclusions can be exerted and information is only available at local level. However there are many areas with significant marine litter densities, ranging from 0 to over 7,700 items per km² depending on the study area. Plastic is the major

Content	Actions[3]	Guidance
		marine litter component, found widespread in the continental shelf of the Mediterranean, ranging up to 80% and 90% of the recorded marine litter items.
Knowledge gaps (brief)	Text (100 words)	Research and monitoring have become critical for the Mediterranean Sea, where information is inconsistent. UNEP/MAP-MED POL (2013), MSFD (Galgani et al., 2011), the European project STAGES (http://www.stagesproject.eu), and CIESM (2014) recently reviewed the gaps and research needs of knowledge, monitoring, and management of marine litter. This requires scientific cooperation among the parties involved prior to reduction measures due to complexity of issues. Accumulation rates vary widely in the Mediterranean Sea and are subject to factors such as adjacent urban activities, shore and coastal uses, winds, currents, and accumulation areas. Additional basic information is still required before an accurate global litter assessment can be provided. Moreover the available data are geographically restricted in the northern part of the Mediterranean Sea. For this, more valuable and comparable data could be obtained by standardizing our approaches. In terms of distribution and quantities, identification (size, type, possible impact), evaluation of accumulation areas (closed bays, gyres, canyons, and specific deep sea zones), and detection of litter sources (rivers, diffuse inputs), are the necessary steps that would enable the development of GIS and mapping systems to locate hotspots. An important aspect of litter research to be established is the evaluation of links between hydrodynamic factors. This will give a better understanding of transport dynamics and accumulation zones. Further development and improvement of modelling tools must be considered for the evaluation and identification of both the sources and fate of litter in the marine environment. Comprehensive models should define source regions of interest and accumulation zones, and backtrack simulations should be initiated at those locations where monitoring data are collected. For monitoring, there is often a lack of information needed to determine the optimum sampling strategy and required number of replicates in time and space. Moreover, the comparability of available data remains highly restricted, especially with respect to different size class categories, sampling procedures, and reference values. Data on floating and seafloor marine litter are inconsistent and geographically restricted in only few areas of the Mediterranean sea. In addition to that, the lack on long-term assessment data makes the assessment of trends of the years extremely difficult. Sources needs also to be further specified and linked to macro- and micro-litter contribution. Moreover, monitoring and assessment of marine litter should be done in a consistent way, based on common protocols and standardized methods, leading to comparable results at basin scale. Effective management practices are also missing, requiring strong policy will and societal engagement. Further work should also be promoted towards identifying marine litter sources more precisely. Cooperation and collaboration between the major marine litter partners in the region with common priority actions is also considered important.
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