SOCIOECONOMIC ANALYSIS OF MARINE LITTER KEY BEST PRACTICES TO PREVENT/REDUCE SINGLE USE OF PLASTIC BAGS AND BOTTLES



July 2019

Table of contents

Table of illustrations

BOX

FIGURES

TABLES

Note to the reader

The present activity is prepared in the context of the UN Environment/Mediterranean Action Plan (MAP) Mid-Term Strategy 2016-2021 (MTS) and Program of Work (PoW) 2018-2019, adopted by the Contracting Parties in December 2017 in Tirana, Albania. More specifically, this activity contributes to the implementation of MTS key Output 2.1.1. "Targeted measures of the regional plans/strategies facilitated and implemented", Activity 2.1.1.1. "Prepare reports on the implementation of the existing regional Plans/Measures: (i.e. Mercury and WWTP) including socio economic analysis" in the UN Environment/MAP programme of work.

Socio-economic analyses can contribute to convince stakeholders on the feasibility and benefits of a specific action, compare different measures to prioritize from, anticipate and identify possible bottlenecks in implementation, avoid costs and ensure their fair distribution, identify when and where flanking measures would be most beneficial, correct existing measures.

This activity is prepared through the Memorandum of Understanding between the UN Environment/MAP and the Italian Ministry for Environment, Land and Sea Protection (IMELS), and implemented by MAP/Plan Bleu Regional Activity Center.

This activity combines two levels of analysis: the level of the Mediterranean Sea via a regional socioeconomic analysis of selected plastic prevention/reduction measures; and the level of case studies of key practices already implemented, covering various natural, socioeconomic and institutional/policy contexts in the Mediterranean.

This activity will contribute to enlightening stakeholders and decision makers on the trade-offs between or among ecological objectives and economic activities and public costs/benefits as well as varying distributional effects of key measures for the prevention or reduction of single use plastic bags and bottles. In addition, the study provides methodological insight for national or local studies.

A draft outline of this report was introduced during the Regional Meeting on Marine Litter Best Practices in Izmir, Turkey (9-10 October 2018). Interim results were brought to the attention of the participants of the Second Regional Meeting on Marine Litter Best Practices in Seville, Spain (8-10 April 2019), for their comments and feedback to be incorporated during the preparation of its final version.

Results were reviewed and discussed by Plan Bleu, the UN Environment/MAP, the Regional Activity Centre for Specially Protected Areas and the Italian Ministry for Environment, Land and Sea Protection (IMELS), during a meeting held in Rome on October 24th-25th.

The present report presents the final outcomes of the study.

This report was drafted by Gloria De Paoli, Shani Lacombe, Pierre Strosser

Acronyms

AaB	Adopt a Beach
DRS	Deposit-Refund System
ES	Ecosystem Services
EU	European Union
FfL	Fishing For Litter
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
HDPE	High-density polyethylene
LDPE	Low-density polyethylene
MED	Mediterranean
MLW	Marine Litter Watch
NGO	Non-Governmental Organization
RAC	Regional Activity Center
SUPB	Single-Use Plastic Bag
UNEP/MAP	United Nations Environment Programme/ Mediterranean Action Plan
UNWTO	United Nations World Tourism Organization
VA	Voluntary Agreements
VAT	Value Added Tax
WTP	Willingness to Pay

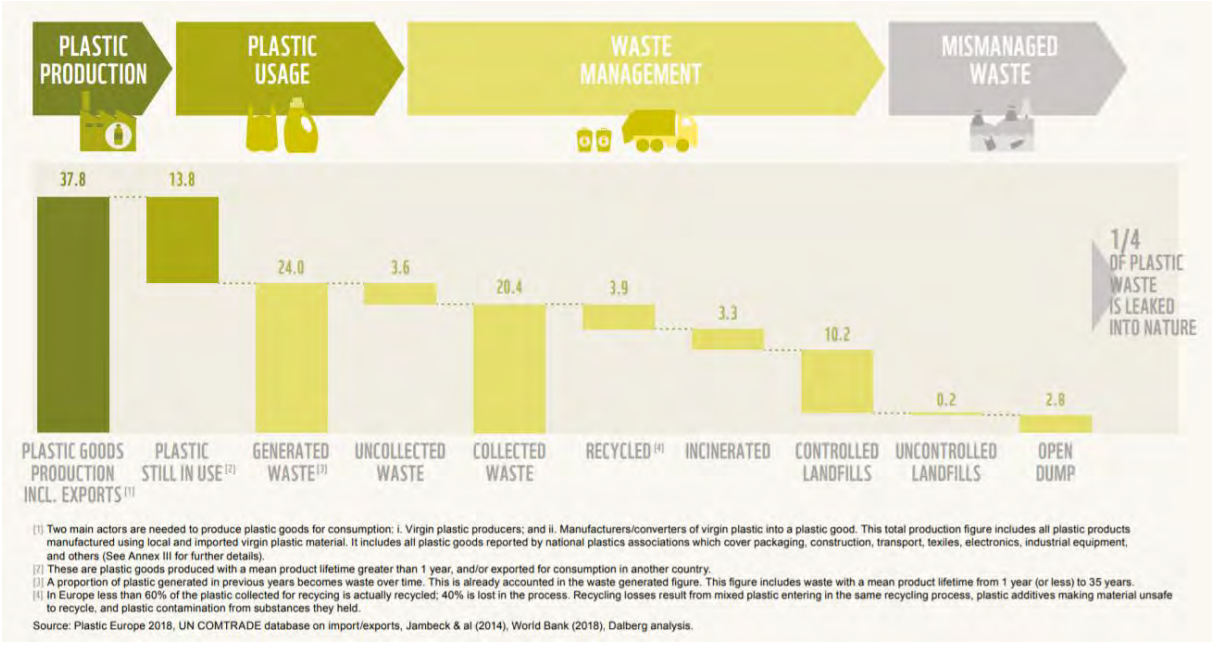
1. Setting the scene

1.1. THE CONTEXT

Plastics are one of the main materials of the modern economy due to their multiple properties, applications and low cost. Their use has been growing exponentially since the 1950s and it is expected to double in the next 20 years. It is estimated that roughly 5 trillion plastic bags are consumed worldwide each year (almost 10 million plastic bags per minute - UNEP/MAP, 2018). Europe is the second largest producer of plastics in the world - after China - with an estimated discharge to the sea of between 70 000 and 130 000 tons of microplastics (pieces <5mm) per year with macroplastics discharged to the sea amounting to 150 000 to 500 000 tons per year (Alessi et al, 2018). In the Mediterranean Sea region, plastics represent 95% of waste in high seas, on the seabed and on beaches (Alessi et al, 2018[1]). Plastic pollution is causing significant costs to the economy, estimated at about $ 13 billion a year in damages to marine ecosystems, including direct financial losses for the fishing and tourism industries, as well as significant time spent/resources allocated for cleaning beaches (Alessi et al, 2018). In front of this situation, UN Environment has positioned in 2018 the issue of **plastics in the ocean as a major global environmental challenge in recent decades** (UNEP, 2017).

One of the main causes of plastic pollution is the management of plastic waste in most of the Mediterranean countries. In the Mediterranean area, only 85% of plastic waste are collected, whereas the remaining 15% can potentially leak into nature (see also Figure 1 below). Of the waste collected, 72% is managed through controlled waste treatment: controlled landfills (42%), incineration (14%) and recycling (16%). The remaining waste is managed inadequately: 1% ends up in uncontrolled landfills, and 12% is dumped illegally. Such mismanaged waste is the main source of plastic leakage in the Mediterranean area (Dalberg Advisors & WWF Mediterranean Marine initiative, 2019).

Figure 1. Overview of the plastic lifecycle in the Mediterranean (million tonnes)



Source: Dalberg and WWF Mediterranean Marine Initiative, 2019

In recent years, several initiatives have been put in place at different scales to **improve the management of plastic waste and reduce its discharge to the sea** by different actors, including regulatory bodies, civil society, Non-

1 WWF data.

Governmental Organizations (NGOs) and the private sector. However, many of these measures are not yet implemented at their full potential in the Mediterranean Sea region. And drivers to support wider implementation of these measures are urgently required for addressing plastic bag/bottle challenges.

Box 1. Something is moving: recent policy initiatives against plastic pollution

As shown throughout this report, plastic litter in marine environments is one of the major environmental issues of our times – but the bright side of it is that policy responses at the European level have started to arrive.

The **EU Directive on the reduction of the impact of certain plastic products** on the environment, also known as "**Single-Use Plastics Directive**" (SUPD), entered into force on June 5th, 2019[2]. The DIrective introduced a set of ambitious measures, including:

- A ban on selected single-use products made of plastic for which alternatives exist on the market: cotton bud sticks, cutlery, plates, straws, stirrers, sticks for balloons, as well as cups, food and beverage containers made of expanded polystyrene and on all products made of oxo-degradable plastic.
- Measures to reduce consumption of food containers and beverage cups made of plastic and specific marking and labelling of certain products.
- Extended Producer Responsibility schemes covering the cost to clean-up litter, applied to products such as tobacco filters and fishing gear.
- A 90% separate collection target for plastic bottles by 2029 (77% by 2025) and the introduction of design requirements to connect caps to bottles, as well as target to incorporate 25% of recycled plastic in PET bottles as from 2025 and 30% in all plastic bottles as from 2030[3].

Member States have two years to bring into force the necessary laws, regulations and administrative provisions[4].

In addition, as part of their 750 billion EUR coronavirus pandemic recovery package, EU leaders agreed on a new **EU tax on plastic packaging wastes**.

The tax, to be introduced as of 1 January 2021, will be calculated on the weight of non-recycled plastic packaging waste, with a rate of 0.8 EUR/kg and a mechanism to avoid regressive impact on national contributions. Proceeds from the tax will go to the EU[5].

1.2. OBJECTIVES OF THE STUDY

In this context, Plan Bleu UN Environment/MAP Regional Activity Center has launched a study for developing **sound economic arguments on the reduction and prevention of single use plastic bags and bottles**. More specifically, the study aims at addressing the following questions:

- What are the **costs** of measures/actions that help reducing and preventing single use plastic bags and bottles? And who bears those costs?
- What are the **benefits** associated to such measures – for marine ecosystems and economic operators impacted by plastics (be it directly or via impacts on ecosystem services that would be established/re-established as a result of improvements in marine ecosystems? Who benefits from the implementation of such measures? ; and
- **How do measures rank** overall in terms of **cost-effectiveness**, the **balance of costs and benefits** – and more globally when considering all positive and negative impacts, but also feasibility and acceptability (**multi-criteria analysis**)?

1.3. THIS REPORT

This report presents the **final results** of the "Socioeconomic analysis of marine litter key best practices to prevent/reduce single use of plastic bags and bottles", and it includes the followings:

[2] https://eur-lex.europa.eu/eli/dir/2019/904/oj
[3] https://ec.europa.eu/commission/presscorner/detail/en/STATEMENT_19_1873
[4] https://www.european-bioplastics.org/guidance-on-single-use-plastics-directive-european-commission-to-stick-to-its-timeline/
[5] https://www.icis.com/explore/resources/news/2020/07/21/10532318/eu-agrees-tax-on-plastic-packaging-waste

- An overview of measures and associated case studies assessed in this socio-economic analysis;
- Pathways to the sea of plastic bags and bottles: value chain and key socio-economic groups involved;
- The methodology for assessing costs and benefits of measures against plastic pollution in the sea;
- An overview of the costs and benefits of the selected measures and case studies, as well as their feasibility and implementability; and
- A comparison of the different measures based on the above elements.

For each measure and case study, a **dedicated factsheet** was developed, including:

- The context of the measure/ case study;
- The process which eventually led to the introduction of the measure;
- Implementation of the measure;
- Positive outcomes and corresponding benefits of the measure;
- Negative impacts and costs of the measure;
- Summary table of costs and benefits, by socio-economic group; and
- Conclusions.

The factsheets are provided as a separate **Annex to this Final Report**.

2. Measures and case studies

This study focuses on **measures tackling specifically** prevention and reduction of **single use plastic bags (SUPB) and bottles**, and it was conducted at two different levels:

a. At the level of the **Mediterranean Sea** via a regional socio-economic analysis of **selected plastic prevention/reduction measures** that can be proposed by individual Mediterranean countries or at the regional scale; and
b. At the level of **practical case studies** that have implemented key practices, covering the diversity of natural, socio-economic and institutional/policy contexts that exists within the Mediterranean Sea region.

In the literature, a wide array of **measures** is available, but they can all be grouped in three main categories:

- Measures aiming at **reducing littering by raising awareness of selected target groups** (behavioral measures, aimed at changing the attitudes and perceptions that drive littering) with for example public and professional awareness raising campaign ("Ocean's Zero", "European Week for Waste Reduction, "Let's do it! Mediterranean" etc.);
- Measures aimed at **preventing littering** (preventive measures, including regulatory measures such as, for example, bans and financial instruments) with direct cost and indirect cost; and
- Measures aiming at **cleaning up litter** in the environment (clean-up measures).

All available measures were screened through an extensive literature review; six key measures were then selected for this study, based on the following criteria:

- Relevance for the regional action plan;
- Interest for national policy makers;
- Geographical coverage of the Mediterranean area;
- Replicability; and
- Effectiveness – or, in other words, the selected measures must be able to make significant differences – whereas other "softer" measures are being considered here rather as accompanying actions required for ensuring smooth and effective implementation.

Once the relevant measures had been identified, practical examples or case studies had to be selected. A variety of **practical applications** of the selected measures can be found in the Mediterranean region; among these, six **case studies** across the Mediterranean were selected as examples of good practice, based on the following criteria:

- The relevance of the case study for the regional action plan (to ensure measures considered in the case study are listed in the plan);
- Ensuring case studies cover a diversity of measures, of socio-economic contexts and of actors (at different scales: national to local, stressing that everybody can contribute at its own level to solving the problems);
- The availability of socio-economic data and assessments; and
- Replicability of these experiences in other countries/ locations in the Mediterranean region.

Case studies can be either large applications of specific measures (e.g. at the national level, as in the case of bans on plastic bags), or pilot projects developed at the local scale, which could be a good source of inspiration for more extended applications of the measure. In all cases, the institutional and governance context of the case study is provided to the reader.

Thanks to this combination of measures and case studies, this socio-economic assessment is able to cover different scales, where **the local level** – though case studies – **informs the regional level**, as shown in the figure below: in fact, case studies allows for the collection of observed costs and benefits figures at the local level, providing a basis for the socio-economic assessment of measures at the Mediterranean level.

Figure 2. Case studies and measures: in this socio-economic assessment, cost and benefit figures and information inform the regional level

The selected measures, and the associated case studies selected as examples of good practice, are presented in the Table 1 below.

Table 1. Measures selected for this study, assessed at the level of the Mediterranean Sea

Ban on SUPBs	
Ans can target different types of SUPBs – such as for example lightweight carrier bags used for food products. Similarly, some types of uses might be excluded from the ban. In the Mediterranean region, the ban exists in five countries (France, Monaco, Italy, Morocco and Albania, and it is under approval in Tunisia. In three cases out of six, compostable bags are allowed.	**Who takes action?** National policy makers **What is targeted?** **Selected case studies** Ban on plastic bags in Italy (with the exception of compostable bags) Ban on PE bags in Morocco
Taxes and levies on SUPBs	
Taxes on SUPBs is a fixed environmental levy that customers must pay in shops or supermarkets for SUPBs, instead of receiving them for free. Taxes can be collected either from the manufacture/ importers or from retailers; however, the tax is always charged on customers, who are at the end of the "pipeline". Some kinds of SYPBs might be exempted from the tax, e.g. ultralight plastic bags for food packaging in shops and supermarkets.	**Who takes action?** National policy makers – Industry **What is targeted?** **Selected case studies** Tax on plastic bags in Israel
Deposit-Refund Systems	
Through Deposit-Refund Systems, customers pay a deposit in addition to the product price when buying a beverage in a PET bottle or can. The customer can then bring back the empty bottle or can to the shop or supermarket, and get the deposit back through a vending-type machine. The plastics collected is then recycled.	**Who takes action?** Deposit-refund schemes reward those consumers who return packaging material in exchange for cash or vouchers via a vending-type machine

	What is targeted? 
	Selected case studies Pilot DRS in Cadaques, Spain
Voluntary agreement approach	
Voluntary agreement can be concluded between the competent public authorities and the concerned economic sectors/ actors, such as for example retailers or producers. The agreements can have different objectives, such as for example stopping free distribution of SUPBs, or to stop distributing SUPBs. For bottles, deposit-refund systems can be implemented though voluntary agreements.	**Who takes action?** Policy makers and retailers – Private sector
	What is targeted? 
	Selected case studies LifeDeBag pilot project in Syros island, Greece
Fishing for Litter	
In Fishing for Litter schemes, fishermen are provided large bags to collect plastics, ghost gear and other debris that gather in their nets during normal fishing activities – this is usually the case, and these are called "passive schemes". Active schemes, where fishermen go out at sea to collect marine litter, are hardly cost-effective and they are not used in the Mediterranean area. The ail of these schemes is two-fold: remove marine litter from the environment and raise awareness on marine litter issues.	**Who takes action?** Fishermen, NGOs, Tourism and leisure sector
	What is targeted? All plastic litter
	Selected case studies MARVIVA project in Catalunya, Spain
Adopt a Beach schemes	
In Adopt-a-Beach schemes, schools, local communities, an NGO or a group of volunteers "adopt" (not in legal sense) a beach and takes care of that beach by regular cleanup events. These schemes combine actions related to beach cleaning/ disposal and marine litter surveying with an overall scope of raising awareness and help Mediterranean people to care about their coastline and clean it.	**Who takes action?** Tourism and leisure sectors
	What is targeted? All plastic litter
	Selected case studies No case study selected in the context of this socio-economic analysis (but several examples exist)

3. Plastic pollution: who is involved?

3.1. PLASTIC BAGS AND BOTTLES: PATHWAYS TO THE SEA

Plastic pollution in oceans and sea is just **the final step of a long pathway**, which starts with plastic production, continues with plastic uses and ends with waste disposal. To tackle plastic pollution, it is thus crucial to understand this pathway, as measures to reduce pollution can intervene along different steps of this pathway.

For the purpose of this study, the focus is on Single Use Plastic Bags (SUPBs) and bottles. To get an insight on how these products end up in our seas, this study reconstructed the different steps of the value chain – from the production of raw plastic to the sale of finished bottles and bags to retailers and supermarkets – and then at the different pathways of plastic litter from consumers to the sea. The full pathways are presented in Figure 3 and Figure 4.

Figure 3. Plastic bottles: pathways to the sea

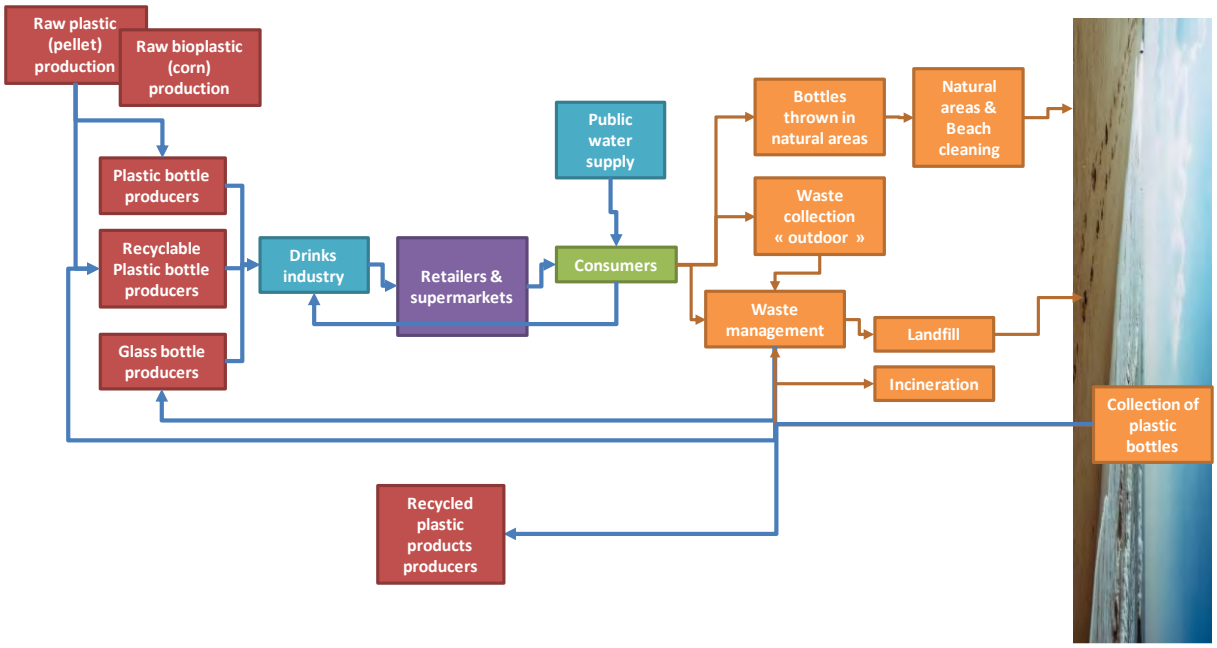
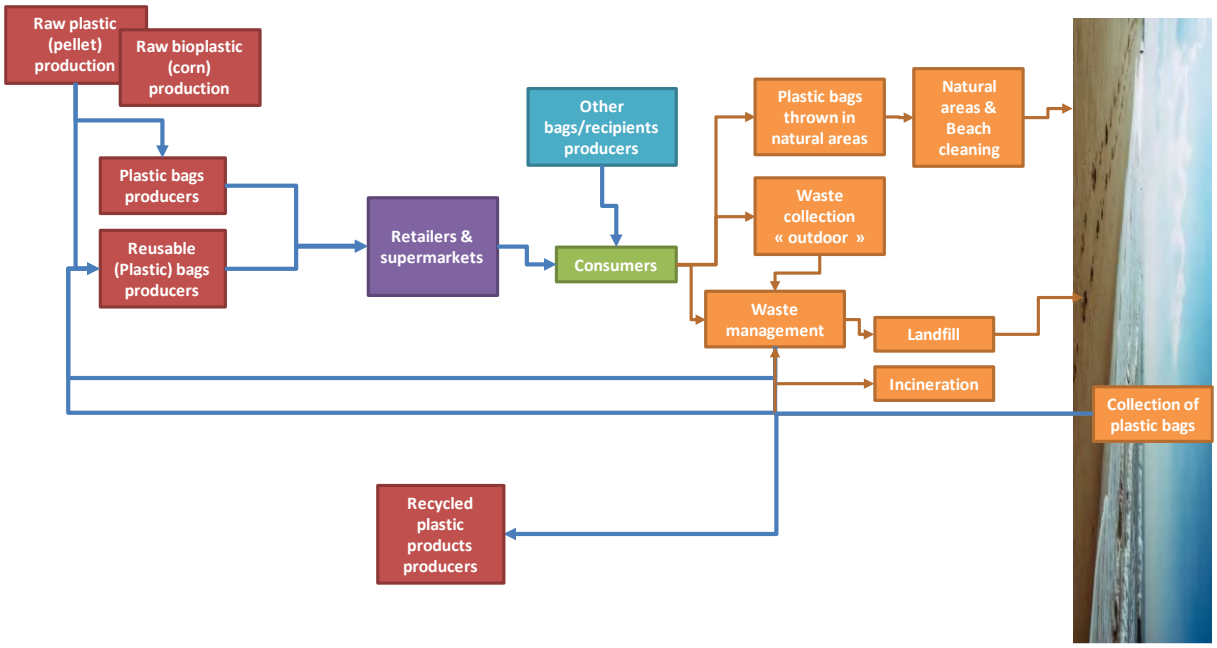


Figure 4. Single-use plastic bags: pathways to the sea



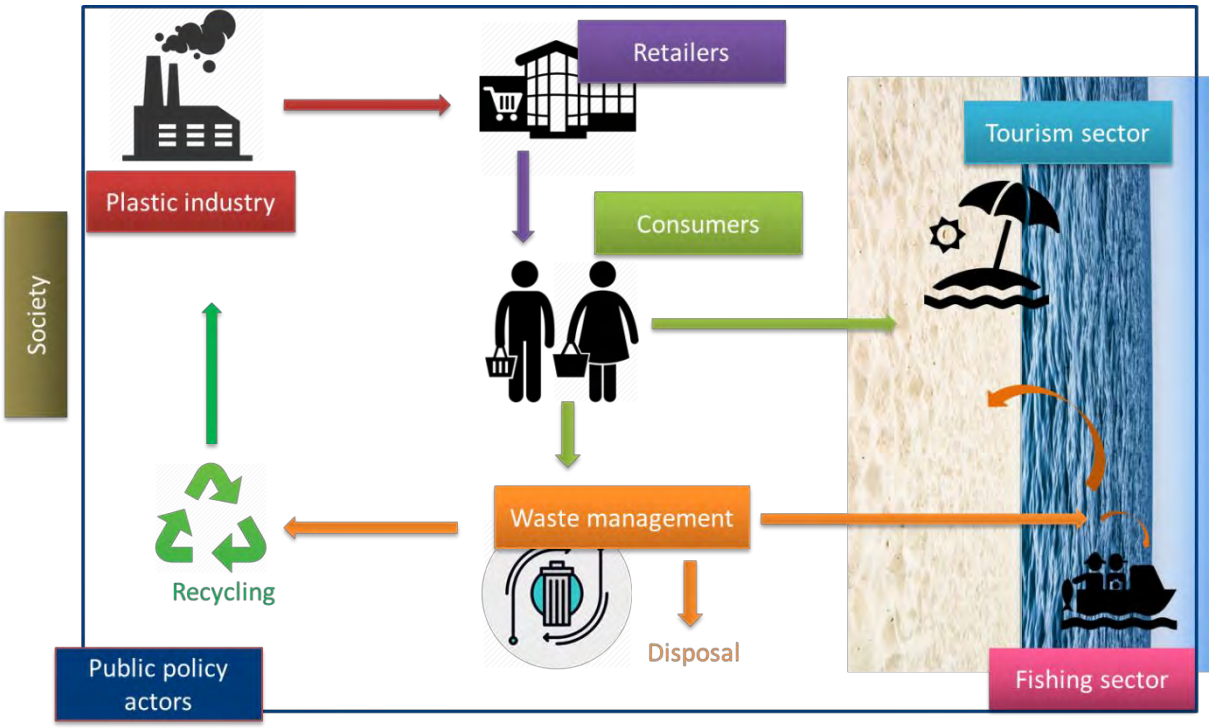
3.2. TACKLING POLLUTION: WHO GAINS AND WHO LOSES?

Identifying the pathways leading to plastic litter in the marine environment allows for identifying the key **socio-economic groups involved**. As different steps of the pathways can be tackled by measure aiming to reduce plastic pollution, this also means that different socio-economic groups will be either affected or will benefit depending on the measure and on the step of the pathway that is specifically targeted. For example, cleaning the beach for removing plastic bags and bottles leads to cleaning cost for local authorities and beach managers, it generates higher revenues from beach-goers, but it does not affect all other actors of the chain/system. To the contrary, a bottle deposit scheme will have implications for consumers, retailers, agro-industry producing drinks, and plastic bottle producers.

Thus, identifying the socio-economic groups involved in these pathways is a key step of the socio-economic analysis carried out by this study: in fact, the study does not only assessed the costs and benefits of each measure and case study, but it also conducted a **distributional analysis** of these costs and benefits – in other words, who wins and who loses?

The key socio-economic groups involved in pathways to the sea are illustrated in Figure 5.

Figure 5. Socio-economic groups involved in plastic pollution – and thus concerned by measures tackling plastic pollution



In this study, the categories shown above are defined as follows:

- **Public policy actors**: it includes all entities in charge of designing, implementing and monitoring the measures, but also entities in charge of managing, regulating and/or protecting the marine environment. Thus, the governance system is composed by public authorities at all levels (supra-national, national, regional and local, both regulators and public managers), non-governmental organizations, MPA and public areas managers, civil society organizations and groups, awareness-raising groups, etc.;
- **Plastic industry**: it includes, of course, SUPBs and plastic bottles producers, but also raw plastic producers – in fact, measures impacting SUPBs and plastic bottles producers will indirectly affect producers of raw materials. In addition, it includes both plastic and compostable plastic industries. In the case of SUPBs producers, this group includes producers of both single-use High-Density Polyethylene (HDPE) bags and multiple-use Low-Density Polyethylene (LDPE) bags: although measures usually target single-use, HDPE bags, a change in consumption trends of HDPE bags might affect consumption of LDPE bags and, thus, their production too. As it will be shown later on in this report, this study gives more attention to HDPE bag producers and plastic bottle producers, as these are the two sub-groups directly affected by the measures, but some qualitative assessment will also be carried out for LDPE bags and raw plastic producers;
- **Retailers**: this group includes all retailers distributing or selling all types of products which can be carried with SUPBs, or retailers selling drinks contained in plastic bottles – thus, in principle all sizes of retailers are included, from the small market stall to the large shopping mall. However, it must be kept in mind that information is mostly available for large retailers (supermarkets) than for small retailers such as small shops and vendors in the informal sector: thus, in many cases the impact of measures on small and/or informal retailers is assessed in a qualitative way;
- **Consumers**: all individual buying products which can potentially carried with SUPBs, or potentially buying drinks contained in plastic bottles. Consumers are a different group as compared to society (see below), because individuals are part of this group when they buy something – whereas individuals are always part of the society, whether they buy stuff or not;

- **Waste management sector**: it includes all utilities in charge of collecting, managing and disposing waste – and plastic waste among others. It also includes all utilities who do not only manage and dispose of plastic waste, but which collect and recycle plastic waste;
- **Fishing sector**: in this study, it mostly focuses on the fishing fleet deployed in the Mediterranean. In principle, fish buyers, processers and retailers should also be included in this group; however, estimating the indirect impact on these categories was very challenging, and out of the scope of this study;
- **Tourism sector**: it refers only the coastal tourism sector, and it includes all actors involved, such as tourists, hotel owners/managers, beach resort owners/managers, restaurant and bar owners/managers, recreational activity owners/managers, local communities depending on tourism, etc.;
- **Society**: it identifies the ensemble of human beings living in the Mediterranean but also in the rest of the world – measures with a positive impact on the Mediterranean marine environment do not only benefit local population, but society as a whole.

4. Socio-economic analysis of measures tackling plastic pollution: which aspects have been considered, and how?

4.1. EFFECTIVENESS OF THE MEASURES

In this study, we consider the effectiveness of the measures as composed by three dimensions:

- Maximum litter reduction/removal potential, in terms of weight of avoided plastics per year;
- Entrance or permanence of plastic in the marine environment, as from an environmental perspective it makes the difference whether plastics reach the sea; and
- Awareness raising potential and incentiveness, as these two aspects reinforce the litter reduction potential of a measure (for example by decreasing use).

These three dimensions are illustrated in more detail in the following paragraphs.

4.1.1. Maximum litter reduction potential

According to UNEP/MAP (2015), **the total yearly plastic litter reaching the Mediterranean Sea amounts to almost 267 000 tonnes per year**. Cigarette butts are the most frequent item, followed by food wrappers and plastic bottles. The Table 2 below (source: UNEP/MAP, 2015) illustrates the first ten items found in the Mediterranean Sea.

Table 2. Top ten items in the Mediterranean Sea, as the total number of items collected on 95 km of beaches from 8 different countries

Item Code	Description	Top-X Score
G76	Plastic/polystyrene pieces 2.5 cm > < 50 cm	36
G27	Cigarette butts and filters	32
G21/G24	Plastic caps and lids (including rings from bottle caps/lids)	32
G7/G8	Drink bottles	22
G124	Other plastic/polystyrene items (identifiable) including fragments	18
G30/G31	Crisps packets/sweets wrappers/Lolly sticks	7
G95	Cotton bud sticks	7
G50	String and cord (diameter less than 1 cm)	6
G208a	Glass fragments >2.5cm	2
G200	Glass bottles (including identifiable fragments)	2

Source: UNEP/MAP, 2019

Thus, the **maximum litter reduction potential** of a measure is a crucial aspect of its effectiveness[6] – either removal of litter already in the sea or reduction of plastic use resulting in a corresponding litter reduction entering the sea. For

6 MAP/ MED POL has established since 2016 Baseline Values for Marine Litter. Nowadays MED POL is updating this values (UNEP, 2019), from which:
Decrease of 39% can be proven since 2016 for beach marine litter.
Decrease of 66% can be proven since 2016 for seafloor marine litter.

i. This values can be used during your elaboration for the effectiveness of the measures.
ii. Please refer to WG.476/3 whish is hereto attached (table 14).

However, the maximum litter reduction potential estimated here is not so specific – there is no distinction between beach, seafloor or floating micro- and macro-litter. Thus, these thresholds could not be used in the socio-economic analysis.

the purpose of this study, we estimated the maximum potential effectiveness of the measures – assuming that the measure is applied in the Mediterranean basis as a whole and using available data on effectiveness observed in existing case studies. The effectiveness of the measures is the basis for the cost and benefit assessment.

However, available data and projections are scarce, not homogenous across measures and sometimes conflicting, so some choices had to be made, sometimes backed by assumptions. The Table 3 below presents the choices and assumptions made in this study to estimate the maximum potential effectiveness of the measures. The source of the data on total plastic waste produced and total plastic waste littered by country (against which the expected percentage reduction was estimated) is UNEP/MAP (2015).

Table 3. Assessing the effectiveness of the measures in terms of reduced marine litter per year – methods, data sources, assumptions and results

Measure	Basis for the estimation	Source	Estimated litter reduction –	
			Tonnes/year	% of total incremental litter
Ban on SUPB	Italian data – Reduction of SUPB use following the ban: 42 500 Tonnes/year (around 50% of previous SUPB consumption)[7]	Plastic Consult, 2018	**27 700**	**10%**
	Non-biodegradable SUPB in the EU: 85.3 billions 8% are littered Average consumption in the EU: 171 non-biodegradable SUPB/person[8] Weight of non-biodegradable bags: 8.6 g	EC, 2013		
Tax on SUPB	The introduction of the tax is expected to lead to a decrease of overall incremental marine litter by at least 8%	Plan Bleu, 2017	**21 400**	**8%**
Voluntary agreements	Implementation of this measure in Australia, UK and Hong-Kong resulted in a reduction of SUPB use of 34%, 35% and 25% respectively. In Catalonia a reduction of 47.8% was noted between 2007-2015 (either a reduction from 327 bags/person/year in 2007 to 164 in 2015). However, in those Med region with an important informal sector, the decrease of SUPB is expected to be lower.	UNEP/MAP, 2018	**17 700**	**7%**
	Looking at the data above, it was decided to use a conservative estimate of the potential for litter reduction → 30% for the whole MED region	Assumption		
	Non-biodegradable SUPB in the EU: 85.3 billions 8% are littered Average consumption in the EU: 171 non-biodegradable SUPB/person Non-biodegradable bags: 8.6 g	EC, 2013		
Deposit-Refund	Based on existing experiences, the implementation of DRS at the MED scale could result in a total reduction	Van Acoleyen et al, 2014	**32 000**	**12%**

7 It only considers the reduction of SUPBs use, and so it does not reflect the increase of compostable bags. This reduction will probablym be higher in the future, because implementation is progressive and it will include other types of bags in the future – in addition, for now the ban is implemented in supermarkets only, so the reduction of SUPBs use is expected to further increase in the future.

8 This data refers to the EU, and it's likely to be higher in the Mediterranean area (300 bags/ person according to a personal communication). However, this is the only documented value that could be found, so it was used in the calculations.

Systems	of marine litter of 12% per year			
Fishing for Litter	In existing FfL schemes, most litter is collected on the sea floor by trawlers – although projects normally accept all types of vessels, to encourage and support best practices. Nevertheless, not to overestimate the potential effectiveness of FfL schemes, this was estimated considering only the Mediterranean trawlers fleet.	Marlisco[9], Fishing for Litter UK[10]	**2 400 (24 000)**	**0.9%**
	The whole Mediterranean fishing fleet joins F4L schemes	Assumption		
	Based on KIMO and F4L project figures, we consider the maximum effectiveness witnessed for FfL schemes, which is 2.5 tons of litter/boat collected yearly (minimum 0.04 tons, on average 0.95 tons/boat). The choice of using the maximum effectiveness stems from the fact that only trawlers are considered in these calculations, and this is likely to be an underestimation as smaller vessels can also join FfL schemes, although they usually collect less litter than trawlers.	KIMO, 2019 UNEP/MAP 2015 + expert judgment		
	The Mediterranean trawlers fleet accounts for 9 600 trawlers.	FAO, 2018		
	The maximum potential effectiveness (value in brackets) considers that the whole Mediterranean fishing fleet joins FfL schemes. The realistic potential effectiveness considers the fact that only a small portion of the Mediterranean fishing fleet is likely to join such schemes – this portion is estimated at 10% of the total fleet (expert judgment, no data available to make a more grounded estimate)	Assumption + Expert judgment		
Adopt a Beach	In the period 2013-2018, the Marine Litter Watch monitored Adopt a Beach events across the MED – which covered a total of 55 km. In total, 344 000 items were collected. The average weight of an item is 0.375 kg[11]. Thus, we estimated that MLW events collected a total of 130 tonnes of marine litter over 6 years and 55 km in total – and this means 2.3 tonnes/km in 6 years.	Vlachogianni et al, 2017 Vlachogianni, 2019	**7 900**	**3%**
	84 % of beach litter found in 2016 on European beaches is made up of plastic material	Addamo et al, 2017		
	Based on figures above, Adopt a Beach schemes are able to collect 0.33 tonnes/km/year of plastics			
	Total length of Mediterranean beaches: 24235 km	Wolff et al, 2018 And CIA data[12]		

[9] http://www.marlisco.eu/fishing-for-litter-in-germany.en.html
[10] http://www.fishingforlitter.org.uk/project-areas/south-west
[11] Alternative estimates of the average weight of litter items in the Mediterranean could not be found. This value, however, is very close to the average weight of plastic litter items used by Buhl-Mortensen and Buhl-Mortensen (2017) to assess distribution, composition and abundance of marine litter in the Nordic Seas
[12] https://www.cia.gov/library/publications/resources/the-world-factbook/fields/282.html

These estimates, however, must be taken with caution. In fact, data on the expected reduction either in plastic use or marine litter following the introduction of the measures are often scarce, fragmented and scattered across sources – and different sources might not be consistent with one another. Estimating the effectiveness of the measure is necessarily the basis of a socio-economic analysis, and finding data on the expected or observed effectiveness of the measures was one of the greatest challenges encountered during this study: it is thus recommended that future research focuses on filling this gap, to improve understanding of the potential benefits of measures against marine litter.

4.1.2. Entrance and permanence of plastics in the marine environment

The different measures intervene at different steps of the pathways of plastics towards the sea, and this has important environmental implications that are not quantifiable in terms of reduction potential, or in terms of monetary costs and benefits. In fact, when plastics reach the marine environment they start degrading into smaller and smaller plastic fragments, which become increasingly different to remove, until fragments become microplastics, which are impossible to remove and are ingested by marine wildlife.

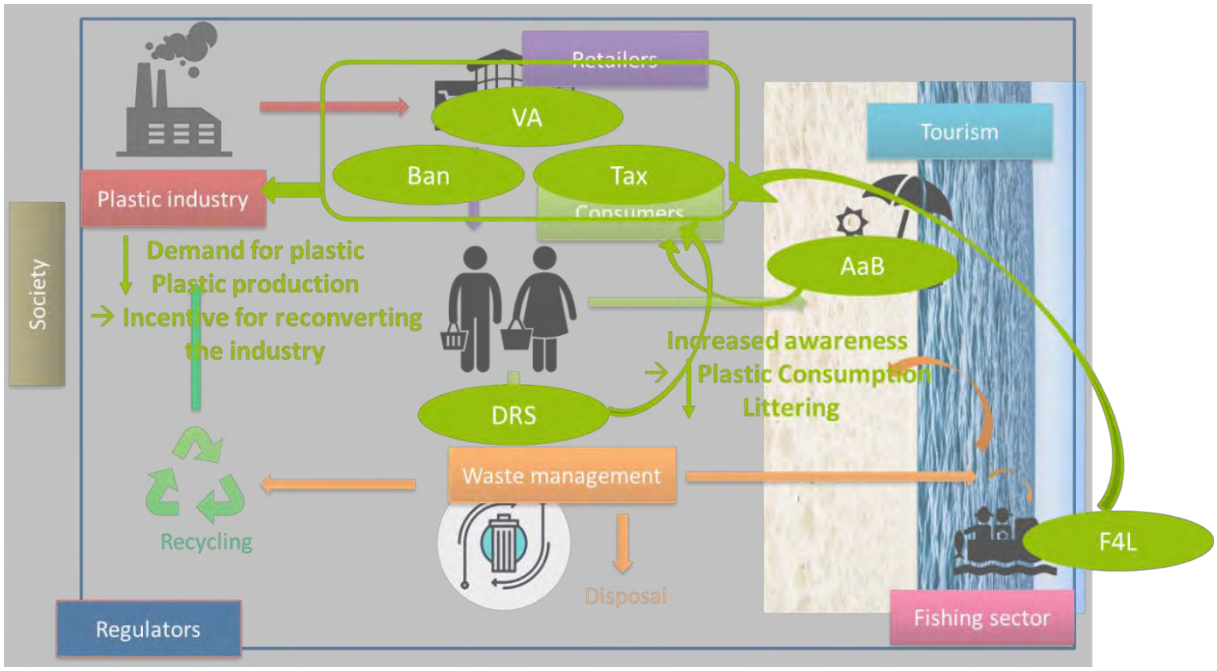
The implications for the different measures are the followings:

- **Measures targeting retailing and consumption of SUPBs** (ban, tax, VAs): these measures are aimed at reducing plastic consumption, i.e. they prevent plastic pollution by banning or dis-incentivising use of plastics. Thus, the strength of these measures is that SUPBs do not enter the system in the first place, so that it won't be ingested by animals or turn into micro-plastic.
- **Measure targeting disposal of empty plastic bottles** (DRS): these systems also avoid plastics entering the sea, thus preventing the negative environmental effects of marine litter (e.g. ingestion, microplastics, etc.).
- **Measures targeting the removal of litter already in the sea, or on beaches** (Fishing 4 Litter and Adopt a Beach): these measures can be considered as a very "last resort", as they remove plastic litter which already entered marine ecosystems, thus provoking damages to ecosystems; nevertheless, massive quantities of plastic debris are already present in our seas, so these measures are absolutely necessary.

4.1.3. Awareness-raising potential and incentiveness

The different measures deploy different mechanisms, which have an effect on the awareness-raising potential of measure and their incentiveness to decrease plastic use or reconvert plastic production.

Figure 6. Measures assessed in this study and their: (i) awareness-raising potential; and (ii) incentiveness for decreased plastic use or adaptation of the plastic industry



More in detail :

- **Measures targeting retailing and consumption of SUPBs** (ban, tax, VAs): these measures are aimed at reducing plastic consumption, i.e. they prevent plastic pollution by banning or dis-incentivising use of plastics. Thus, the strength of these measures is that SUPBs do not enter the system in the first place, so that it won't be ingested by animals or turn into micro-plastic. In addition, these measures reduce the demand for plastic, so that in turn production must also decrease: this might represent an incentive for research on new alternative materials and, ultimately, an incentive to accelerate the conversion of plastic industries towards a low-carbon economy, less dependent on fossil fuel resources.
- **Measure targeting disposal of empty plastic bottles** (DRS): at a first sight, DRS do not provide any incentive to consumers to decrease plastic use, as consumers can buy their drinks and get back the money for the plastic bottle[13]. At the same time, the very fact that a DRS is in place can bring consumers to think about the consequences of plastic use, thus raising awareness: as a result, consumers might decrease their plastic use, and thus the measure can have an indirect effect on consumption – and, in turn, on the plastic industry, as described above. In addition, these systems avoid plastics entering the sea, thus preventing the negative environmental effects of marine litter (e.g. ingestion, microplastics, etc.).
- **Measures targeting the removal of litter already in the sea, or on beaches** (Fishing 4 Litter and Adopt a Beach): these measures can be considered as a very "last resort", as they remove plastic litter which already entered marine ecosystems, thus provoking damages to ecosystems; nevertheless, massive quantities of plastic debris are already present in our seas, so these measures are absolutely necessary. At the same time, at a first sight one could argue that these measures do not provide any incentive to decrease plastic use, but this not true: in fact, these measures are very effective in raising awareness on the consequences of marine litter. Fishermen, who already experience the negative consequences of marine litter on their equipment, commit to clean up the sea while they are out fishing; tourists and residents spend time cleaning the beaches and touching with their hands the extent of the problems. This raises a sense of ownership and commitment to care for the marine environment, which is expected to: (i) prevent further littering from fishing boats and on beaches; and (ii) promote the reduction of plastic use when back home. And of course, decreased consumption will ultimately provide an incentive for the re-conversion of the plastic industry, and for the introduction of new, environmental-friendly materials.

In this perspective, the effectiveness of a measure is not only in terms of how many tonnes of marine litter it avoids each year, but also of its incentiveness for decreasing plastic consumption or improper disposal via its awareness-raising potential.

4.2. COSTS AND BENEFITS: WHICH ONES SHOULD BE CONSIDERED?

As indicated above, the study investigates **the socio-economic impacts (costs and benefits) linked to the implementation of measures** for preventing/reducing single use of plastic bags and bottles.

The socio-economic analysis at the level of both case studies and measures is the heart of this study, and the identification of which costs and benefits should be considered is thus crucial. To ensure comparability and continuity with previous Plan Bleu activities, this study applied **a slightly adapted version of the classification of costs and benefits adopted in Plan Bleu, 2017**, which includes:

- **Direct costs and benefits**, including all financial costs and benefits linked to design, implementation and enforcement of the measure, as well as compliance;
- **Direct economic impacts** – on the cost side, this category includes economic losses or gains for one specific sector following the introduction of a measure (e.g. increase/decrease of production/sales), as well as employment impacts of the measure;
- **Indirect benefits resulting from environmental improvement**: reduced plastic waste into the sea can result in economic benefits for some economic groups, such as for example savings in the fishing sector due to less cleaning and repair operations. In addition, measures against plastic pollution can result in increased delivery of ecosystem services with benefits for a range of activities dependent on the good environmental status. Indirect benefits associated with existence and option values are also part of this category, but these were not assessed in this study.

[13] Unless the DRS targets specifically reusable plastic bottles

In addition, these categories of costs and benefits were assessed with specific reference to the **socio-economic groups** which are bearing the costs or enjoying the benefits, to include the distributional dimension to our analysis. The socio-economic groups involved in the pathways of plastic from production to the sea were all considered in the assessment, but other groups were included in the analysis if relevant, as well as society as a whole – in fact, plastic pollution control measures aim at benefiting society at large in the first place, as well as potential users of the marine environment.

The resulting assessment template for costs and benefits is illustrated in Table 1 in the following page. It was applied to both case studies and regional measures. The table includes a final qualitative assessment of the overall impact on each specific socio-economic group – the so-called distributional impact.

Table 4. Template for assessing costs and benefits of case studies and measures, as well as their distributional aspects – The table includes examples of possible costs and benefits

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits inked to environmental improvement	Overall impact on socio-economic group (+/0/-)
	Costs	Benefits	Costs	Benefits		
Public policy actors	e.g. launching costs, information campaigns, implementation costs, enforcement costs	Revenues (e.g. from a new tax, or from fines)	Likely to be irrelevant	Likely to be irrelevant	e.g. Savings linked to less beach cleaning and litter picking	
Plastic industry	Compliance costs (e.g. expenditure in a new tax)	Likely: no gains	Investments in adaptation	Investments in innovation and re-adaptation of the industry bring gains and competitive advantages – including for example production and increased sales of compostable SUPBs		
Retailers	Compliance costs (e.g. purchase of DRS vending machines)	e.g. monetary rewards or fiscal incentives	e.g. increased expenditures in bio-plastic bags	e.g. Savings linked to largely reduced purchase of plastic bags and linked storage costs Improved company image (e.g. for not using SUPBs)		
Consumers	Yearly expenditure (e.g. for new tax/charge)	e.g. monetary rewards	Unlikely	Unlikely		
Waste management	Compliance costs (if any, but could be unikely)	Some measures (FfL, AaB) will result in increased waste management, and thus in higher fees paid to waste management companies	Investments in new recycling facilities? (unsure)	Savings for waste management due to less waste to be managed		
Society	n/a	n/a	Employment losses	Employment gains	e.g. Saving of resources (mainly hydrocarbons, water and energy needed in the manufacturing process of plastic bags) Provisioning services: Reduced death, illness, intoxication and	

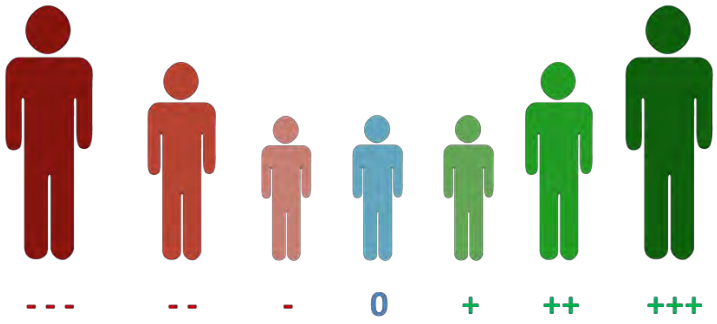
					injury of fish, shellfish and turtles caused by marine plastic bag waste; Cultural services: aesthetic and recreational service Increased value of biodiversity assets Non-use value increased	
Fishing sector	Unlikely (only FfL active schemes, but usually not convenient)	e.g. monetary or in-kind rewards (FfL))			e.g. Additional earnings in the fishing sector due to improved health of marine species; Savings in the fishing sector due to less cleaning and repair operations	
Other sector: … (e.g. tourism)				Increased revenues due to cleaner beaches	Increased recreational value of cleaner beaches	

4.3. DISTRIBUTIONAL ASPECTS

As seen in the table above, different socio-economic groups will experience different magnitudes of costs and benefits. In other words, implementing measures to prevent or reduce marine litter will surely create "winners", but it might also create "losers". This information is crucial for the design and implementation of such measures: for example, it can support the design of specific accompanying measures for mitigating potential negative impacts on affected groups.

In this report, distributional aspects are assessed in a qualitative way. For each measure, we assessed how different groups would be affected by assigning qualitative rates from - - - (very negative impact), to 0 (no impact) to +++ (very positive impact) – as shown in the Figure 7 below.

Figure 7. Legenda: scores applied to the qualitative assessment of distributional aspects



4.4. ACCEPTABILITY AND FEASIBILITY

Acceptability and feasibility are two key aspects to be assessed when evaluating policy measures, as they relate directly to the practical implementation of a measure.

Assessing the **acceptability** of the policy measure implies replying the following questions: is the proposed measure acceptable to socio-economic groups? Which socio-economic groups, in particular, are likely to oppose the measure? Are accompanying measures needed to increase acceptance? Thus, there are direct links with the (qualitative) assessment of distributional impacts discussed above.

Feasibility refers to whether a measure is easy to implement and enforce, and it includes the following aspects: is adaptation in the administrative setup needed? Is the creation of a new unit or body needed? Does the measure require the establishment of new financial flows or rules? Is it expensive for the actor in charge of implementation and enforcement?

4.5. COMPARING THE OVERALL PERFORMANCE OF MEASURES: SCORING SYSTEM

Before illustrating the performance evaluation of measures, it is important to clarify one point: ideally, **the measures illustrated in this report (and potentially others) should be implemented collectively, coherently and in a coordinated way, to give a strong response to marine litter issues**. As previously mentioned, these measures target different steps of the pathways of plastics towards the sea: thus, implementing all these measures at the same time would allow for addressing different issues, from the source (consumption) to the litter already present in the sea.

Thus, **comparing the performance of the measures** should not be seen as a way to select and prioritize measures, but rather as a way to make a synthesis of what each measure can offer, what it can help addressing and which constraints must be addressed for ensuring that the measure works well. To compare the overall performance of the measures, the six criteria presented in this chapter were evaluated using **a simple qualitative scoring system**, which takes into account all the elements, characteristics and effects of the measures presented so far. This scoring system is presented in the Table 5 below.

Table 5. Proposed scoring system to evaluate the overall performance of the measures

Evaluation criteria	Description	Scores 1 → 5	
Acceptability	Whether the measure can be easily accepted by the target groups, or whether accompanying measures are necessary, and to what extent	Very low acceptability	Very high acceptability
Feasibility	Whether the measure is easy to implement, or it requires more or less complex implementation arrangements or actions	Very low feasibility	Very high feasibility
Effectiveness	To which extent the measure is effective: (i) in reducing marine litter; (ii) in providing an incentive for reduced plastic consumption; and (iii) in raising awareness on marine litter and its effects.	Not effective	Very effective
Benefits	Total amount of yearly benefits delivered by the measure	Very low benefits	Very high benefits
Costs	Total amount of implementation and yearly costs associated to the measure	Very high costs	Very low costs
Distributional aspects	Whether some socio-economic groups are negatively or positively impacted by the measure, and to which extent	Very high impact on several groups	Very low impact on one or two groups

The following chapter provides an insight on the methodology developed to assess costs and benefits in this socio-economic study. Chapter 6 to 11 are dedicated to each measure, providing an overview of the assessment following the assessment criteria presented in this chapter, as well as the final scores assigned to each criterion.

5. Zoom on costs and benefits

5.1. ASSESSMENT METHODOLOGY

Costs and benefits were assessed combining qualitative and quantitative aspects, depending on available data and information. The costs and benefits are assessed **assuming that a measure is implemented in all Mediterranean countries**, so as to provide an indication of the potential of each measure for the MED region as a whole.

Overall, the assessment was conducted as follows:

- **Direct costs and benefits**: as these are "real" monetary costs and benefits – i.e. some entity actually disbursed or received an amount of money as part of measure implementation – the assessment had to be based on actual figures – in other words, there was limited space for estimating and/or extrapolating figures. Thus, the assessment was based on data and information from case studies, literature and interviews, and the result is a mix of quantitative and qualitative assessment.
- **Direct economic impacts**: in some cases, figures exist on the direct economic impacts of the measures. Moreover, direct economic impacts often stem from the reduction of plastic use and production, for example, or from a reduction in the quantity of plastic litter in the sea. Thus, knowing existing figures (e.g. for some countries only) and the expected effect of the measure in terms of plastic consumption, production and/or marine litter, in some cases it was possible to develop a harmonized method to estimate some of these direct impacts at the level of the Mediterranean: it was the case for savings for the waste management sector. In contrast, it was not possible to ascertain the impact on the plastic industry, nor to develop a harmonized method for the Mediterranean as a whole, because too many variables are involved with different effects based on location, type of industry, import/export of plastic in each country, etc. (see below). For some socio-economic groups the direct impacts of the measures are not relevant, whereas in one case (retailers) a qualitative assessment was carried out if relevant. Due to lack of data, the avoided costs for the tourism sector due to a decrease in marine (and beach) litter could not be assessed in a quantitative way.
- **Indirect benefits linked to the environmental improvement** (including ecosystem services): environmental benefits rarely correspond to actual monetary flows, or are accounted for (for example in public budget) as avoided costs – for example, a reduction in plastic litter on beaches definitely implies a reduction in the costs of beach cleaning, but monetary figures barely exist. This is even truer in the case of ecosystem services: a cleaner sea is likely to deliver higher ecosystem services (for example, larger fish stocks); although this increase in ecosystem services can result in monetary benefits for some groups, or for society as a whole in case of regulation and cultural services, but these values are either not accounted for as such (e.g. estimates of the lost turnover for the fishing sector due to marine litter are not available) or do not correspond to actual monetary flows (e.g. decreased value of biodiversity assets due to marine litter). Thus, the valuation of environmental benefits typically builds on various valuation techniques such as for example the avoided cost method, the travel cost method, contingent valuation and benefit transfer. In this study, we could estimate the value of four environmental benefits deriving from measure implementation: avoided costs of beach cleaning, avoided degradation of ecosystem services due to a reduction in marine litter, increased recreational value for the tourism sector and avoided costs for the fishing sector. The estimates of these benefits built on unitary values available in the literature and extrapolated to the Mediterranean as a whole: thus, it must be kept in mind that these estimates lean on strong assumptions, and thus these are indicative figures. Nevertheless, the figures assessed by the study provide an useful order of magnitude of the expected environmental benefits of the measures. In the case of consumers, they might enjoy some benefits, but information (even qualitative) was not found. In three cases (benefits for the plastic industry, for retailers and for the waste management sector) benefits were deemed not relevant, and thus these were not estimated.

The Table 6 below provides an overview of which costs and benefits were assessed, and how.

Table 6. Estimation of costs and benefits of the measures: an overview

	Direct costs and benefits	Direct economic impacts	Indirect benefits linked to environmental improvement
Regulators	Information from case studies, literature, interviews - Mix quantitative/qualitative	Mostly not relevant - no harmonized assessment possible	Avoided costs of beach cleaning: harmonized estimation across measures
Plastic industry	Information from case studies, literature, interviews - Mix quantitative/qualitative	Too many variable involved, impossible to provide a reliable quantitative estimate	Not relevant for the assessed measures and case studies
Retailers	Information from case studies, literature, interviews - Mix quantitative/qualitative	Qualitative assessment when relevant	Not relevant for the assessed measures and case studies
Consumers	Information from case studies, literature, interviews - Mix quantitative/qualitative	Mostly not relevant - qualitative assessment when relevant	Possible, but no information was found
Waste management	Information from case studies, literature, interviews - Mix quantitative/qualitative	Savings for waste management: harmonized estimation across measures	Not relevant for the assessed measures and case studies
Society	Information from case studies, literature, interviews - Mix quantitative/qualitative	It might be relevant, but no information were found	Avoided costs of degradation of ecosystem services due to a reduction in marine litter - Harmonized assessment across measures
Tourism sector	Information from case studies, literature, interviews - Mix quantitative/qualitative	Not possible to provide a quantitative estimate due to lack of data, only mentioned qualitatively	Increased recreational value of less litter on beaches - Harmonized assessment across case studies
Fishing sector	Information from case studies, literature, interviews - Mix quantitative/qualitative	Not relevant for the assessed measures and case studies	Avoided costs for the fishing sector: harmonized estimation for all measures and case studies
Other sectors	Information from case studies, literature, interviews - Mix quantitative/qualitative	Not relevant for the assessed measures and case studies	Not relevant for the assessed measures and case studies

In the case of **direct economic impacts and environmental benefits assessed through a harmonized method**, the results proposed in this report must be considered as **indicative estimates, calculated to give an order of magnitude of the potential benefits of the measures**. In fact, these estimates are based on the expected reduction of plastic use (if relevant) and plastic litter in the sea following the introduction of the measure. In this case, the estimates of the benefits are backed by an important assumption, which must be kept in mind: this expected reduction is based on available data and projections, often available for some countries only, which are then extended to the Mediterranean basin as a whole. On this basis, available benefit figures from the literature are transferred to the Mediterranean region; however, available benefit figures are often scarce and scattered, and thus again the resulting figures must be taken as indications of the expected potential benefits. Nevertheless, these estimated allow for **comparing the different measures**, and can be very useful **to promote these measures in the policy agenda**.

The following paragraphs illustrate in more detail the sources of information and the assumptions made for estimating direct impacts and economic benefits linked to environmental improvements. In case of non-market benefits, a full review of available literature is provided in Annex I to this report, to provide a full picture of what is available and explain the choices made in this study.

5.1.1. Economic impact on the plastic industry

The economic impact on the plastic industry is relevant for two of the measures investigated in this study: **taxes and bans on SUPB and voluntary agreements for SUPBs**, as these three measures impact production.

As previously mentioned, the term “plastic industry” is very broad, as it includes producers of very different products, such as SUPBs (High-Density Polyethylene – HDPE bags) and bottles, but also reusable plastic bags (LDPE bags), raw materials, compostable plastic bags, etc. A measure aiming at reducing consumption of HDPE bags will

thus impact production of these bags, as well as consumption and production of alternative bags (Low-Density Polyethylene – LDPE and compostable bags) – if HDPE bags are no longer available, or are more expensive, consumers will look for alternatives. If a change in consumption patterns of carrier bags surely impact production of these bags, it will also impact the consumption and production of raw and intermediate materials, going up the value chain: thus, the plastic industry must be considered as a whole. Of course, this study gives more attention to HDPE bags producers and bottle producers, as they are directly impacted, but it also keeps a wider look on the sector as a whole.

As a simple example, the expected decrease in consumption of plastic bags is expected to result in a decrease in the production of plastic bags. The corresponding lost production value can be estimated based on PRODCOM data (Eurostat)[14], as the average production value[15] of plastic bags in EU MED countries to 3 500 EUR/tonne.

However, estimating the costs of measures (ban and tax on plastic bags) based on this only parameter would result in a huge cost per tonne of reduced marine litter (outweighing benefits by far), without considering other important variables, and namely (BIOis, 2011):

- Lower quality single-use HDPE bags tend to be imported from outside the EU, while EU producers tend to specialize in higher-value, thicker, multiple-use LDPE bags. These bags can be an alternative to single-use HDPE bags, and thus bans and taxes might actually favor EU producers; and
- Producers of single-use HDPE bags might invest in new equipment and adapt their production, thus with a mitigating the effect on production and employment in the medium-long term.

To the authors' knowledge, two studies are available on the impacts of measures to reduce plastic use, and namely:

- BIOis, 2011 – Assessment of impacts of options to reduce the use of single-use plastic carrier bags (for DG Environment): the study does not provide a quantitative assessment of impacts, but only some qualitative considerations reported above. The study concludes that, considering reconversion efforts by the plastic industry, the final impact of these measures might even be slightly positive;
- ICF & Eunomia, 2018 – Assessment of measures to reduce marine litter from single use plastics: the study assesses the impacts of different combinations of voluntary approaches, bans and extended producer responsibility to reduce single-use plastics in the EU. The study applies a complex model which takes into account different plastic products (single use plastics - SUP, single-use non-plastics - SUNP, multi-use items - MU). The study assesses the impact on producers in terms of changes in turnover for the three types of products and globally – the global impact is negative for all assessed policy options. The report specifies that some variable were taken into account, and namely: (i) the proportion of their turnover accounted for by the sale of sue specific SUP in question; (ii) the flexibility of their industry to re-orientate production, and the revenue that might be generated; their ability to manufacture items of materials other than plastics. However, the model used to assess the impacts is not disclosed, so it is unclear which variables were included in the model, and how these were actually measured. The impact was assessed at the EU level, and it was not possible to reproduce such estimations at the Mediterranean level in the context of this study (model not available, lack of capacity and resources).

All this considered, it was decided to provide only a qualitative estimation of the direct impacts on the plastic industry, with a recommendation of further investigating this aspect in future studies.

5.1.2. Savings for the waste management sector

The saving slinked to the reduction of waste generation are approximated by the minimal and maximal cost of landfilling 1 tonne of waste generated. The indicator is built on World bank data[16] on waste generation and management, based on the income level of the country. It takes into account the efficiency of waste collection, collection and landfilling costs. Minimum and maximum values are provided, as shown in the table below.

14 https://ec.europa.eu/eurostat/web/prodcom
15 PRODCOM indicator: PRODVAL – Value of sold production in EUR
https://ec.europa.eu/eurostat/cache/metadata/Annexes/prom_esms_an2.doc
16 https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-334852610766/What_a_Waste2012_Final.pdf

Table 7. Minimum and maximum costs of landfilling for 1 ton of waste generated (EUR/ton) – Source: World Bank

Economy	Income group	Min cost of landfilling for 1 tons of wastegenerated (EUR/t of waste)	Max cost of landfilling for 1 tons of wastegenerated (EUR/t of waste)
Albania	Upper middle income	49	116
Algeria	Upper middle income	49	116
Bosnia and H	Upper middle income	49	116
Croatia	High income	108	302
Cyprus	High income	108	302
Egypt, Arab R	Lower middle income	27	69
France	High income	108	302
Gaza			
Greece	High income	108	302
Israel	High income	108	302
Italy	High income	108	302
Lebanon	Upper middle income	49	116
Libya	Upper middle income	49	116
Malta	High income	108	302
Monaco	High income	108	302
Montenegro	Upper middle income	49	116
Morocco	Lower middle income	27	69
Slovenia	High income	108	302
Spain	High income	108	302
Syrian Arab R	Low income	11	30
Tunisia	Lower middle income	27	69
Turkey	Upper middle income	49	116

The avoided costs were then calculated for each country based on the expected reduction of plastic waste: avoided costs are thus relevant for taxes and bans on plastic bags, voluntary agreements and deposit-refund systems. In this report, average figures are reported – minimum and maximum figures are provided in measure and case study factsheets.

5.1.3. Avoided impact on the tourism sector

The absence of beach litter, or a reduced quantity of beach litter, is expected to benefit the tourism sector, as clean beaches are more attractive for tourists. Thus, measures reducing marine litter are expected to have a positive direct impact on the tourism sector.

Unfortunately, the only data that could be found on the impact of litter on tourism refer to Sweden. In UNEP (2017), it was reported that, according to estimates, the presence of beach litter on the Skagerrak coast (Sweden) decreased tourism by between 1 and 5%. However, the Swedish context is so different from the Mediterranean context that these estimates cannot be transferred.

Thus, this benefit is assessed int this study in a qualitative way only.

5.1.4. Avoided costs of beach cleaning for regulators and public administrations

The estimation of this benefit is based on van Acoleyen et al (2014). Van Acoleyen estimated unitary costs for beach cleaning in Europe (table below), and then assumed a linear correspondence between these costs and the quantity of beach litter on beaches: for example, a 3% reduction in beach litter would result in a 3% reduction of the costs of beach cleaning[17].

[17] It could be argued that all not beaches are actually cleaned. However, this variable could not be quantified; in addition, the approach proposed here, and used by van Acoleyen et al, was validated by the European Commission, and thus it can be considered as reliable.

Table 8. Unitary costs of beach cleaning

Unitary costs for beach cleaning	
EU - van Acoleyen et al, 2014	
	EUR/km
Average	8171
Minimum	3828
Maximum	12446

Source: van Acoleyen et al, 2014

To estimate the total costs and the avoided costs for the Mediterranean as a whole, the total length of beaches in the Mediterranean was calculated based on Wolff et al (2018) and on CIA data[18].

In this report, average figures are reported – minimum and maximum figures are provided in measure and case study factsheets.

5.1.5. Avoided costs of degradation of ecosystem services

Beaumont et al (2019) collated and analysed available evidence on the negative impacts of marine litter on ecosystem services at a global scale. Based on this review, they postulated a 1-5% reduction in marine ecosystem service delivery as a result of marine plastics – a conservative estimate as compared to other estimate available in the literature, such as for example Constanza et al, 2014, which estimated this reduction at 11-28%. In 2011, it was estimated that marine ecosystem servies provided benefits to society approximating USD 50 trillion per year (Constanza et al, 2014). "*This 1-5% in marine ecosystem service delivery equates to an annual loss of USD billion 500-2500 in the value of benefits derived from marine ecosystem services. With the 2011 stock of plastic in the marine environment being estimated between 75 and 150 million tonnes (Jang et al, 2015, McKinsey, 2015), this would equate in 2011, under 2011 levels of marine plastic pollution and based on 2011 ecosystem services values to each tonne of plastic in the ocean having an annual cost in terms of rrduced marine natural capital of between USD 3300 and USD 33000*" (Beaumont et al, 2019).

To the authors' knowledge, this is the only piece of literature attempting to provide an economic estimate of the impacts of marine plastic on ecosystem services (ES), and it was thus decided to transfer these values to the Mediterranean, as shown in the table below (values in EUR).

Table 9. Economic costs of marine plastics as related to the natural capital in EUR

	Minimum	Maximum	Mean value
Economic costs - reduction of marine ES - EUR/tonne	2970	29700	16300
Total economic costs - reduction of marine ES in the MED - Million EUR	792	7920	4350

Source: Beaumont et al, 2019

The benefits of a reduction of marine litter were estimated as avoided costs of degradation of ecosystem services. Also, in this case, a linear relationship was assumed – e.g. e.g. to a 3% reduction in marine litter, a 3% avoided costs is assumed.

In this report, average figures are reported – minimum and maximum figures are provided in measure and case study factsheets.

[18] https://www.cia.gov/library/publications/resources/the-world-factbook/fields/282.html

5.1.6. Increased recreational value of reduced beach litter

Brouwer et al (2017) assessed the willingness to pay for plastic litter removal in beaches in Greece, Bulgaria and the Netherlands. To the authors' knowledge, other transferrable estimates on this type of benefit are not available, and thus this was selected as the reference for this study. The mean willingness to pay (WTP) values per visitor per year are presented in the Table 10 below.

Table 10. Mean WTP values for plastic litter removal in Greece, Bulgaria and the Netherlands

Mean WTP for plastic litter removal (Brouwer et al, 2017)	
	EUR/visitor/year
Greece	**0,67**
Bulgaria	8,25
Netherlands	2,05

Source: Brower et al, 2017

To have a conservative estimate (and avoid the risks of over-estimating the benefits) the value for Greece was selected, as it is the lowest value assessed in Brouwer et al.

The WPT per person per year was multiplied by the total yearly tourist arrivals in Mediterranean countries[19] (Source: UNWTO, 2018): this gave an approximation of the total recreational value of NO litter at all on all Mediterranean beaches. Starting from this basis, also in this case a linear correspondence was assumed: for example: 3% decrease in marine litter is assumed to correspond to 3% of the total recreational value with no litter – which is thus gained following the litter decrease.

5.1.7. Avoided costs for the fishing sector

Van Acoleyen et al (2014) estimated the unitary benefits that would be brought by having no litter both on the sea bottom and the water column, in terms of avoided costs for the fishing fleets – in fact, fishing fleets currently face costs related to large quantities of plastic litter and debris in fishing nets and entangled on parts of the vessels. These unitary costs are shown in the Table 11 below.

Table 11. Unitary benefits of zero marine litter for the fishing sector

Unitary benefits for the fishing sector			
EU - van Acoleyen et al, 2014			
		EUR/vessel/year	
Benefits related to marine litter on the sea bottom	Avoided costs of removing litter from fishing gear	233	trawlers only
	Avoided costs of reduced catch revenue	569	trawlers only
Marine litter in water column	Avoided costs of broken gear and fouled propellers	47	
	Avoided costs of rescue services	13	

Source: van Acoleyen et al, 2014

[19] Tourist arrivals for the Mediterranean area only could not be found, so national data were used.

To have the total benefits of zero litter in the Mediterranean region as a whole, these unitary values were multiplied by the total number of fishing vessels in the MED, of course distinguished by type of vessel (source: FAO data[20]). Then, also in this case, a linear correspondence was assumed: thus, for example, the benefits of a 3% reduction in marine litter would correspond to the 3% of the total avoided costs of zero litter in the Mediterranean.

5.2. COSTS AND BENEFITS OF THE MEASURES CONSIDERED IN THIS STUDY: AN OVERVIEW

Overall, **costs** are strictly dependent on the type of measure; data on implementation/ compliance costs, as well as on negative direct impacts, are quite fragmented, so it was often impossible to come up with quantitative estimates.

In the case of **benefits of implementation/compliance** (e.g. revenues for regulators), in a few cases it was possible to come up with quantitative figures at the MED level; however, more often only a qualitative estimate is provided.

In contrast, the estimation of some **direct positive impacts**, as well as the **benefits linked to an environmental improvement**, was estimated for each measure using harmonized methods (see previous chapter). These methods are all based on the expected reduction of plastic litter in the sea: the assumption at the base of them all is that one tonne of litter not reaching, or removed by the sea corresponds to a given level of benefits. As a consequence of this approach, the unitary value[21] of these benefits resulted to be the same for all measures – and this is quite reasonable, because the removal of one tonne of litter from the sea (or avoiding that one tonne of new litter enters the sea) is expected to deliver the same benefits in terms of ecosystem services, positive impacts and benefits deriving from an environmental improvement. Clearly, **measures allowing for the largest plastic removal or reduction of plastics reaching the sea each year will yield higher benefits**. The strength of this approach is that calculations made for the different measures revealed simple unitary benefit estimates (EUR/ tonne of plastic not reaching, or removed from the sea); and this unitary values can be applied to other measures too; the main weakness is that, at present, estimates on the potential of litter reduction of available measures are often not coherent, and they need to be further investigated.

The unitary values of these benefits are shown in the Table 12 and Figure 8 below.

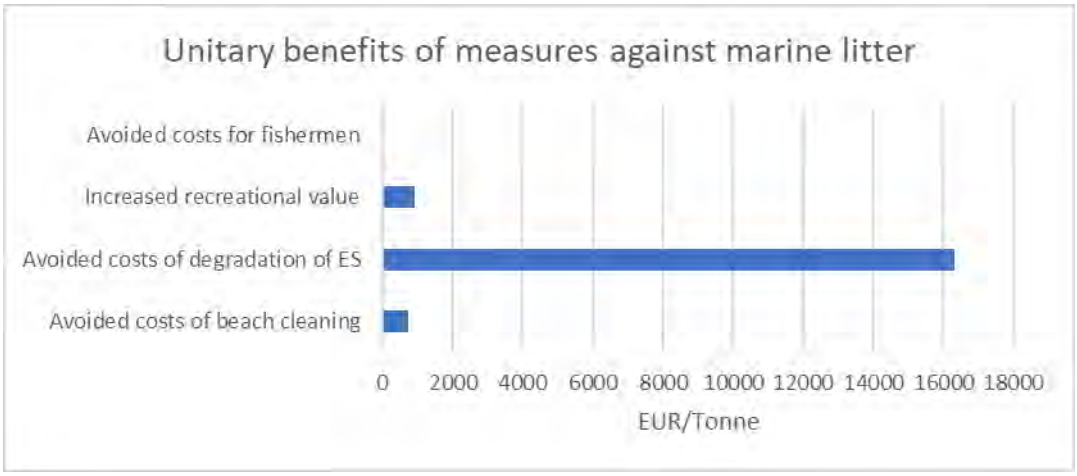
Table 12. Unitary benefits of measures against marine litter

Socio-economic group	Benefit	EUR/tonne
Regulators	Avoided costs of beach cleaning	**740**
Society	Avoided costs of degradation of ES	**16 320**
Tourism sector	Increased recreational value	**900**
Fishing sector	Avoided costs	**40**

Source: own calculation based on methodologies illustrated in section 5.1

[20] FAO - http://www.fao.org/3/a-i5496e.pdf
[21] EUR/tonne of litter removed or not reaching the sea

Figure 8. Unitary benefits of measures against marine litter



Source: own calculation based on methodologies illustrated in Chapter 4

From the graph, one can immediately see that **two benefit types clearly outweigh the others**, and namely the **avoided negative impact on tourism** and the **avoided costs of degradation of ecosystem services**. Nevertheless, also the other benefits are far from being negligible if considered over the whole Mediterranean region.

6. Ban on SUPBs

6.1. MEDITERRANEAN COUNTRIES WHERE THE MEASURE IS IMPLEMENTED

In the Mediterranean, several countries have banned single-use plastic bags, and namely:

- A ban on SUPBs is in place since 2011 in Italy, which was extended to light and ultra-light plastic bags for food packaging in 2018. Compostable SUPBs (also light and ultra-light SUPBs) are allowed, provided to consumers upon payment of a small charge. The ban was preceded by the introduction of a plastic bag production fee in 1988;
- In France the ban on carrier SUPBs was introduced in 2016 – allowing multiple use plastic bags (thickness > 50 microns). In 2017, the ban was extended to all other plastic bags used in shops (e.g. for food packaging on the spot). Compostable bags are allowed;
- Morocco, the world's second largest SUPB consumers after the US, banned all polyethylene (PE) plastic bags in 2016; polypropylene (PP) SUPBs are still allowed;
- Monaco banned SUPBs in June 2016; in 2017, the ban was extended to all plastic bags for the packaging of bulk products on the shelves of food stores or on market stands. Only compostable bags consisting of at least 30 percent bio-sourced materials are allowed;
- Tunisia has developed a ban on all SUPBs with the exception of compostable SUPBs; however, the law has not been approved yet, so the ban will be implemented in the future;
- Albania banned lightweight plastic bags in 2018; however, some implementation challenges were reported.

Figure 9. Implementation of the ban on SUPBs in Mediterranean countries

6.2. EFFECTIVENESS

The table below summarizes how the measure performs in terms of effectiveness, taking into account the three dimensions of effectiveness.

Table 13. Summary of the effectiveness of the measure

							Overall score
Maximum potential litter removal	27 700 Tonnes/year					5	5
Permanence in the marine environment	This measure bans the production of SUPBs, thus solving the problem at the source: it cannot be sold anymore, so it is not produced, so less incremental plastic is introduced into the environment.					5	
Awareness raising potential and incentiveness	On the short run, this measure is likely to encounter citizens' opposition and needs awareness campaigns to increase acceptability; on the long run, however, it increases awareness. At the same time, it does provide an incentive for the adaptation of the plastic industry (decreasing demand for plastics).				4		

6.3. COSTS AND BENEFITS

The expected costs and benefits of the ban on SUPBs at the Mediterranean level are summarized in the Table 14 below.

Table 14. Summary of costs and benefits of the ban on SUPBs at the Mediterranean level

BAN ON PLASTIC BAGS	Maximum potential litter reduction **27 700 Tonnes/year**				
	Direct		**Direct impacts**		**Indirect benefits environmental improvement**
	Benefits	**Costs**	**Positive**	**Negative**	
	Million EUR/year	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*
Public policy actors		Implementation costs			**21**
Plastic industry			Investments in innovation and adaptation, new markets	Not possible to obtain a reliable estimate	
Retailers		Compliance costs			
Consumers		1 Billion EUR the 1st year (purchase alternative bags)			
Waste management			**41**		
Society			No data found	No data found	**453**
Tourism sector			Positive impact on turnover		**25**
Fishing sector					**1**
Other sectors					

On the **direct costs** side, quantitative information on implementation and compliance costs – for regulators and retailers respectively – could not be found. For consumers, UNEP/MAP (2018) estimates a cost per household of EUR 6.9 during the first year for the purchase of reusable bags[22], which would mean 1 Billion EUR in total, considering all MED countries[23] – however, this figure is not very informative, because it hides two assumptions, and namely: (i) all MED countries implement the ban in the same year; and (ii) all consumers buy the same type and quantity of reusable bags. For these same reasons, it is not possible to provide a cost per tonne, as it is a hypothetical, one-time only sum of money.

For **direct impacts**, it was not possible to estimate the costs for the plastic industry (see previous chapter), and no data was found for the direct impacts on society (mostly in terms of employment effects). Positive impacts on the waste management sector (avoided costs of plastic waste collection and disposal) are estimated 1 480 EUR/tonne of plastic litter not reaching the sea as a result of the measure, or 41 Million EUR/year. Avoided negative impacts on the tourism sector were estimated only in a qualitative way, and these are expected to be substantial.

Indirect benefits for environmental improvement are as follows:

- Avoided costs of beach cleaning (benefits for regulators): 21 Million EUR/year;
- Avoided costs of degradation of ecosystem services (benefits for society): 453 Million EUR/year;
- Increased recreational value of less litter on beaches (benefits for the tourism sector): 25 Million EUR/year;
- Avoided costs for the fishing sector: 1 Million EUR/year.

Table 15. Benefits and costs of the ban on SUPBs at the Mediterranean level: synthesis scores

Benefits	High benefits				4	
Costs	Some costs involved, negative impacts on the plastic industry to be ascertained			3		

6.4. DISTRIBUTIONAL ASPECTS

Based on the benefits and costs illustrated above, the measure is expected to largely benefit society as a whole and the tourism sector, followed by the waste management sector. Some (lighter) positive effect is expected on public policy actors. A substantially neutral impact is expected on retailers and consumers, and a light positive impact on the fishing sector.

[22] Data reported in San Francisco, California – data for the Mediterranean area (or at least for a Mediterranean country) could not be found
[23] Population data: Eurostat – Data on average household size: UN, 2017, https://www.un.org/en/development/desa/population/publications/pdf/ageing/household_size_and_composition_around_the_world_2017_data_booklet.pdf

Figure 10. Summary of the distribution of costs and benefits across relevant socio-economic groups

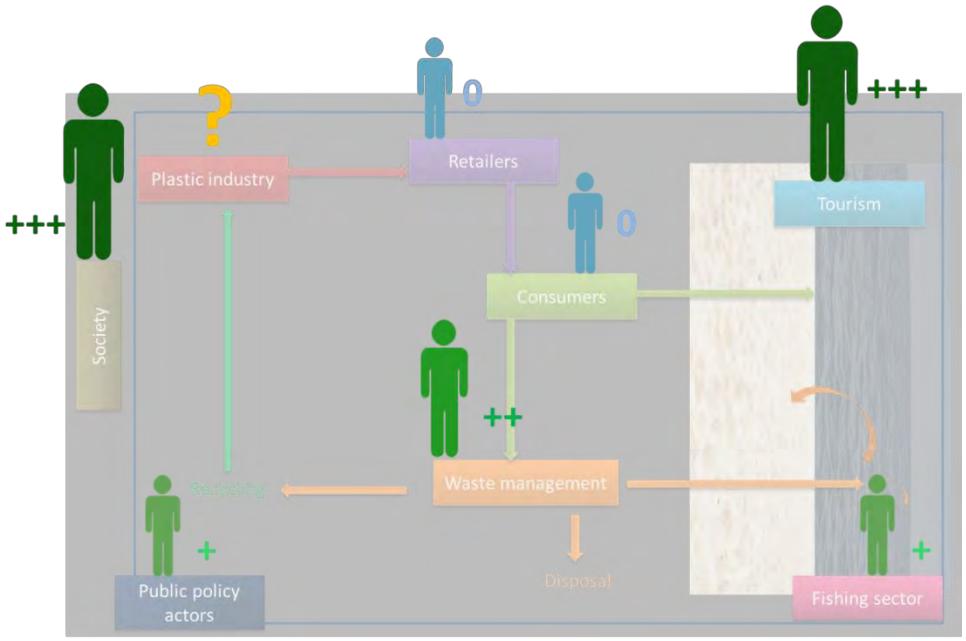


Table 16. Synthesis of score for distributional aspects

Distributional aspects	Very limited negative impacts on social groups - negative impacts on the plastic industry to be ascertained				4	

6.5. ACCEPTABILITY AND FEASIBILITY

Accompanying measures to ease implementation are recommended, and these include (UNEP/MAP, 2018):

- Progressive entry into force of the ban, to give sufficient time to plastic manufacturers and retailers to adapt and reconvert;
- "Prepare" the entry into force of the ban with awareness campaigns, to be continued during the first years of the ban;
- To avoid overconsumption of some alternative single-use bags (e.g. paper bags) the ban can be combined with a levy on such alternatives.

In additions, existing experiences indicate that the ban must include clear specifications on minimum thickness or grammage, so that enforcement and inspections are made easier for public authorities.

The main challenge to the effectiveness of the ban is represented by the **informal sector**, which is quite large in some Mediterranean countries[24] – in countries with a ban, such as Italy and Morocco, it was reported that conventional single-use plastic bags are still used.

Table 17. Acceptability and feasibility of the ban on SUPBs at the Mediterranean level: synthesis scores

Acceptability	It requires awareness raising campaigns to increase acceptability			3		
Costs	Quite feasible, provided that SUPBs concerned by the ban are well specified				4	

[24] In Morocco, for example, the IMF (2019) assessed that the informal sector accounts for 11.5% of nonagricultural GDP, and 36.3% of nonagricultural employment. https://www.imf.org/~/media/Files/Publications/CR/2019/1MAREA2019004.ashx

7. Tax on SUPBs

7.1. MEDITERRANEAN COUNTRIES WHERE THE MEASURE IS IMPLEMENTED

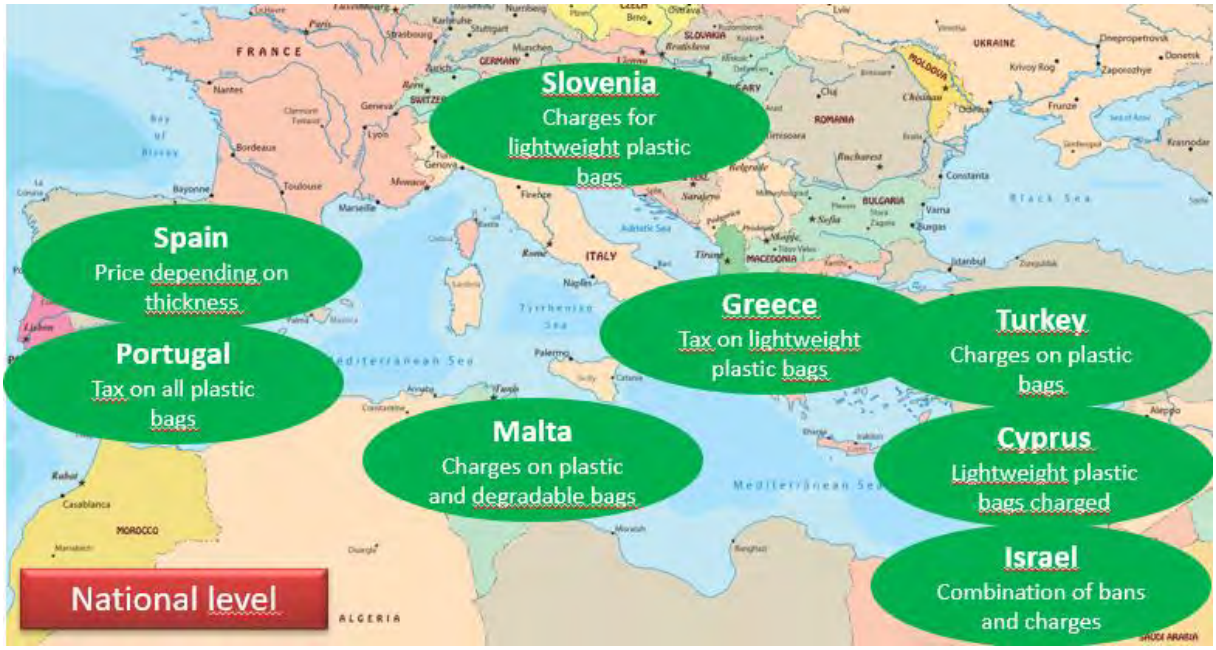
Taxes and charges on plastic bags are already in place in eight Mediterranean countries, and namely: Cyprus, Greece, Israel, Malta, Portugal, Slovenia, Spain and Turkey (Schnurr et al., 2018; Surfrider Foundation Europe, 2018). Taxes are imposed by the State, and revenues are paid to the Government and can thus be re-invested for public purposes. In the case of compulsory charges, consumers must pay a charge on SUPBs, but the revenues do not necessarily go to the State, but can remain with retailers.

The difference can become clearer by looking at the different examples in the Mediterranean basin, and namely:

- In Cyprus, lightweight plastic bags are charged EUR 0.05 as of 1 July 2018. The law was adopted in November 2017 and came into effect on 1 January 2018, with a 6-month transition period.
- Since January 2018, there is an ecotax of EUR 0.04 in place in Greece for lightweight plastic bags. The tax will rise to EUR 0.07 as of 2019. Kiosks and open-air markets are exempted.
- In Israel, the distribution of lightweight plastic bags <20µm is banned since 2017 and bags between 20 and 50µm are subject to charge in all supermarkets.
- Charges for bags exist in Malta since 2005. Biodegradable bags are not taxed. Taxes for degradable bags are EUR 0.14 and for plastic bags EUR 0.16.
- A tax of EUR 0.10 on plastic bags is in place in Portugal since February 2015
- Since January 2019 it is prohibited in Slovenia to give lightweight plastic bags for free. The minimum price is the purchasing price by retailers.
- In Spain, some regions have prohibited free plastic bags since a few years (Andalucía since 2011 and Catalonia since 2017). A national decree from May 2018 prohibits the free distribution of lightweight plastic bags from July 2018. It excludes very lightweight bags (e.g. used for reasons of hygiene) and thicker bags with at least 70% of recycled plastic. The price for plastic bags varies according to its thickness, from 5 to 15 EUR cents per bag[25]. The same decree foresees a ban on lightweight and very lightweight plastic bags (except for compostable bags) as of 2021.
- Since January 1st, 2019, plastic bags are charged in Turkey. A national zero waste program is being implemented. The objective is 90 plastic bags per person per year until 2020.

[25] https://www.citizensadvice.org.es/obliged-to-charge-for-plastic-bags-from-july-1-2018/

Figure 11. Implementation of taxes and charges on SUPBs in Mediterranean countries



7.2. EFFECTIVENESS

The Table 18 below summarizes how the measure performs in terms of effectiveness, taking into account the three dimensions of effectiveness.

Table 18. Summary of the effectiveness of the measure

							Overall score
Maximum potential litter removal	21 400 Tonnes/year				4		4
Permanence in the marine environment	This measure limits the use, and thus the production, of SUPBs, thus limiting the problem at the source: less incremental plastic is introduced into the environment. At the same time, it's less effective than the ban, as SUPBs can still be produced and distributed.				4		
Awareness raising potential and incentiveness	On the short run, this measure is likely to encounter citizens' opposition and needs awareness campaigns to increase acceptability; on the long run, however, it increases awareness. At the same time, it does provide an incentive for the adaptation of the plastic industry (decreasing demand for plastics).				4		

7.3. COSTS AND BENEFITS

The expected costs and benefits of the tax on SUPBs at the Mediterranean level are summarized in the table below. Please note that, to be able to estimate these figures, it was assumed that a tax, and not other type of charges, is imposed in the Mediterranean basin as a whole.

Table 19. Summary of costs and benefits of the tax on SUPBs at the Mediterranean level

TAX ON PLASTIC BAGS	Maximum potential litter reduction 21 400 Tonnes/year				
	Direct		Direct impacts		Indirect benefits environmental improvement
	Benefits	Costs	Positive	Negative	
	Million EUR/year	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*
Public policy actors	**670**	**107 (1st year) 20 (following years)**			**16**
Plastic industry			Investments in innovation and adaptation, new markets	Not possible to obtain a reliable estimate	
Retailers					
Consumers		**670**			
Waste management			**138**		
Society			No data found	No data found	**349**
Tourism sector			Positive impact on turnover		**19**
Fishing sector					**1**
Other sectors					

On the **direct costs** side, the following was found:

- **Implementation and enforcement costs for regulators** amount to 107 million EUR the first year, and 20 million EUR/year for the following years;
- At the same time, **regulators receive 670 million EUR/year as revenues** for the tax – approximately six time higher than implementation and enforcement costs in the first year, and more than thirty times higher than implementation and enforcement costs in the following years. Thus, this measure can be extremely convenient for regulators. As revenues largely outweigh the costs, these revenues could be earmarked for environmental projects, or even for additional measures against marine litter: in this way, the benefits of the tax would be multiplied.
- If regulators receive revenues, someone must be paying. And in fact, **consumers would disbourse 670 million EUR/year for the tax**. However, per capita expenditure would represent 0.03% of GDP per capita, and it can thus be considered largely affordable for consumers.

For **direct impacts**, it was not possible to estimate the costs for the plastic industry (see previous chapter), and no data was found for the direct impacts on society (mostly in terms of employment effects). Positive impacts on the waste management sector (avoided costs of plastic waste collection and disposal) are estimated 6 470 EUR/tonne of plastic litter not reaching the sea as a result of the measure, or 138 Million EUR/year. Avoided negative impacts on the tourism sector were estimated only in a qualitative way, and these are expected to be substantial.

Indirect benefits for environmental improvement are as follows:

- Avoided costs of beach cleaning (benefits for regulators): 16 Million EUR/year;
- Avoided costs of degradation of ecosystem services (benefits for society): 349 Million EUR/year;
- Increased recreational value of less litter on beaches (benefits for the tourism sector): 19 Million EUR/year;
- Avoided costs for the fishing sector: 1 Million EUR/year.

Table 20. Benefits and costs of the tax on SUPBs at the Mediterranean level: synthesis scores

Benefits	High benefits					5
Costs	Some costs involved, negative impacts on the plastic industry to be ascertained			3		

7.4. DISTRIBUTIONAL ASPECTS

Based on the benefits and costs illustrated above, the measure is expected to largely benefit society as a whole and the tourism sector, followed by the waste management sector. Some (lighter) positive effect is expected on public policy actors. A substantially neutral impact is expected on retailers and consumers, and a light positive impact on the fishing sector. A light negative impact might be experienced by consumers.

Figure 12. Summary of the distribution of costs and benefits across relevant socio-economic groups

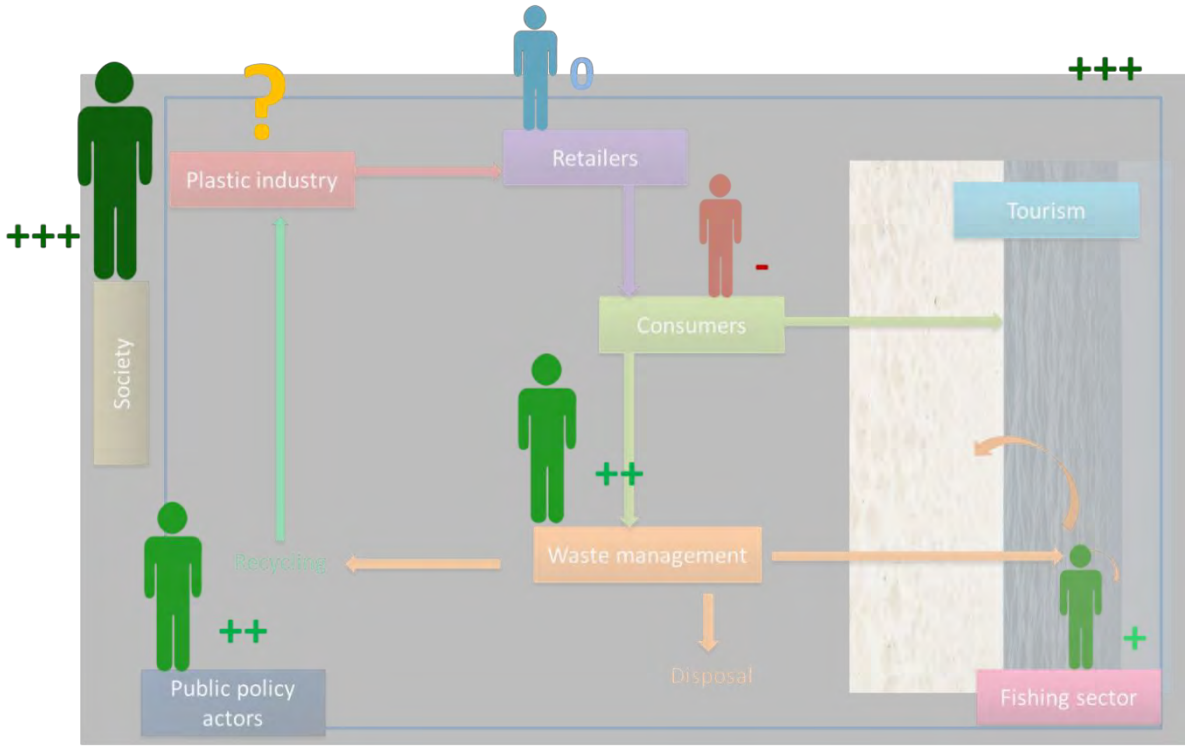


Table 21. Synthesis of score for distributional aspects

Costs	Very limited negative impacts on social groups - negative impacts on the plastic industry to be ascertained	4

7.5. ACCEPTABILITY AND FEASIBILITY

Implementing a tax on single-use plastic bags is linked to important administrative settings and follow up activities. However, it is effective in reducing consumption of plastic bags – and, in turn, of marine litter.

Pre-conditions for successful implementation include (Plan Bleu, 2017):

- The rate of the tax must be fixed at the right amount – i.e. sufficiently high to refrain from using single-use plastic bags. At the same time, if the tax is too high, acceptance and credibility of the tax will be low;
- The definition of bags subject to the tax must be clear and as large as possible, to avoid replacement with bags which have a similar negative impact on the environment;
- The tax must be visible for consumers – i.e. it should be well indicated in shops as well as on invoices or receipts. This has awareness raising and psychological impacts well above its actual cost for consumers;
- Levying the tax at the manufacturer/importer level reduces the administrative effort to a limited number of collection points which are already VAT registered. This could to be advisable for the Mediterranean region, where informal (non-VAT registered) outlets are numerous. Manufacturers and importers then collect the fee from retailers who in turn are obliged to pass the per bag tax on to the final consumers; and

- Public consultation should involve all relevant stakeholders: retailers, producers, importers and various trade groups. However, the consultation process should not put the measure into question but concentrate on defining implementation modalities.

With adapted consultation and communication processes which accompany the introduction of plastic bag taxes its **acceptability** is quite high. In addition, consumers tend to show more acceptance for a plastic bag tax when the revenue generated by it is earmarked for environmental purposes, instead of revenues being injected in general budget. Given its revenue generating character, no issues of financial feasibility exist.

Table 22. Acceptability and feasibility of the tax on SUPBs at the Mediterranean level: synthesis scores

Acceptability	It requires awareness raising campaigns to increase acceptability		**2**	
Feasibility	It requires building a management system within the public authority		**2**	

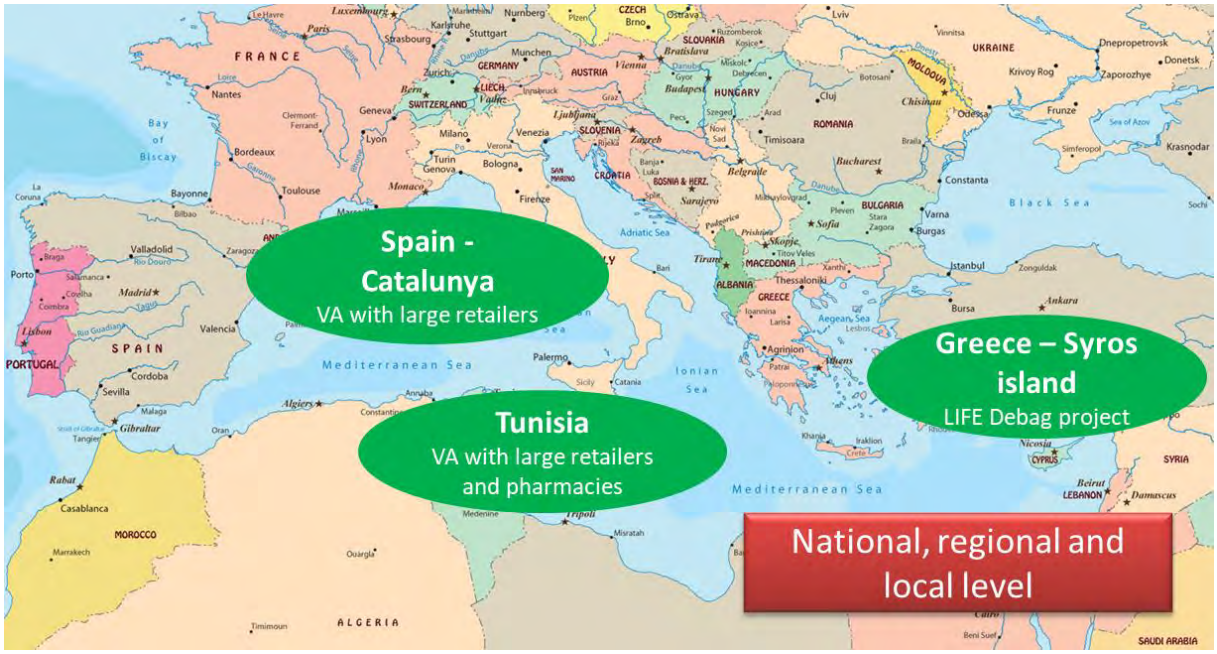
8. Voluntary agreements

8.1. MEDITERRANEAN COUNTRIES WHERE THE MEASURE IS IMPLEMENTED

Voluntary initiatives, often at the initiative of the government and retail sector, exist in many countries such as for example Belgium, UK, Finland, Germany and Austria (UNEP/MAP, 2018, and Surfrider Foundation, 2018). In the Mediterranean region, in contrast, few countries have voluntary agreements in place, and namely:

- Tunisia: two conventions were signed in in 2017 between the Tunisian government and the Union Chamber of large retailers (UTICA) and the Union of Tunisia Pharmaceutics (SPOT) – so that SUPBs are no longer distributed in supermarkets (since 2017) and in pharmacies (since 2018);
- Greece – Syros island: a VA is implemented through the LIFE Debag project;
- Spain – Catalonia: large retailers signed up for voluntary agreements with the regional public authorities, so that now they charge SUPBs or pay a small amount back (around EUR 0.10) to customers who do not take any plastic bag.

Figure 13. Implementation of voluntary agreements in Mediterranean countries



8.2. EFFECTIVENESS

The Table 23 below summarizes how the measure performs in terms of effectiveness, taking into account the three dimensions of effectiveness.

Table 23. Summary of the effectiveness of the measure

						Overall score
Maximum potential litter removal	17 700 Tonnes/year			3		4
Permanence in the marine environment	This measure limits the use, and thus the production, of SUPBs, thus limiting the problem at the source: less incremental plastic is introduced into the environment. At the same time, it's less effective				4	

	than the ban, and the tax, as SUPBs are charged or forbidden on a voluntary basis, by certain economic actors only.	
Awareness raising potential and incentiveness	Economic actors are acting voluntary, and they are likely to promote their participation to the schemes with customers – they are doing something for the environment, they are responsible companies. This promotion in fact acts as an awareness-raising campaigns, as it reaches all customers – and thus, also those customers with no knowledge of the marine litter issue. In addition, it provides an incentive for the adaptation of the plastic industry (decreasing demand for plastics).	4

8.3. COSTS AND BENEFITS

The expected costs and benefits of voluntary agreements at the Mediterranean level are summarized in the Table 24 below.

Table 24. Summary of costs and benefits of voluntary agreements at the Mediterranean level

Voluntary approaches	Maximum potential litter reduction 17 700 Tonnes/year				
	Direct		Direct impacts		Indirect benefits environmental improvement
	Benefits	Costs	Positive	Negative	
	Million EUR/year	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*
Public policy actors	Lower admin and compliance costs as compared to other measures	Monitoring and awareness-raising campaigns			**13**
Plastic industry			Investments in innovation and adaptation, new markets	Not possible to obtain a reliable estimate	
Retailers	Foregone costs of free SUPBs	Administration costs			
Consumers		Purchase alternative bags			
Waste management			**26**		
Society			No data found	No data found	**289**
Tourism sector			Positive impact on turnover		**16**
Fishing sector					**1**
Other sectors					

On the **direct costs and benefits** side, these costs can depend on the type of agreement, as different types are available, as well as on the percentage of retailers joining, so it is not possible to provide one-size-fits-all figures. Nevertheless, lower administration and compliance costs – as compared to other measures – can be expected for public policy actors; costs for this group can be expected for monitoring activities and awareness campaigns. For retailers, they will save money if they used to distribute SUPBs for free before the agreement, but they will have to sustain some costs for administering the scheme. Consumers might incur in costs for purchasing alternative shopping bags but, as it was shown for the other measures, these costs are expected to have e negligible impact.

For **direct impacts**, it was not possible to estimate the costs for the plastic industry (see previous chapter), and no data was found for the direct impacts on society (mostly in terms of employment effects). Positive impacts on the

waste management sector (avoided costs of plastic waste collection and disposal) are estimated 1 480 EUR/tonne of plastic litter not reaching the sea as a result of the measure, or 26 Million EUR/year. Avoided negative impacts on the tourism sector were estimated only in a qualitative way, and these are expected to be substantial.

Indirect benefits for environmental improvement are as follows:

- Avoided costs of beach cleaning (benefits for regulators): 13 Million EUR/year;
- Avoided costs of degradation of ecosystem services (benefits for society): 289 Million EUR/year;
- Increased recreational value of less litter on beaches (benefits for the tourism sector): 16 Million EUR/year;
- Avoided costs for the fishing sector: 1 Million EUR/year.

Table 25. Benefits and costs of the ban on SUPBs at the Mediterranean level: synthesis scores

Benefits	Good benefits, limited in magnitude by the voluntary character of the measure			3		
Costs	Some costs involved, negative impacts on the plastic industry to be ascertained				4	

8.4. DISTRIBUTIONAL ASPECTS

Based on the benefits and costs illustrated above, the measure is expected to largely benefit society as a whole and the tourism sector, followed by the waste management sector. Some (lighter) positive effect is expected on public policy actors. A substantially neutral impact is expected on retailers and consumers, and a light positive impact on the fishing sector. A light negative impact might be experienced by consumers.

Figure 14. Summary of the distribution of costs and benefits across relevant socio-economic groups

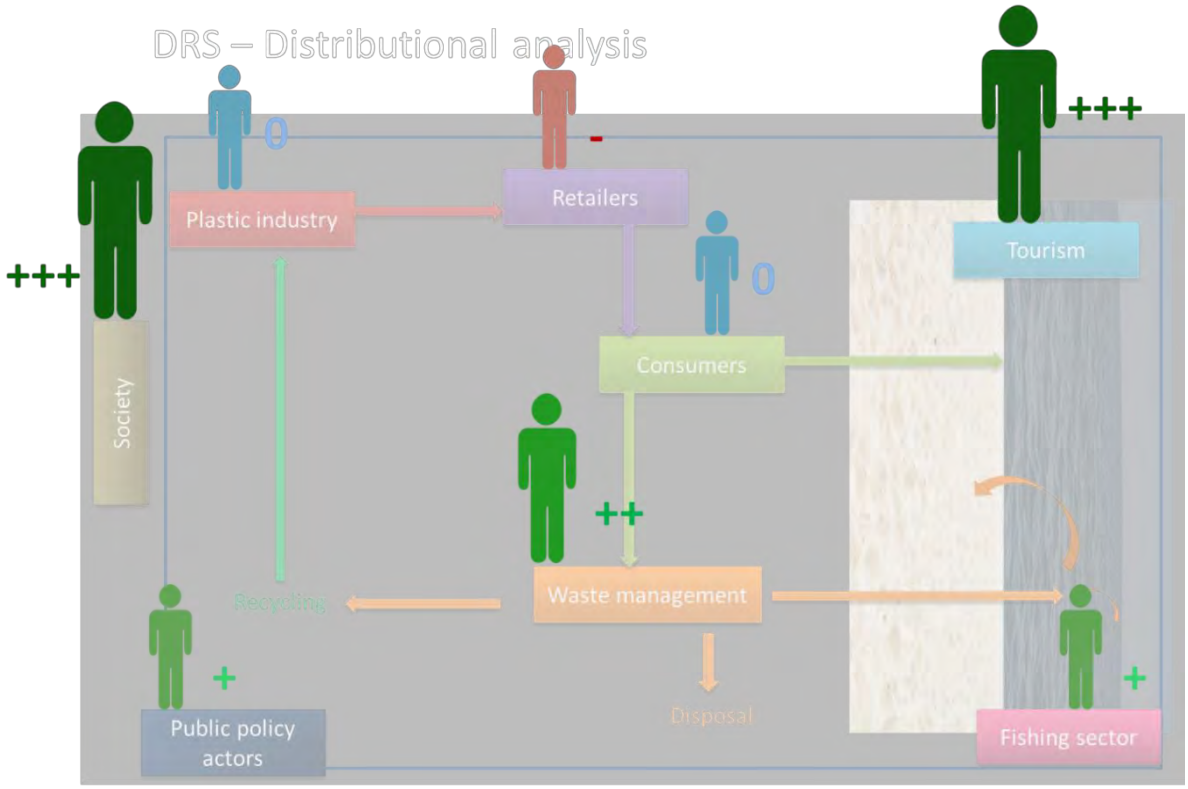


Table 26. Synthesis of score for distributional aspects

Costs	Very limited negative impacts on social groups - negative impacts on the plastic industry to be ascertained				4	

8.5. ACCEPTABILITY AND FEASIBILITY

Voluntary actions target broad groups of stakeholders, and their effectiveness might be limited by the fact that uncompliant partners are often weakly sanctioned; on the other hand, they are **simple and inexpensive to implement** for public policy actors, whereas retailers face a similar implementation complexity as with the tax on SUPBs. As the tax, voluntary agreements are low-cost to consumers. The voluntary character of this measure can result in less participation from retailers and consumers and the benefits and impacts are not significant like ban or tax.

In terms of **feasibility**, the measure is voluntary, so it might not be adopted by some economic operators, or operators might join but eventually not comply, as sanctions are weak or inexistent – and this might (even significantly) limit its effectiveness (UNEP/MAP, 2018; Croci, 2005).

To **improve general performance and success** of VA, the following is suggested:

- Establish penalties for non-compliance by participants. Without penalties, participants will "compare the benefits deriving from the non-compliance with the expected costs" (Croci 2005).
- Differents reports as Croci (2005) suggests that in order for voluntary actions to be effective, there must be an active, legitimate threat of regulation.
- Targets must go beyond 'business as usual'. Voluntary action can stimulate innovation and performances, but the established targets must be set before.
- An education and awareness campaigns have to be organized in the same time of the implementation of VA for consumers to understanding of the measures (UNEP/MAP, 2018).

Clearly, being a voluntary measure, its **acceptability** is expected to be very high for retailers who decide to join the campaign. In contrast, the measure could meet opposition from consumers, who must pay a charge on SUPBs.

Table 27. Acceptability and feasibility of the ban on SUPBs at the Mediterranean level: synthesis scores

Acceptability	Acceptability very high for retailers, who join the scheme on a voluntary basis, and potentially low for consumers, who are charged for SUPBs			3		
Feasibility	Easy to implement for public policy actors, retailers face similar implementation complexity as with the Tax, but with no or little penalties in case of non-compliance					5

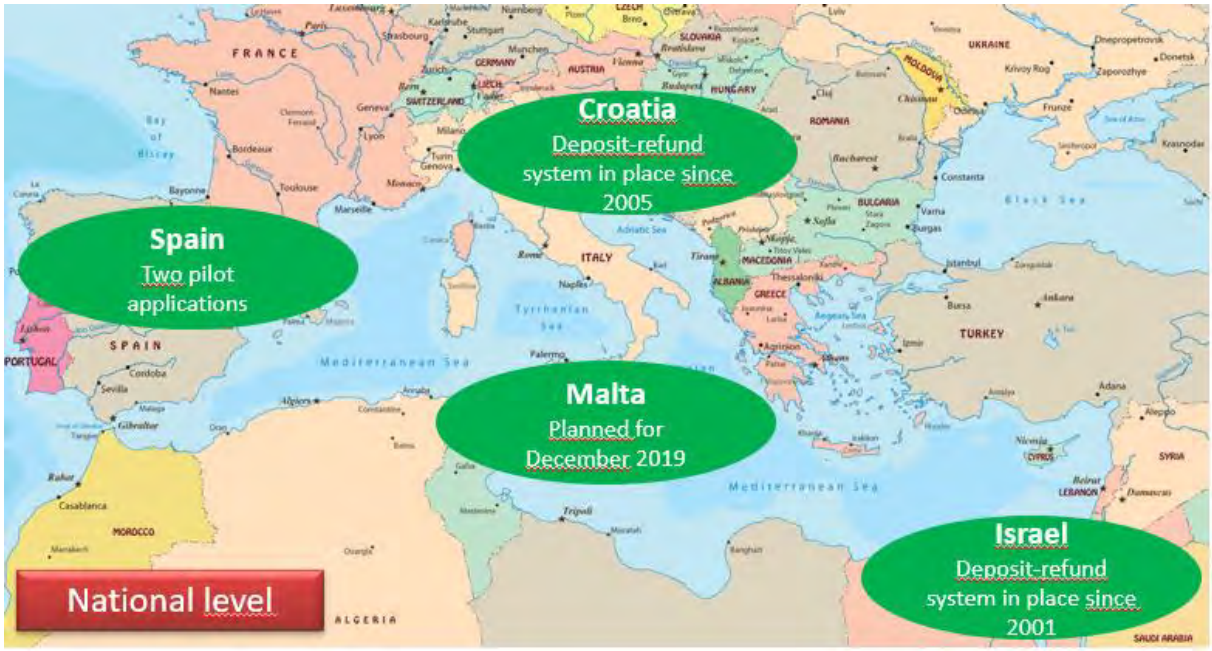
9. Deposit-Refund Systems

9.1. MEDITERRANEAN COUNTRIES WHERE THE MEASURE IS IMPLEMENTED

In the Mediterranean, deposit-refund systems are in place in Israel (since 2001) and Croatia (since 2005). A deposit refund system is planned to be introduced in Malta by December 2019. Furthermore, pilot applications have been conducted in Catalonia, Spain (several sources):

- In both countries, Israel and Croatia, the deposit-refund system includes plastic (in particular PET), metal (in particular aluminum), and glass
- The scheme which is planned for Malta will apply to metal cans, plastic and glass bottles.

Figure 15. Implementation of deposit-refund systems in Mediterranean countries



9.2. EFFECTIVENESS

The Table 28 below summarizes how the measure performs in terms of effectiveness, taking into account the three dimensions of effectiveness.

Table 28. Summary of the effectiveness of the measure

							Overall score
Maximum potential litter removal	32 000 Tonnes/year					5	4
Permanence in the marine environment	The measure provides a strong incentive to bring bottles back to the retailer. This reduces considerably the risk that plastic bottles end up in the environment and hence in the sea. Less incremental plastic is introduced into the environment				4		
Awareness raising potential and incentiveness	DRS do not change production and consumption mechanisms, but they do raise awareness on the impact of single-use plastics			3			

9.3. COSTS AND BENEFITS

The expected costs and benefits of Deposit-Refund Systems at the Mediterranean level are summarized in the Table 29 below.

Table 29. Summary of costs and benefits of Deposit-Refund Systems at the Mediterranean level

Deposit-Refund Systems	Maximum potential litter reduction: 32 000 Tonnes/year				
	Direct		Direct impacts		Indirect benefits environmental improvement
	Benefits	Costs	Positive	Negative	
	Million EUR/year	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*
Public policy actors	Unclaimed deposit	Implementation costs			**24**
Plastic industry		Possible compliance costs			
Retailers		Compliance costs (e.g. vending machines)			
Consumers	Collection of plastic bottles				
Waste management			**35**		
Society					**523**
Tourism sector			Positive impact on turnover		**29**
Fishing sector					**1**
Other sectors					

On the **direct costs** side, quantitative information on implementation and compliance costs – for regulators, retailers and plastic industry respectively – could not be found. However, this measure might be very expensive for retailers, as reverse vending machines (collecting used bottles) cost more than 15 000 EUR each.

Depending on how the system is designed and managed, there can be **revenues for the entities managing the deposit-refund system and consumers**. Available information does not allow for estimating these revenues at the MED level. However, possible revenues include: (i) the entities managing the deposit-refund system can gain the

amount of unclaimed deposits (about 10% of total deposits). The ones selling the recycled material can receive higher selling prices compared to material collected through separate waste collection systems; and (ii) Consumers may collect bottles thrown away by others and to receive the deposit.

For **direct impacts**, no particular impacts are expected on the plastic industry, as this measure targets waste generation rather than consumption. As plastic bottles are collected and recycled, there are still positive impacts on the waste management sector (avoided costs of plastic waste collection and disposal), estimated at 1 078 EUR/tonne of plastic litter not reaching the sea as a result of the measure, or 35 Million EUR/year. Avoided negative impacts on the tourism sector were estimated only in a qualitative way, and these are expected to be substantial.

Indirect benefits for environmental improvement are as follows:

- Avoided costs of beach cleaning (benefits for regulators): 24 Million EUR/year;
- Avoided costs of degradation of ecosystem services (benefits for society): 523 Million EUR/year;
- Increased recreational value of less litter on beaches (benefits for the tourism sector): 29 Million EUR/year;
- Avoided costs for the fishing sector: 1 Million EUR/year.

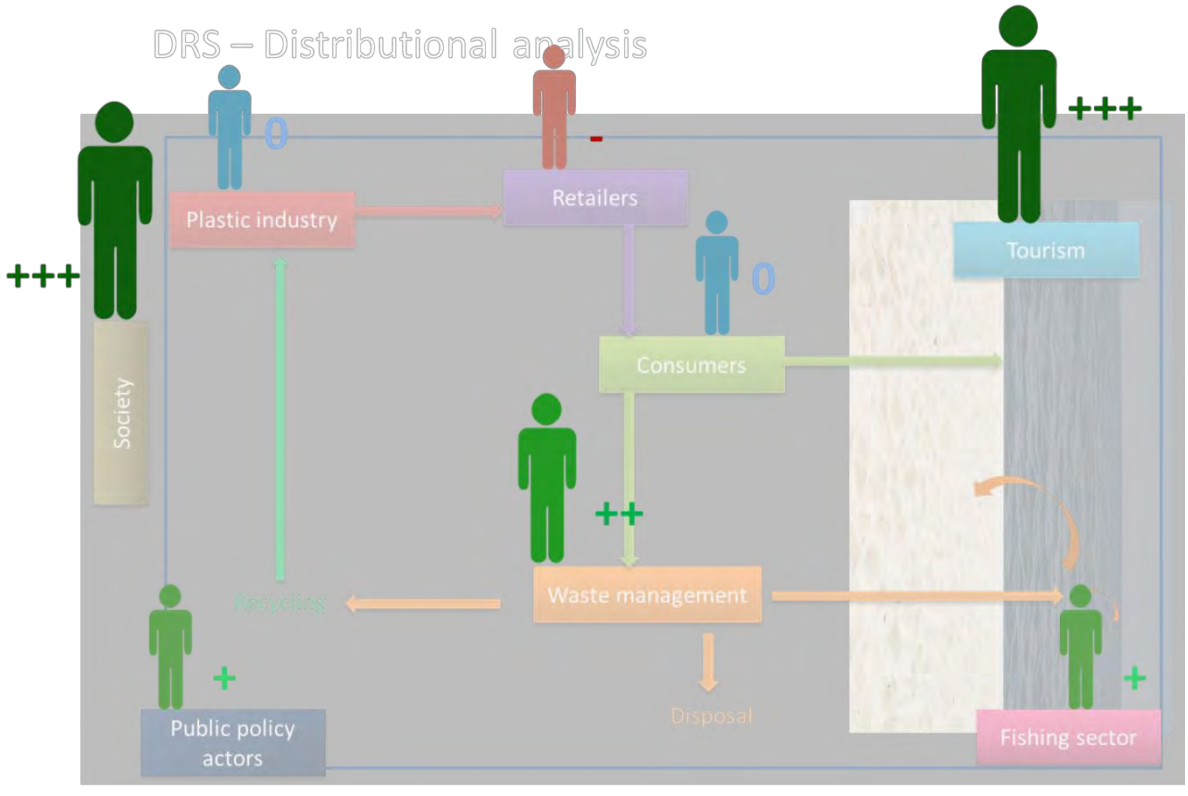
Table 30. Benefits and costs of Deposit-Refund Systems at the Mediterranean level: synthesis scores

Benefits	High benefits, especially because of the very high potential for plastic litter reduction (as compared to other measures)					5
Costs	Reverse-vending machines can be expensive			3		

9.4. DISTRIBUTIONAL ASPECTS

Based on the benefits and costs illustrated above, the measure is expected to largely benefit society as a whole and the tourism sector, followed by the waste management sector. Some (lighter) positive effect is expected on public policy actors and the fishing sector. A substantially neutral impact is expected on consumers and the plastic industry, whereas a light negative impact might occur on retailers (linked to the costs of vending machines).

Figure 16. Distributional aspects of Deposit-Refund systems



Distributional aspects	Light negative impact on retailers, positive or zero impact on other social groups – even very positive for society and the tourism sector				4	

9.5. ACCEPTABILITY AND FEASIBILITY

Whereas for reusable packaging like glass, deposit-refund systems are often voluntary (and effective) market mechanisms to recollect the packaging, DRS for single use beverage containers are often legally binding for producers and/or retailers and provide at the same time **economic incentives** for consumers to participate. Individual benefits or disadvantages seem to be very effective in increasing collection rates of good quality material for recycling, and a quite **fast change in behavior** can be observed. However, the introduction of the system needs to be accompanied by good communication, emphasizing the effectiveness of the measure as well as the sense-of-urgency to act with regards to the environmental problem of littering. This will increase social acceptance of the instrument (Van Acoleyen et al. 2014, Djemaci 2011).

The main disadvantage of the DRS lies in the high costs for the installation of reverse vending machines as well as subsequent operational (in particular transport) costs. These costs are often only partly covered by revenues through uncollected deposits as well as by selling the collected raw materials (Drab and Slučiaková 2018). In case there is a negative balance between revenues and costs, it is often paid by producers through administrative fees. The academic literature comparing the total costs and benefits of the deposit-refund system is ambiguous, citing cases in which benefits exceed costs, and other cases where costs seem to be higher than the benefits gained from the introduction of the system (Drab and Slučiaková 2018).

Table 31. Acceptability and feasibility of Deposit-Refund Systems at the Mediterranean level: synthesis scores

Acceptability	Skepticism is often encountered at the beginning, in particular on the part of the retailers as well as companies putting packaging on the market. However, communication campaigns and high participation of the population dissipate concerns quickly.				4	
Feasibiltiy	The implementation at a large scale is challenging, as all supermarkets must have the reverse vending machine			3		

10. Fishing for Litter

10.1. MEDITERRANEAN COUNTRIES WHERE THE MEASURE IS IMPLEMENTED

In the Mediterranean, Fishing for Litter actions are usually implemented as independent projects with varying geographical scope, from port-based projects (e.g. San Remo, Italy) to regional projects (e.g. DeFishGear, Adriatic and Ionian Sea). Since 2008, 10 FfL projects have been implemented, involving 806 boats – as a matter of comparison, the fishing fleet in the Mediterranean is estimated at about 55,900 vessels, of which 9,600 trawlers (FAO, 2018).

Table 32. Inventory of FfL schemes in the Mediterranean

Project	Ports	Effectiveness	Period	Area
DeFishGear	15	124 fishing vessels, 144 tons of litter retrieved	2014-2016	Italy, Slovenia, Croatia, Montenegro, Greece
Upcycling the Oceans (including Marviva)	37	546 boats, 2500 fishermen 113 tons of litter retrieved	2017	Spain
Reseaclons	1	22 trawlers engaged	2008-2018	Camarguese Coast (France)
Ecological bags on board	1	30 trawlers and 8 trammels engaged	2012	Alicante Coast (Spain)
Ecopuertos	1	5 trawlers	2013-2014	Andalusian Coast (Spain)
Port of San Remo	1	11 trawlers engaged	2015	Ligurian Coast (Italy)
Port of Rovinj	1	20-25 boats engaged	2015	Northern Adriatic (Croatia)
ML-Repair	5	30 fishing vessels 5 tons of litter retrieved	2018	Croatia, Italy
Marlisco	3	5 garbage collection boats engaged in 3 municipalities	2005-2012	Turkey
North Aegean	2?	No data on results, number of vessels, etc.	No info	Kavala and Thessaloniki, Greece

Figure 17. Geographical distribution of FfL projects in the Mediterranean since 2008

10.2. EFFECTIVENESS

The Table 33 below summarizes how the measure performs in terms of effectiveness, considering the three dimensions of effectiveness.

Table 33. Summary of the effectiveness of the measure

		Overall score
Maximum potential litter removal	2 400 Tonnes/year	2
Permanence in the marine environment	FfL schemes remove plastic litter already in the sea – it is likely that litter is collected after very different time spans of permanence in the marine environment, thus at different degradation stages.	
Awareness raising potential and incentiveness	The measure is very effective and good at raising awareness on marine litter, especially among fishermen – also improving their sense of stewardship towards the sea. However, this awareness-raising potential is limited by the low share of fishermen joining such schemes.	

10.3. COSTS AND BENEFITS

The costs and benefits of Fishing for Litter schemes at the Mediterranean scale are summarized in the Table 34 below.

Table 34. Costs and benefits of Fishing for Litter schemes at the Mediterranean level

Fishing for Litter	Maximum potential litter reduction 2 400 Tonnes/year				
	Direct		Direct impacts		Indirect benefits environmental improvement
	Benefits	Costs	Positive	Negative	
	Million EUR/year	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*
Public policy actors		Significant costs are expected for administrating the system and collecting litter at ports			**2**
Plastic industry					
Retailers					
Consumers					
Waste management		**0.3**			
Society					**39**
Tourism sector			Positive impact on turnover		**2**
Fishing sector		Collection and packing of litter (passive schemes)			**0.1**
Other sectors					

Design, implementation, monitoring and enforcement of Fishing 4 Litter schemes might involve significant costs for public policy actors, as costs include involvement of fishermen, project coordination and waste collection at ports. In the literature, available estimates of these costs range from 800 to 5 200 EUR/tonne of litter retrieved. However, Large economies of scale can be found in FFL schemes with proper area targeting, which at constant fleet level can increase up to a hundredfold its efficiency – and thus lower the costs per tonne. In addition, these schemes involve **additional workload for fishermen**, who invest their time and energy in the collection and packing of litter marine retrieved from the sea – even in passive schemes, that are the focus of this assessment. However, it was not possible to come up with a quantitative estimate of these costs. The **additional costs for waste disposal and management** was estimated at 0.3 million EUR per year.

For **direct impacts**, no particular impacts are expected on the plastic industry, as this measure targets litter already in the sea, and thus does not have any influence on consumption. In turn, avoided negative impacts on the tourism sector are expected to be significant as compared to other benefits of the measure.

I**ndirect benefits for environmental improvement** are also significant, and namely:

- Avoided costs of beach cleaning (benefits for regulators): 2 Million EUR/year;
- Avoided costs of degradation of ecosystem services (benefits for society): 39 Million EUR/year;
- Increased recreational value of less litter on beaches (benefits for the tourism sector): 2 Million EUR/year;
- Avoided costs for the fishing sector: 0.1 Million EUR/year.

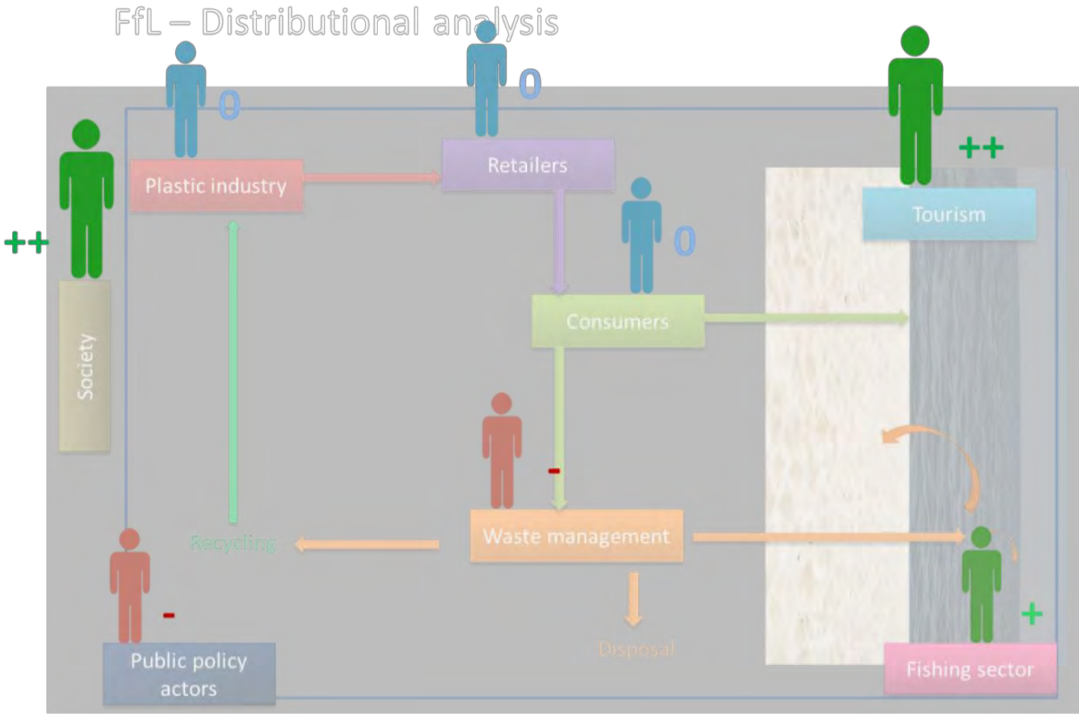
Table 35. Benefits and costs of Fishing for Litter schemes at the Mediterranean level: synthesis scores

Benefits	Limited benefits as compared to other measures, linked to limited litter removal potential			2		
Costs	Administration and litter collection costs might be significant for public policy actors. Costs for other sectors are negligible.				3	

10.4. DISTRIBUTIONAL ASPECTS

Based on the benefits and costs illustrated above, the measure is expected to benefit society as a whole and the tourism sector some light benefits are also expected for the fishing sector. A substantially neutral impact is expected on consumers, retailers and the plastic industry, whereas a light negative impact might occur on public policy actors and the waste management sector.

Figure 18. Distributional aspects of Fishing for Litter schemes



Distributional aspects	Light negative impact on public policy actors and the waste management sector, neutral con retailers, consumers and the plastic industry, positive impact on other groups			3		

10.5. ACCEPTABILITY AND FEASIBILITY

Pre-conditions for successful implementation include:

- Fishing vessels of appropriate size – they need to have enough room on board to accommodate large bags or containers in which the waste is collected. However, experience from the DeFishGear project shows that even small-scale fisheries can effectively implement fishing for litter programmes;
- Appropriate port reception facilities: The waste fished during fishing for litter initiatives needs to be handled and disposed of;
- A communication plan should be developed and implemented to promote the initiative and to raise awareness of fishermen and the fishing sector to the impacts of marine litter, thus insuring their willingness to participate. To achieve this, strong commitment from the regulator is needed (UNEP/MAP, 2018; Plan Bleu, 2017);
- 'Passive' Fishing for Litter schemes, where fishermen collect waste during their normal fishing trips, are more cost-effective and have very little negative effects. In contrast, in 'active' schemes fishermen are paid to go out and collect waste with dedicated trips, thus with negative environmental effects (e.g. CO_2 emissions) (Belin et al, 2017);
- Establishing partnerships for litter handling: litter collection in the port, transport and disposal (recycling or incineration) are expensive activities, but if these are undertaken by specialized companies the costs decrease.

Table 36. Acceptability and feasibility of Fishing for Litter schemes at the Mediterranean level: synthesis scores

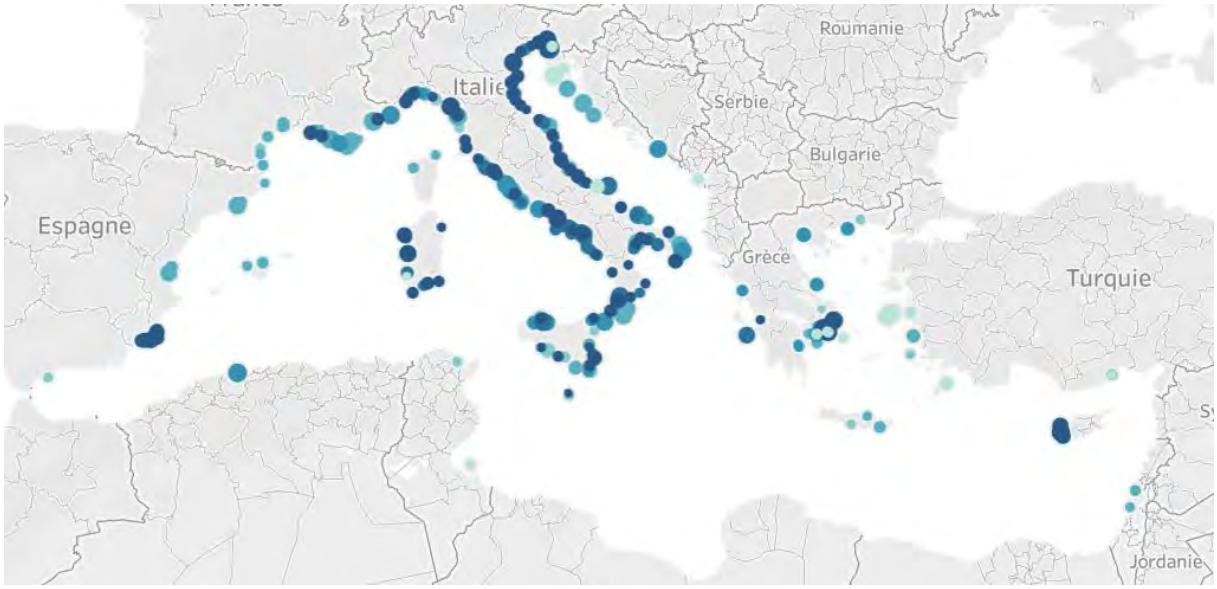
Acceptability	Some awareness raising work with fishermen is required, but normally it's well accepted				4	
Feasibility	Working with fishermen can be time consuming; the scheme needs appropriate port facilities and it might take a long time to set up large schemes			3		

11. Adopt a Beach

11.1. MEDITERRANEAN COUNTRIES WHERE THE MEASURE IS IMPLEMENTED

Adopt-a-beach schemes are rarely accounted as such by governmental and non-governmental programs. More often, they are to be found under **cleanup or marine litter monitoring initiatives**. According to data from the Marine Litter watch (MLW) database of the European Environment Agency, at least 312 cleanup or monitoring events have taken place along Mediterranean shores and collected about 344.000 items between 2013 and 2018; these are shown in the Figure 19 below.

Figure 19. Map of Marine Litter Watch communities events 2013 -2019 (source: Marine litter Watch



In addition to MLW events, the followings actions were found:

- The Clean Up the Med initiative, coordinated by Legambiente, involves more than 1,500 locations in 21 Mediterranean countries[26];
- One pilot project is currently being implemented in Montenegro by UNEP/MAP in collaboration with other partners;
- Vlachogianni (2019) reported eight recent assessment studies of marine litter on Mediterranean beaches, covering eleven countries.

11.2. EFFECTIVENESS

The Table 37 below summarizes how the measure performs in terms of effectiveness, taking into account the three dimensions of effectiveness.

[26] https://www.legambiente.it/clean-up-the-med-en/

Table 37. Summary of the effectiveness of the measure

		Overall score
Maximum potential litter removal	7 900 Tonnes/year	3
Permanence in the marine environment	Adopt a Beach initiatives collect plastic litter when it lands on beaches, so potentially after a long permanence in the sea – with consequent degradation and generation of micro-plastics pollution.	
Awareness raising potential and incentiveness	This measure is very effective in raising awareness, and also in generating a sense of ownership/ stewardship toward marine ecosystems	

11.3. COSTS AND BENEFITS

The expected costs and benefits of Adopt a Beach initiatives at the Mediterranean level are summarized in the Table 38 below.

Table 38. Summary of costs and benefits of Adopt a Beach initiatives at the Mediterranean level

Adopt a Beach	Maximum potential litter reduction 7 900 Tonnes/year				
	Direct		Direct impacts		Indirect benefits environmental improvement
	Benefits	Costs	Positive	Negative	
	Million EUR/year	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*	*Million EUR/year*
Public policy actors		No quantitative information			6
Plastic industry					
Retailers					
Consumers					
Waste management		0.9			
Society					129
Tourism sector			Positive impact on turnover		7
Fishing sector					Some avoided costs, but impossible to quantify
Other sectors					

On the **direct costs** side, quantitative information on implementation costs for public policy actors – usually, Adopt a Beach initiatives are organized and managed by public entities, associations or NGOs – could not be found. In any case, these costs are not expected to be high. The additional costs for waste management, linked to the collection and disposal of plastic waste collected on beaches, amount to 0.9 million EUR/year.

Among **direct impacts,** avoided negative impacts on the tourism sector were estimated only in a qualitative way, and a positive impact on turnover due to cleaner beaches is expected.

Indirect benefits for environmental improvement are as follows:

- Avoided costs of beach cleaning (benefits for regulators): 6 Million EUR/year;
- Avoided costs of degradation of ecosystem services (benefits for society): 129 Million EUR/year;
- Increased recreational value of less litter on beaches (benefits for the tourism sector): 7 Million EUR/year;
- Avoided costs for the fishing sector: some avoided costs exist, but it is impossible to quantify such benefits. In fact, in the absence of Adopt a Beach initiatives part of the litter would go bak to the sea as an effect of waves and tides; however, no information could be found on the share of litter going back to the sea, and thus it is not possible to quantify the avoided costs.

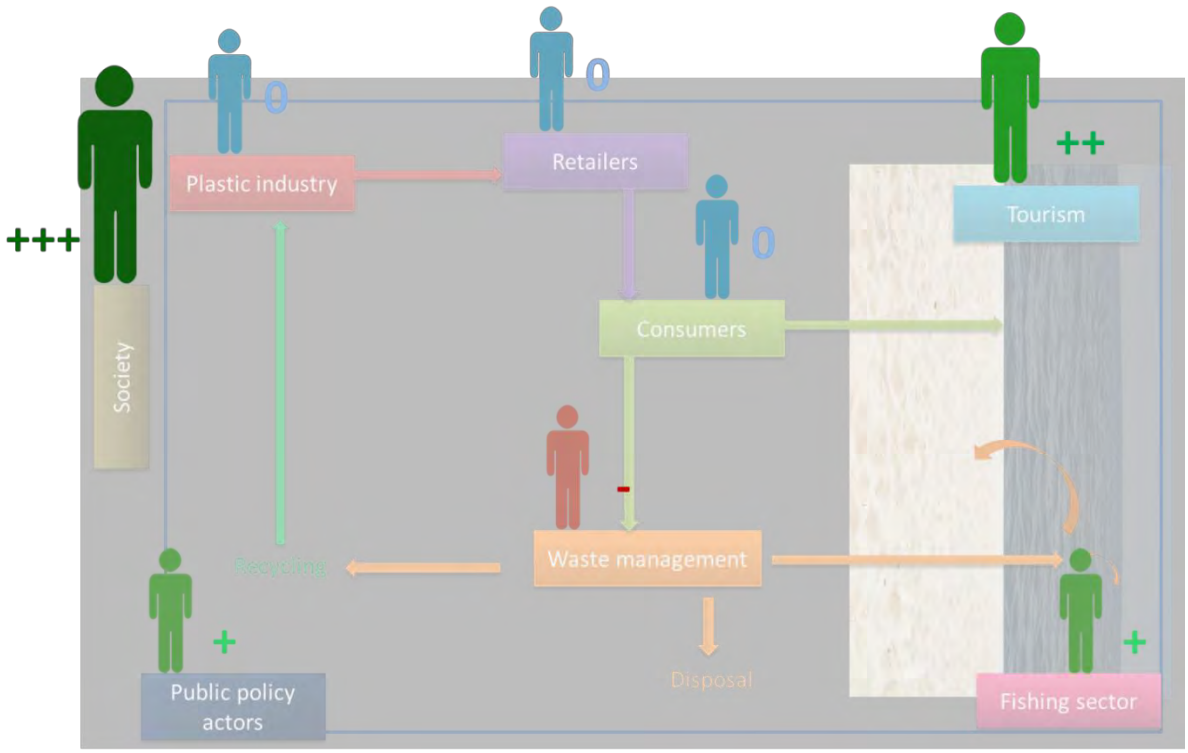
Table 39. Benefits and costs of Adopt a Beach initiatives at the Mediterranean level: synthesis scores

Benefits	This measure delivers only a few benefits, as it acts on the final stage of plastic pollution (plastic landed on beaches); in addition, due to the limited litter removal potential, these benefits are much less substantial than other measures (e.g. ban and taxes).	2
Costs	Very little costs, as beaches are cleaned by volunteers – some costs for organizing and managing the events, usually done by public policy actors, but costs are not expected to be substantial	5

11.4. DISTRIBUTIONAL ASPECTS

Based on the benefits and costs illustrated above, the measure is expected to largely benefit society as a whole and, to a lesser extent, the tourism sector; public policy actors and the fishing sector are also expected to lightly benefit from this measure. A substantially neutral impact is expected on retailers, consumers and the plastic industry, whereas a light negative impact is expected on the waste management sector.

Figure 20. Distributional analysis of Adopt a Beach initiatives



11.5. ACCEPTABILITY AND FEASIBILITY

Adopt-a-beach successful implementation depends on the easiness for local communities to engage in the activities proposed by the regulator. Preparation of communication material, institutional frameworks and appointment of local beach coordinator are key aspects of local communities engagement.

Adopt-a-beach initiatives can be of local interest to raise local communities' awareness toward marine litter and keep clean beaches of specific importance for cultural, economic or wildlife preservation reasons. However it cannot be a substitute to a consistent and global approach of waste generation. They can go hand in hand with the implementation of sound economic instruments that can generate revenues to fund them.

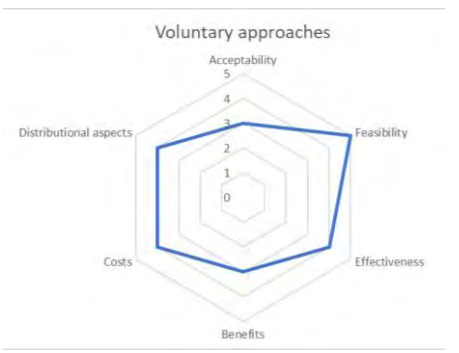
Table 40. Acceptability and feasibility of Adopt a Beach initiatives at the Mediterranean level: synthesis scores

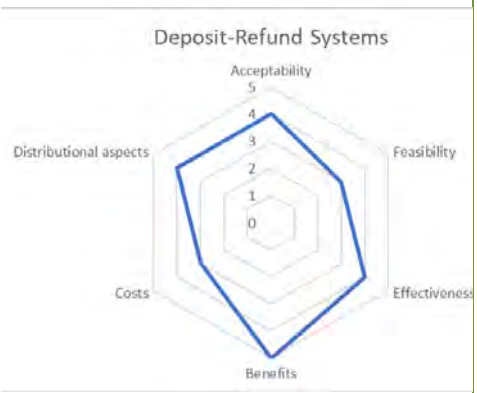
Acceptability	The measure is usually welcome by tourists and residents	5
Feasibility	Cleaning actions are very easy to organize and manage	5

12. Synthesis of results

The Table 41 below summarizes the scores assigned in the socio-economic assessment of measures against marine litter presented in the previous chapters.

Table 41. Synthesis of the overall socio-economic assessment of measures against marine litter

Ban on SUPB	Summary	Scores
Acceptability	It requires awareness raising campaigns to increase acceptability (short run)	
Feasibility	Quite feasible, provided that SUPBs concerned by the ban are well specified	
Effectiveness	Very effective, providing an incentive for re-conversion of the plastic industry	
Benefits	High benefits	
Costs	Some costs involved, negative impacts on the plastic industry to be ascertained	
Distributional aspects	Very limited negative impacts on social groups - negative impacts on the plastic industry to be ascertained	
Tax on SUPB	**Summary**	**Scores**
Acceptability	Very likely to encounter citizens' opposition, it requires awareness raising campaigns	
Feasibility	It requires building a management system within the public authority	
Effectiveness	Very effective, providing an incentive for re-conversion of the plastic industry – but smaller reduction of SUPBs as compared to the ban	
Benefits	High benefits + revenues which could be earmarked for environmental purposes	
Costs	Costs for consumers, as well as implementation and management costs (but compensated by revenues)	
Distributional aspects	Very limited negative impacts on social groups - negative impacts on the plastic industry to be ascertained	
VA	**Summary**	**Scores**
Acceptability	Similar to the tax (similar mechanisms are proposed to consumers)	
Feasibility	Very easy to implement for public authorities (little efforts required)	
Effectiveness	Effective, but with a less significant impact than the ban or the tax (voluntary schemes)	
Benefits	Lower as compared to the ban and the tax	
Costs	Costs for consumers, but very low costs for the public sector (negligible?)	
Distributional aspects	Very limited negative impacts on social groups -	

	negative impacts on the plastic industry to be ascertained	
DRS	**Summary**	**Scores**
Acceptability	Initial concerns of retailers and packaging industry usually dissipate. Rewards for consumers	
Feasibility	The implementation at a large scale is challenging, as all supermarkets must have the reverse vending machine	
Effectiveness	High effectiveness in terms of reduced plastic litter, but it does not change production and consumption mechanisms	
Benefits	High benefits	
Costs	Reverse-vending machines are expensive	
Distributional aspects	Negative impact on retailers, positive or zero impact on other social groups	
F4L	**Summary**	**Scores**
Acceptability	Some awareness raising work with fishermen is required, but normally it's well accepted	
Feasibility	Working with fishermen can be time consuming, it might take a long time to set up large schemes	
Effectiveness	Very effective and good to raise awareness on marine litter, but limited number of fishermen. It targets litter already in the sea. Very limited litter removal capacity	
Benefits	Limited benefits as compared to other measures, linked to limited litter removal potential	
Costs	Administration and litter collection costs might be significant for public policy actors. Costs for other sectors are negligible.	
Distributional aspects	Light negative impact on public policy actors and the waste management sector, neutral con retailers, consumers and the plastic industry, positive impact on other groups	
Adopt a Beach	**Summary**	**Scores**
Acceptability	The measure is usually welcome by tourists and residents	
Feasibility	Cleaning actions are very easy to organize and manage involving local communities, civil societies and NGOs	
Effectiveness	Not so effective as it targets litter which spent some time in the sea, but very effective in raising awareness and sense of ownership	
Benefits	High benefits	
Costs	Very little costs (beaches are cleaned by volunteers)	
Distributional aspects	Some additional costs for the waste management sector	

This performance comparison shows that **no measure is perfect**: for example, the ban on SUPBs is very effective, feasible and deliver high benefits, but it can cause some acceptability issues; DRS yield very high benefits, perform fairly well on distributional aspects and acceptability, but costs are quite high and the feasibility of the measure can pose some concern. At the same time, **the weaknesses highlighted in this analysis should not be seen as limiting factors, but rather as points of attention: when implementing a measure, alert on specific issues can guide the design of specific accompanying and/or supporting measures** to mitigate or compensate for such weaknesses. If it is true, on the one hand, that no measure is perfect, it is also true that all measures are needed to face the current dramatic marine litter issue in the Mediterranean Sea.

From a socio-economic perspective, it is also useful to summarize and compare the **distributional effects** of the measures, as illustrated in the Table 42 below. The distributional aspects are assessed in a qualitative way, on the basis of the assumptions made for this socio-economic analysis and illustrated in previous chapters of this report.

Table 42. Measures against marine litter: summary of distributional effects on relevant socio-economic groups

	Ban	Tax	VA	DRS	F4L	Adopt a Beach
Public policy actors	+	++	+	+	-	+
Plastic industry	?	?	?	0	0	0
Retailers	0/-	0	0/-	-	0	0
Consumers	0/-	-	-	0	0	0
Waste management	++	++	++	++	-	-
Society	+++	+++	+++	+++	++	+++
Tourism sector	+++	+++	+++	+++	++	++
Fishing sector	+	+	+	+	+	+
Other sectors	0	0	0	0	0	0

As it can be seen, all measures are expected to be very beneficial for **society** as a whole and for the **tourism sector**.

All measures are also expected to deliver benefits (much lower in monetary terms, but still important) to the **fishing sector**.

Public policy actors are also expected to be positively impacted by all measures with the exception of Fishing for Litter (although to a lesser extent), for two main reasons: (i) revenues from taxes; and (ii) avoided costs of beach cleaning, delivered by all measures.

As previously mentioned, measures targeting plastic consumption are likely to have an impact on the **plastic industry**: however, this impact will depend on several variables not fully known, so it was not possible to ascertain this impact in the context of this study. In addition, appropriate policies promoting investment in innovation and adaptation can boost the sector, while guiding it in its transition towards more sustainable products.

Consumers might be slightly affected by measures targeting plastic consumption, as they might incur in some additional costs: the costs of alternative reusable bags in the case of the ban, and the payment of a tax or a charge on plastic bags in the case of the tax and voluntary agreements. The most expensive measure for consumers is of course the tax, followed by VAs: according to the literature and to our calculations, however, the expenditure for the tax is expected to represent the 0.03% of the average GDP per capita, and thus it can be considered more than affordable for consumers.

Retailers might be slightly affected in the case of a ban (compliance costs) or voluntary agreements (competitive disadvantage possible with retailers not joining the VA); however, this negative impact is expected to be almost negligible. Retailers might definitely be negatively impacted by Deposit-Refund Systems, if they are in charge of paying for the reverse vending machines.

The **waste management sector** is of course positively impacted by measures reducing plastic consumption (tax, ban, VA) of plastic disposal (DRS). IN the case of Fishing 4 Litter and Adopt a Beach, the sector is likely to incur in additional costs for handling plastic litter collected through the measure.

13. In conclusion…

This study focuses on the development of sound economic arguments on the reduction and prevention of single use plastic bags and bottles. It focuses on six measures and related case studies: ban on SUPBs, tax on SUPBs, voluntary agreement for SUPBs, Deposit-Refund Systems for plastic bottles, Fishing 4 Litter and Adopt a Beach schemes.

Case studies were selected all around the Mediterranean, including case studies in Spain, Italy, Israel, Greece, Morocco. Measures refer to the Mediterranean basin, and estimates are based on the assumption that each single measure is applied by all MED countries.

This study applied a slightly adapted version of the classification of costs and benefits adopted in Plan Bleu, 2017, which includes: (i) direct costs and benefits; (ii) direct economic impacts, positive and negative; and (iii) indirect benefits resulting from environmental improvement (including ecosystem services). All costs and benefits estimates are based on assumption, and thus must be taken as indicative figures. For several direct economic impacts and indirect benefits, a harmonized method of estimation was developed and applied to all measures: this approach depends on the expected yearly reduction of marine litter. For some benefits, this allowed for determining a unitary benefit, or a fixed amount that is gained for one tonne of marine litter avoided or removed.

The socio-economic analysis highlighted some key messages which are presented below, together with the associated recommendations.

Key Message 1 – Effectiveness of measures: Prevention VS Removal/ Cleaning up

Three of the investigated measures can be defined as **preventive measure**, as they are aimed at reducing plastic consumption by targeting retailing and consumption of SUPBs – and namely the ban on SUPBs, taxes and charges on SUPBs and voluntary agreements. Deposit-Refund Systems, in turn, target disposal of empty plastic bottles, targeting consumption habits rather than consumption itself – however, these systems still prevent plastic litter from entering marine ecosystems. In contrast, Fishing for Litter and Adopt a Beach initiatives are **removal, or cleaning up measures**, as they collect marine litter in the sea or stranded on beaches.

The socio-economic analysis assessed three dimensions of effectiveness, and it highlighted the followings:

- **Litter reduction potential**: DRS have the highest potential for marine litter reduction, followed by preventive measures such as (order according to decreasing magnitude of litter reduction potential): the ban, taxes and charges and voluntary agreements. In contrast, removal measures showed a much lower litter reduction potential;
- **Permanence of plastics in marine ecosystems**: preventive measures (including DRS) avoid that SUPBs and plastic bottles enter marine ecosystems, thus they are very effective in preventing the negative environmental effects of marine litter. Removal and cleaning up measures, in contrast, are not useful in preventing the damages to ecosystems caused by plastics in the sea;
- **Awareness-raising potential and incentiveness**: in this case, removal and cleaning up measures are the ones that perform better: by joining these actions, citizens, tourists and fishermen can touch with their hands the extent of the problem, and acting against it raises a sense of ownership and commitment to care for the marine environment. Preventive measures, in contrast, need to be accompanied by awareness-raising campaigns, at least in the initial implementation phases – on the long run, as consumers get used to the new regulations, also these measures have an awareness-raising effect.

→ Overall, preventing measures (including DRS) have an overall better performance on the three dimensions of effectiveness, as compared to removal and cleaning up measure. At the same time, the issue of marine litter is so widespread and serious that an effective litter reduction strategy must intervene on both fronts – prevention and cleaning up. Of course, removal and cleaning up measures alone are not a good solution to combat marine litter, but the quantity of marine litter in the Mediterranean Sea makes these measures necessary. An effective litter reduction strategy must in fact consider a mix of available measures able at tackling all aspects of the issue.

Key Message 2 – Costs and benefits of the measures: data availability

One of the main challenges associated with assessment of costs and benefits of the measures was the **availability of economic data and assessments**: while detailed data and information are available on the marine litter issue (e.g quantity of litter produced, pathways to the sea, type of items constituting marine litter, etc.), quantitative information on the impacts of marine litter and on its costs and benefits is much scarcer – and this influenced the assessment, requiring assumptions to sustain the cost and benefit estimate presented in this report.

This socio-economic assessment provides some indications of the likely costs and benefits of some measures against marine litter. Further socio-economic studies – both on the impacts of marine litter and on its economic dimension, as well as the economic dimension of litter reduction measures – are thus recommended.

Key Message 3 – Estimating the potential impact on the plastic industry

It was not possible to assess or estimate the **potential impact on the plastic industry** of those measures targeting plastic consumption – in this case, SUPBs. Many variables are in fact involved, and information in the literature is scattered and difficult to find: thus, this estimation was beyond the scope of this study. Nevertheless, the impact on the plastic industry **could be a key issue to be addressed when implementing measures targeting plastic consumption**.

It is recommended to investigate in detail these aspects and, if needed, to identify possible accompanying measure to mitigate negative impacts and facilitate adaptation of the industry towards environmental-friendly materials[27].

Key Message 4 – No measure is perfect!

This socio-economic study assessed the performance of the six measures against five criteria: effectiveness, costs, benefits, distributional aspects, acceptability and feasibility. Overall, **the measures assessed in this study are generally feasible, fairly acceptable and yield (often significant) benefits at reasonable costs**.

Society as a whole would get the largest benefits from the implementation of these measures thanks to the benefits arising from the different services more healthy ecosystems would deliver. The **tourism sector** (as a result of avoided negative impact on tourism activities and enhanced recreational value) and, to a lesser extent, the **fishing sector**, would also benefit from these measures. Costs for other groups are limited.

Nevertheless, the assessment also shows that **no measure is perfect**: for example, the ban on SUPBs is very effective, feasible and deliver high benefits, but it can cause some acceptability issues; DRS yield very high benefits, perform fairly well on distributional aspects and acceptability, but costs are quite high and the feasibility of the measure can pose some concern.

The weaknesses highlighted in this analysis should not be seen as limiting factors, but rather as points of attention: when implementing a measure, alert on specific issues can guide the design of specific accompanying and/or supporting measures to mitigate or compensate for such weaknesses – to be designed at the same time of the measure itself. In particular, the following aspects proved to be worth particular attention:

- **Distributional aspects:** some measures are likely to have some negative impacts on some socio-economic groups – for example, DRS can be expensive for retailers, if these are to buy reverse vending machines by themselves. The distributional analysis is very useful in indicating which economic groups should be **the target of supporting and compensating measures** (see above for example on the plastic industry), including for example financial support, fiscal incentives etc.
- The **acceptability** of all measures assessed in this study is likely to improve if **awareness-raising campaigns and public consultation processes** are implemented in parallel – thus, these actions should be seen as

[27] In Morocco, for example, to accompany the ban on SUPBs the Government set up a fund to finance industry restructuring and adaptation; a small share of the Fund was specifically allocated to SMEs.

integral parts of a strategy to prevent marine litter, on the same level as actual prevention measures. The "Adopt a Beach" actions can be considered as awareness-raising actions that could, for example, accompany in coastal areas Fishing 4 Litter initiatives and bans at the local level (e.g. plastic-free holiday places).

Key Message 5 – Mediterranean VS national scale

As the assessment has been **made at the Mediterranean Sea scale**, it hides the variability in results one can expect between countries. Thus, one cannot directly "transfer" these results and recommendations to the scale of any of the Mediterranean countries without accounting for the specificities of the plastic (bag & bottle) sector and system and for the socio-economic importance of the different sectors benefiting from healthy marine ecosystems (e.g. tourism, fishing…).

Country-specific socio-economic assessments are recommended to support the design of litter reduction measures at the national and regional level. The Mediterranean region is very heterogenous, and it includes countries with different socio-economic conditions that are likely to impact the effectiveness, feasibility, acceptability of measures, and also their likely socio-economic impacts. In particular, measures tested in Europe (which provide the bulk of information and knowledge on the likely effectiveness of measures investigated, for example) might not be as effective in Mediterranean countries. In addition, in countries with large informal sectors such as in Southern and Eastern MED, the effectiveness of bans and taxes on SUPBs can be limited.

References

Addamo, A.M., Laroche, P., Hanke, G., 2017. Top Marine Beach Litter Items in Europe A review and synthesis based on beach litter data. JRC Technical Reports, MSFD Technical Group on Marine Litter. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC108181/technical_report_top_marine_litter_items_eur_29249_en_pdf.pdf

Alessi. et al. 2018. "Out of the plastic trap: saving the Mediterranean from plastic pollution". WWF Mediterranean Marine Initiative, Rome, Italy. 28 pp

http://awsassets.panda.org/downloads/a4_plastics_med_web_08june_new.pdf

Beaumont, N.J., Aanesen, M., Austen, M.C., Borger, T., Clark, J.R., Cole, M., Hooper, T., Lindeque, P.Q., Pascoe, C., Wyles, K.J., 2019. Global ecological, social and economic impacts of marine plastic. Marine Pollution Bulletin 142 (2019) 189‑195. https://www.sciencedirect.com/science/article/pii/S0025326X19302061

Belin, A., Dom, A., Stockhausen, B., Priestland, E., Moore, M., 2017. Tackling overfishing and marine litter An analysis of Member States measures under the Marine Directive. Seas at risk. https://seas-at-risk.org/images/pdf/publications/Seas-at-Risk_Tackling-FishingMarine-Litter_AnalysisofMSFDMeasures_December-2017.pdf

BIOis, 2011 – Assessment of impacts of options to reduce the use of single-use plastic carrier bags – Final Report. European Commission, DG Environment, 12 September 2011. http://ec.europa.eu/environment/waste/packaging/pdf/report_options.pdf

Brouwer, R., Hadzhiyska, D., Ioakeimidis, C., Ouderdorp, H., 2017. The social costs of marine litter along European coasts. Ocean & Coastal Management 138 (2017) 38-49. https://research.vu.nl/en/publications/the-social-costs-of-marine-litter-along-european-coasts

Buhl-Mortensen, L., Buhl-Mortensen, P., 2017. Marine litter in the Nordic Seas: Distribution composition and abundance. Marine Pollution Bulletin 125, 1-2(260-270) https://www.sciencedirect.com/science/article/pii/S0025326X17307166

Croci, E., 2005. The Economics of Environmental Voluntary Agreements. In *The Handbook of Environmental Voluntary Agreements: Design, Implementation and Evaluation Issues*, edited par Edoardo Croci, 3‑30. Environment & Policy. Dordrecht: Springer Netherlands. https://doi.org/10.1007/1-4020-3356-7_1

Dalberg Advisors, WWF Mediterranean Marine Initiative , 2019 "Stop the Flood of Plastic: How Mediterranean countries can save their sea" Dalberg Advisors, WWF Mediterranean Marine Initiative , 2019 "Stop the Flood of Plastic: How Mediterranean countries can save their sea". WWF Reports, 2019. https://www.wwf.fr/sites/default/files/doc-2019-06/20190607_Rapport_Stoppons_le_torrent_de_plastique_WWF-min.pdf

Djemaci, B., 2011. « Recyclage des déchets à travers un système de consigne : Cas des bouteilles en plastique en Algérie ». Université de Rouen.

Drab, J., and Slučiaková, S. 2018. 'Real Price of Deposit: Analysis of the Introduction of the Deposit-Refund System for Single-Use Beverage Packaging in the Slovak Republic'. 2018. https://www.minzp.sk/files/iep/real_price_of_deposit.pdf

European Commission, 2018. COMMISSION STAFF WORKING DOCUMENT – IMPACT ASSESSMENT. Reducing Marine Litter: action on single use plastics and fishing gear Accompanying the document Proposal for a Directive of the European Parliament and of the Council on the reduction of the impact of certain plastic products on the environment {COM(2018) 340 final} - {SEC(2018) 253 final} - {SWD(2018) 255 final} - {SWD(2018) 256 final} - {SWD(2018) 257 final}. http://ec.europa.eu/environment/circular-economy/pdf/single-use_plastics_impact_assessment.pdf

European Commission. 2013. « Impact Assessment for a Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 94/62/EC on packaging and packaging waste to reduce the consumption of lightweight plastic carrier bags. » https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013SC0444&from=EN

FAO. 2018. The State of Mediterranean and Black Sea Fisheries. http://www.fao.org/3/ca2702en/ca2702en.pdf

KIMO. 2019. Fishing for Litter – Working with fishermen to clean our seas. http://fishingforlitter.org/

ICF and Eunomia, 2018. Assessment of measures to reduce marine litter from single use plastics. Part of European Commission Study Contract "Plastics: Reuse, recycling and marine litter. European Union, 2018. https://ec.europa.eu/environment/waste/pdf/Study_sups.pdf

Plan Bleu (2017). Socio-economic tools for supporting the achievement of Good Environmental Status of Mediterranean marine waters. Valbonne, Plan Bleu. (Technical Report)

Plastic Consult, 2018. La filiera dei polimeri compostabili. Presentation by Paolo Arcelli, Plastic Consult President, to AssoBioplastiche on December 13, 2018. http://assobioplastiche.org/assets/documenti/ricerche/La%20filiera%20dei%20polimeri%20compostabili%20-%20Roma%2013%20dic%202018.pdf

Schnurr, R.E.J., Alboiu, V., Chaudhary, M., Corbett, R.A., Quanz, M., Sankar, K., Singh Srain, H., Thavarajah, V., Xanthos, D., Walker, T.R., 2018. Reducing marine pollution from single-use plastics (SUPs): A review. Marine Pollution Bulletin 137(12):157-171. https://www.researchgate.net/publication/327989798_Reducing_marine_pollution_from_single-use_plastics_SUPs_A_review

UNEP (2017). Marine Litter Socio Economic Study, United Nations Environment Programme, Nairobi. Kenya. https://wedocs.unep.org/bitstream/handle/20.500.11822/26014/Marinelitter_socioeco_study.pdf?sequence=1&isAllowed=y

UNEP/MAP, 2019. Agenda item 5: Marine Litter Assessment Tools. Marine Litter Assessment: Updated Baseline Values and Threshold Values for IMAP Marine Litter Indicators. UNEP/MED WG.476/3. Regional Meeting on Pilot Projects and Assessment Tools for Marine Litter - Athens, Greece, 19-20 November 2019.

UNEP/MAP, 2018. Agenda item 4: Main elements for Regional Guidelines for Selected Marine Litter Prevention and Reduction Measures. Phase out single use plastic bags in the Mediterranean Region (Main Elements).

UNEP/MAP, 2015. Marine Litter Assessment in the Mediterranean. Athens, Greece. http://web.unep.org/unepmap/marine-litter-assessment-mediterranean-2015-0

UNWTO, 2018. UNWTO Tourism Highlights – 2018 Edition. https://www.e-unwto.org/doi/pdf/10.18111/9789284419876

Van Acoleyen, M., Laureysens, I., Lambert, S., Raport, L., Van Sluis, C., Kater, B., van Onselen, E., Veiga, J., Ferreira, M., 2014. Marine Litter study to support the establishment of an initial quantitative headline reduction target - SFRA0025. Report for the European Commission, DG Environment. http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/pdf/final_report.pdf

Vlachogianni, T., 2019. Assessing Marine Litter on Mediterranean Beaches. Filling in the Knowledge Gaps via a Participatory-Science Initiative. MIO-ECSDE.

Vlachogianni, T., Ronchi, F., Fortibuoni, T., Aikaterini, A., Zeri, C., 2017. Marine Litter Assesment in the Adriatic and Ionian Seas. IPA-Adriatic DeFishGear Project, MIO-ECSDE, HCMR and ISPRA. http://mio-ecsde.org/wp-content/uploads/2017/02/Final-MLA-pages_final.pdf

Wolff, C., Vafeidis, A.T., Muis, S., Lincke, D., Satta, A.,Lionello, P., Jimenez, J.A., Conte, D. & Hinkel, J., 2018. Data Descriptor: A Mediterranean coastal database for assessing the impacts of sea-level rise and associated hazards. SCIENTIFIC DATA | 5:180044. https://www.nature.com/articles/sdata201844

Annex I – Valuation of non-market benefits: review of available literature

BROUWER ET AL, 2017 – SOCIAL COSTS OF MARINE LITTER IN TERMS OF IMPACT ON BEACH VISITORS' RECREATIONAL EXPERIENCE

Brouwer, R., Hadzhiyska, D., Ioakeimidis, C., Ouderdorp, H., 2017. The social costs of marine litter along European coasts. Ocean & Coastal Management 138 (2017) 38-49. *https://research.vu.nl/en/publications/the-social-costs-of-marine-litter-along-european-coasts*

"These social costs were estimated based on public perception of the impact of littering on beach experience and beach visitors' willingness to contribute in kind (volunteering to clean up beach litter a number of hours per year) and in money terms by paying either an entrance fee or an increase in local tax. Previous studies focusing on the valuation of beach recreation neither assessed the impact of marine litter specifically on beach experience in most cases, nor did they make a distinction between pollution sources. This latter distinction is considered important in view of the fact that a large share of the litter originates from beach visitors and requires another type of coastal zone policy intervention than diffuse pollution washed ashore. Assessing how responsible beachgoers feel for the presence of beach litter they partly leave behind themselves and to what extent they are willing to pay for the clean-up of this litter compared to litter washed ashore provides important information for priority setting in coastal policy and management.

Based on the estimated choice models, beach visitors' willingness to pay can be derived. The results are presented in Table 7. Standard errors and 95 percent confidence intervals (CI's) are calculated based on the Krinsky and Robb (1986) bootstrap procedure. The WTP amounts are adjusted for differences in purchasing power across the three countries. Two different WTP values are estimated: one for the complete removal of plastic litter washed ashore by the sea and one for cigarette butts left behind by beach visitors. The differences between these two WTP values are small and not statistically significant within samples. The CI's overlap and also the Poe et al. (2005) test confirms that the differences are not statistically significant.

Table 7
Public WTP (€/visitor/year) for the removal of plastic litter washed ashore by the sea and cigarette butts left behind by beach visitors in the three countries.

		Greece	Bulgaria	Netherlands
Plastic litter washed ashore by the sea	Mean WTP	0.67	8.25	2.05
	St. error	0.34	1.79	0.86
	95% CI	0.01–1.33	4.74–11.77	0.37–3.72
Cigarette butts left by beach visitors	Mean WTP	0.42	7.06	2.57
	St. error	0.39	1.58	0.94
	95% CI	−0.34–1.18	3.96–10.16	0.73–4.41

Note: CI: confidence interval.

Differences of the WTP values between samples are bigger and more significant. Bulgarian beach visitors are willing to pay significantly more than Greek and Dutch visitors for both marine plastics washed ashore and cigarette butts left behind by visitors. Although the 95% CI between the Bulgarian and Dutch sample slightly overlap for cigarette butts, the Poe et al. (2005) test convincingly rejects the null hypothesis of equality at the 1 percent level. No significant differences can be detected between Dutch and Greek beach visitors for either marine plastic or cigarette butts. Note that mean WTP for the removal of cigarette butts is not significantly different from zero for the Greek sample. Compared to the beach visitors' average annual income levels, the estimated WTP values constitute no more than 0.07 percent of a household's disposable income in the Bulgarian sample, 0.01 percent in the Dutch sample and 0.003 percent in the Greek sample.

Almost 70 percent of all interviewed beach visitors indicated that they would stop visiting a dirty beach due to littering (varying between 45% in Greece and 95% in Bulgaria).

The estimated WTP welfare measures associated with beach littering are used here as indicators of the social costs involved. Actual or potential clean-up costs can be directly compared to these estimates to assess the economic welfare effects of clean-up actions in a cost-benefit framework.

WTP values are calculated for different countries in different European climate zones: Greece, Bulgaria and the Netherlands. The data for Greece might be the most realistic one for the MED area; if, on the one hand, is by far the lowest value found in the study, it is also true that this value could be an average of potential WTP in richer EU countries and potential WTP in Southern countries with a lower average income per capita. Data on tourism arrivals in the MED are easily available, and thus this value can be transferred to the MED basin.

MCILGORM ET AL, 2009 - UNDERSTANDING THE ECONOMIC BENEFITS AND COSTS OF CONTROLLING MARINE DEBRIS IN THE APEC REGION

McIlgorm, A., Campbell H. F. and Rule M. J. (2008). Understanding the economic benefits and costs of controlling marine debris in the APEC region (MRC 02/2007). A report to the Asia-Pacific Economic Cooperation Marine Resource Conservation Working Group by the National Marine Science Centre (University of New England and Southern Cross University), Coffs Harbour, NSW, Australia, December.

Different types of debris damage and cost estimates in different APEC (Asia-Pacific Economic Cooperation) economies (* notes non -APEC economies).

Category	Type of damage/loss	Type of debris	APEC Economy	Estimated cost	Source
FISHING	Damage to fishing boats	Drifting objects	Japan	¥ 6.6 billion	Takehama (1990)
	Loss of fisheries production	Nets "ghost fishing"	US	Loss of $250m in lobsters UNEP	(Raaymakers 2007)
	Loss of fishing gear and down time	Entanglement with derelict fishing gear	CDA	$10m for retrieval of nets	(Slater 1994)
	Damage to leisure boats	Entanglement of propellers	US	$792m	(Ofiara and Seneca 2006)
	Human injury/fatality/rescue costs	Rescues due to debris	UK*	£440 000/yr	Fanshawe (2002)
SHIPPING	Damage to ships		Korea	Vessel loss of 292 lives	Cho (2005)
	Damage to intake line for cooling	Plastic ingested to intake lines for cooling	UK*	>£100 000	Fanshawe (2002)
COASTLINE/ TOURISM	Loss of amenity to beaches and reefs	Plastics, fishing and general debris	US	US$1-28m/yr	(Ofiara and Seneca 2006)
WILDLIFE and MARINE ECOSYSTEM	Loss of environmental amenity, death of animals, Coral reef habitat damage	Plastics, fishing nets	Unknown	Recovery /animal rescue - costs unknown	(Fanshawe and Everand 2002)

Most of the benefits quantified in this study are based on not-so-recent literature; in the Plan Bleu study, we could estimate similar benefits basing our calculations on more recent literature – and, besides, the literature we used was referring to the EU or the Mediterranean, while this publication refers to the Asian-Pacific region. For this reason, these data were not used.

THE ECONOMIC BENEFITS OF CLEANING OUR BEACHES

Ohio State University - https://www.aau.edu/research-scholarship/featured-research-topics/economic-benefits-cleaning-our-beaches

"We were able to correlate ocean debris with trip patterns and arrive at potential cost savings if people went to closer beaches."

Estimated savings ranged from $29.5 million ($12.91 per Orange County resident) to $46.5 million ($42.30 per Orange County resident) in a three-month period. The lower-end estimate was based on a 25 percent reduction in debris; the higher-end estimate on a 75 percent reduction.

In the Plan Bleu study, to estimate the avoided costs of beach cleaning we used the numbers provided by van Acoleyen et al (2014). In fact, these data refer to Europe, and are thus closer to the MED context; in addition, van Acoleyen unitary costs are based on 1 km of beach, which makes it very practical to transfer these results to the MED area. For this reason, the data above were not used.

BEAUMONT ET AL. (2019) GLOBAL ECOLOGICAL, SOCIAL AND ECONOMIC IMPACTS OF MARINE PLASTIC

Beaumont, N.J., Aanesen, M., Austen, M.C., Borger, T., Clark, J.R., Cole, M., Hooper, T., Lindeque, P.K., Pascoe, C., Wylesd, K.J., 2019. Global ecological, social and economic impacts of marine plastic. Marine Pollution Bulletin 142 (2019) 189–195.

"Based on available research it is not yet possible to accurately quantify the decline in annual ecosystem service delivery related to marine plastic. However, the evidence set out in Fig. 3 suggests substantial negative impacts on almost all ecosystem services at a global scale (S4 for detail). In light of this evidence, it is considered reasonable to postulate a 1–5% reduction in marine ecosystem service delivery as a result of the stock of marine plastic in the oceans in 2011."

"The economic costs of marine plastic, as related to marine natural capital, are conservatively conjectured at between $3300 and $33,000 per tonne of marine plastic per year, based on 2011 ecosystem service values and marine plastic stocks. Given this value includes only marine natural capital impacts, the full economic cost is likely to be far greater."

This study is conducted at a global scale and, unlikely other valuation studies, provides unitary values of ecosystem services loss per tonne of marine litter: thus, this figure is very easy to use, although it must be kept in mind that it must be considered as a rough estimate. On the other hand, other quantitative studies on ecosystem services and marine debris could not be found.

UN MARINE LITTER STUDY 2017

UN Environment (2017). Marine Litter Socio Economic Study, United Nations Environment Programme, Nairobi. Kenya.

There is a whole chapter on "Tourism, aesthetic value and recreation" – with quite some information on case studies where impact of plastic waste on tourism has been evaluated, but I did not see figures which could be directly used for an extrapolation. By looking closer at the studies mentioned, it might be possible to find such figures – e.g. by checking the length of beaches in these case studies, etc., but this will be time consuming… The two most promising figures are presented below. Please note that the first one might be referring to the same "Orange county study" mentioned above.

p. 68 - "A study of 31 beaches in Orange County, California, USA (Leggett et al. 2014) showed that marine litter had a significant impact on residents' beach choices. The study found that a 50% reduction in marine litter at the surveyed beaches could generate USD 67 million in benefits to residents over a three-month period. It also found that reducing marine litter by 75% on six beaches near the outflow of the Los Angeles River would benefit users by USD 5 per trip and increase visitors by 43% leading to USD 53 million in benefits."

p.69 - "It has been estimated that the presence of beach litter on the Skagerrak coast of Bohuslan (Sweden) decreases tourism by between 1 and 5%, equating to an estimated annual loss of approximately USD 22.5 million (GBP 15 million) and 150 man-years of work to the local community. Local clean-up efforts are estimated to cost approximately USD 1.4 million (GBP 937,000) per annum. Thus, the total cost to the local economy is USD 24 million (GBP 16 million) per year (Fanshawe and Everard 2002)."

Figures from the Orange County were impossible to extrapolate at the MED level – not only for geographical and contextual reasons, but also because it is unclear what the numbers are referring to – how large or long are 31 beaches? The value of 67 million EUR, how was it calculated?

In contrast, figures from the Skagerrak Coast can be more easily extrapolated: even though the geographical context is far from the MED context, a decrease in tourism revenues of 1-5% seems like a reasonable estimate, if not an underestimate. In addition, data on current tourism receipts in the Mediterranean are available.

Other articles and reports – not quoted here – only reported qualitative assessment of ecosystem services.

Annex II: Factsheets