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



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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

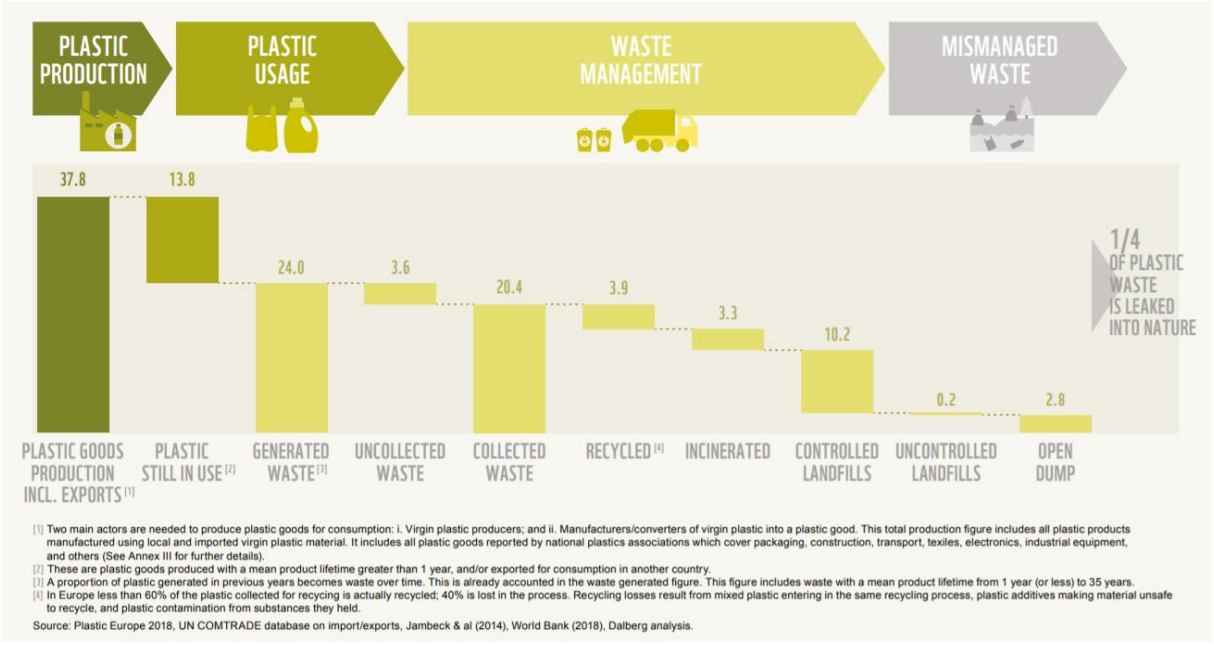
1. Setting the scene

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.

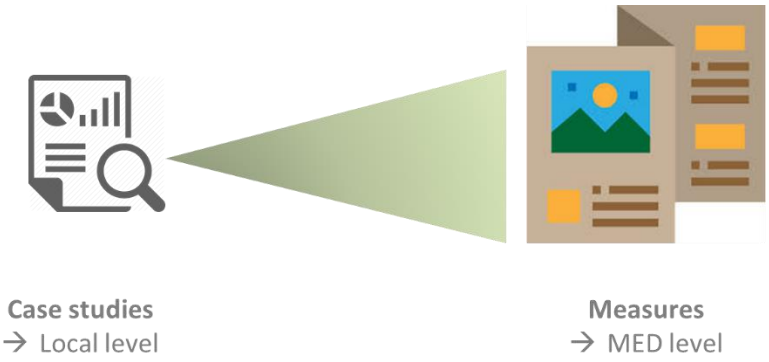
Once the relevant measures had been identified, practical examples or case studies had to be selected. A variety of **practical applications** of the selected measures can be found in the Mediterranean region; among these, six **case studies** across the Mediterranean were selected as examples of good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

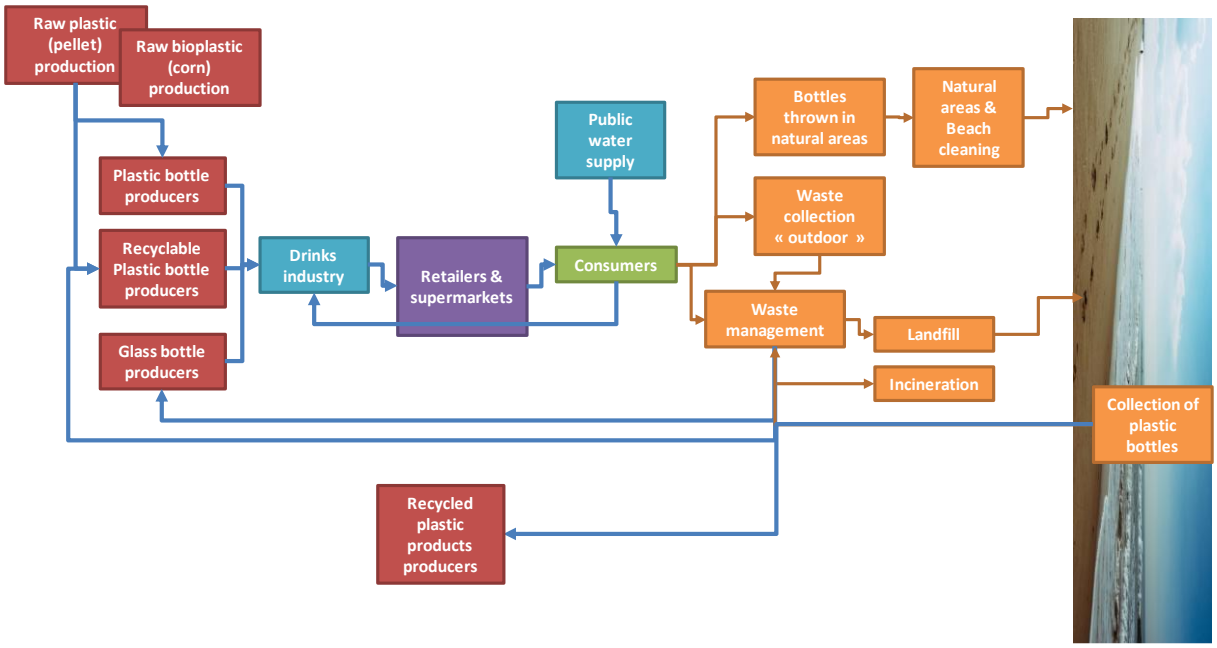
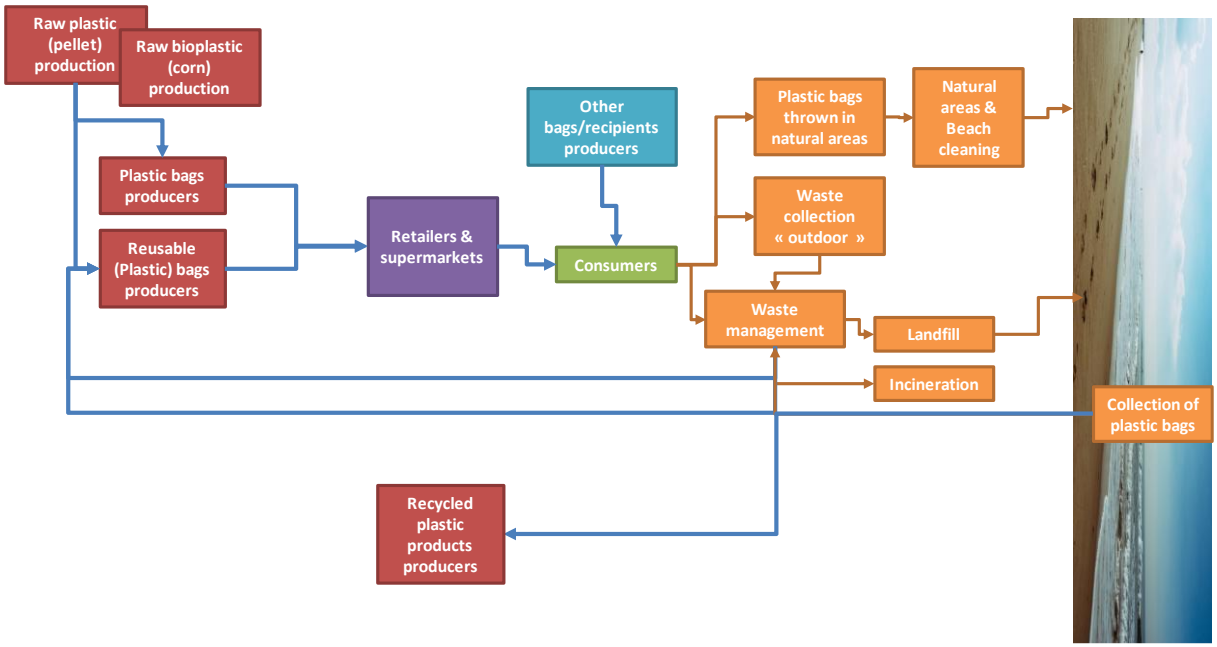


Figure 4. Single-use plastic bags: pathways to the sea



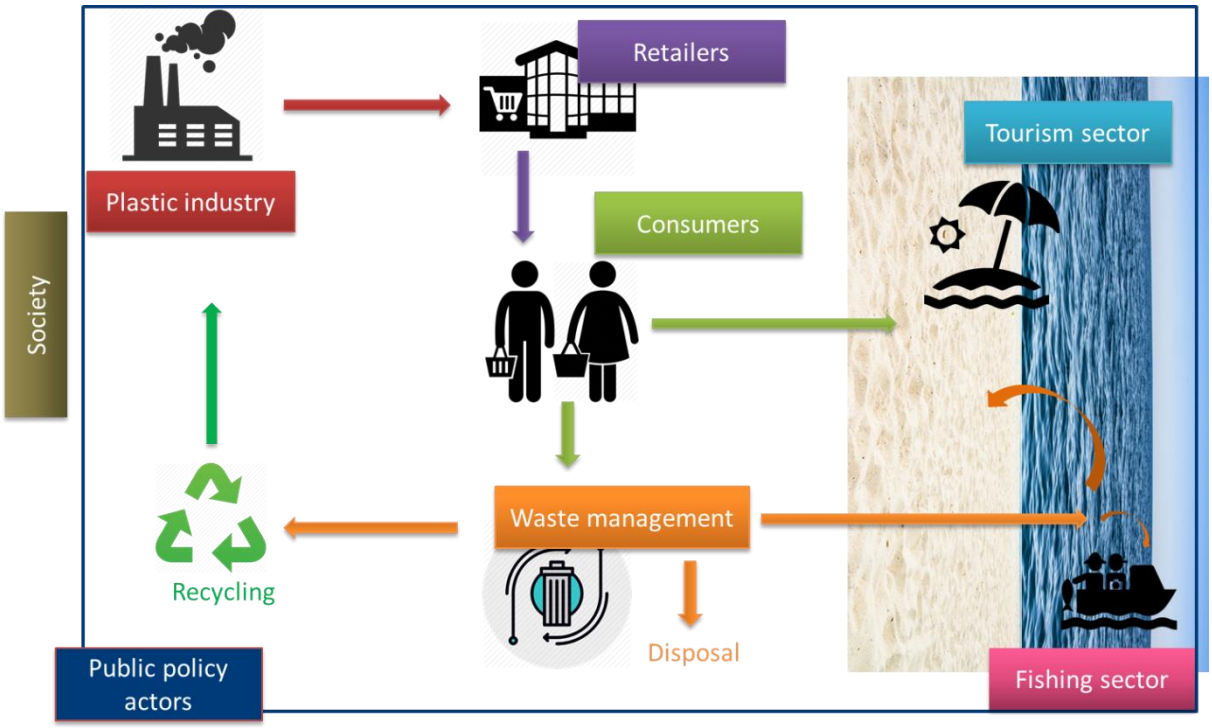
3.2. TACKLING POLLUTION: WHO GAINS AND WHO LOSES?

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.

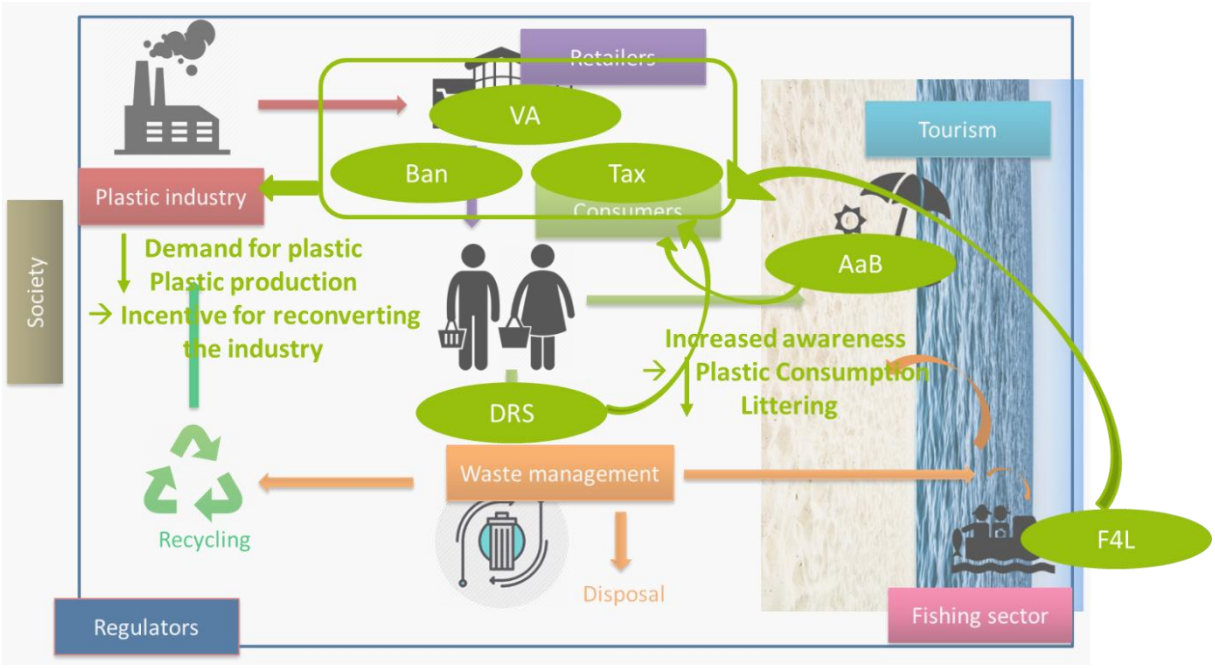
The implications for the different measures are the followings:

- **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	

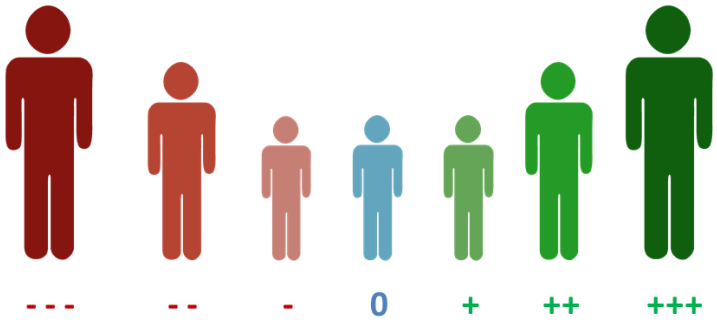
					injury of fish, shellfish and turtles caused by marine plastic bag waste; Cultural services: aesthetic and recreational service Increased value of biodiversity assets Non-use value increased	
Fishing sector	Unlikely (only FfL active schemes, but usually not convenient)	e.g. monetary or in-kind rewards (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.

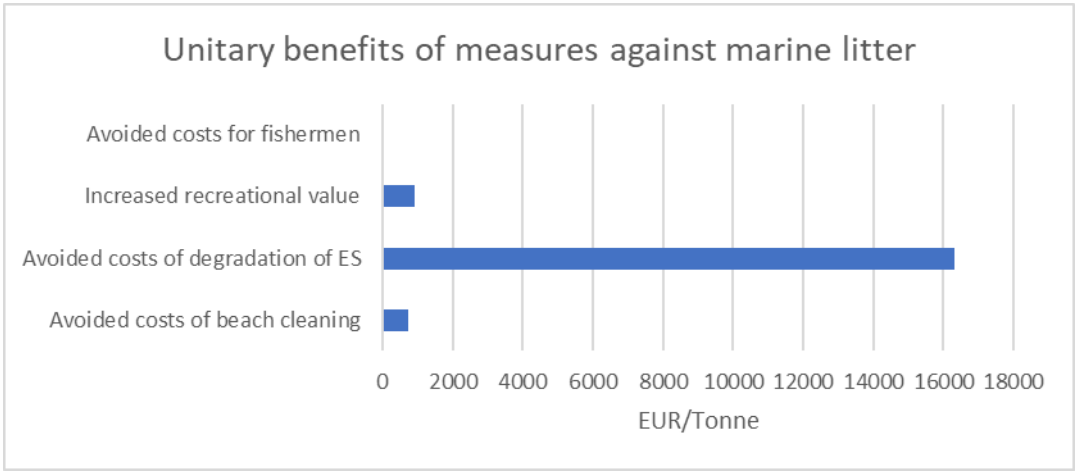
Table 12. Unitary benefits of measures against marine litter

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

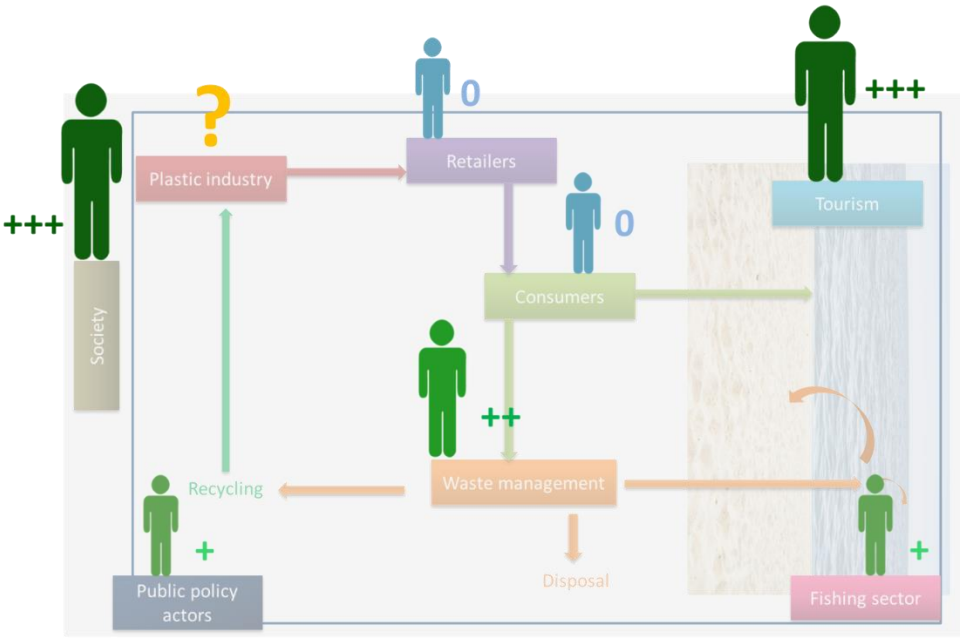


Table 16. Synthesis of score for distributional aspects

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

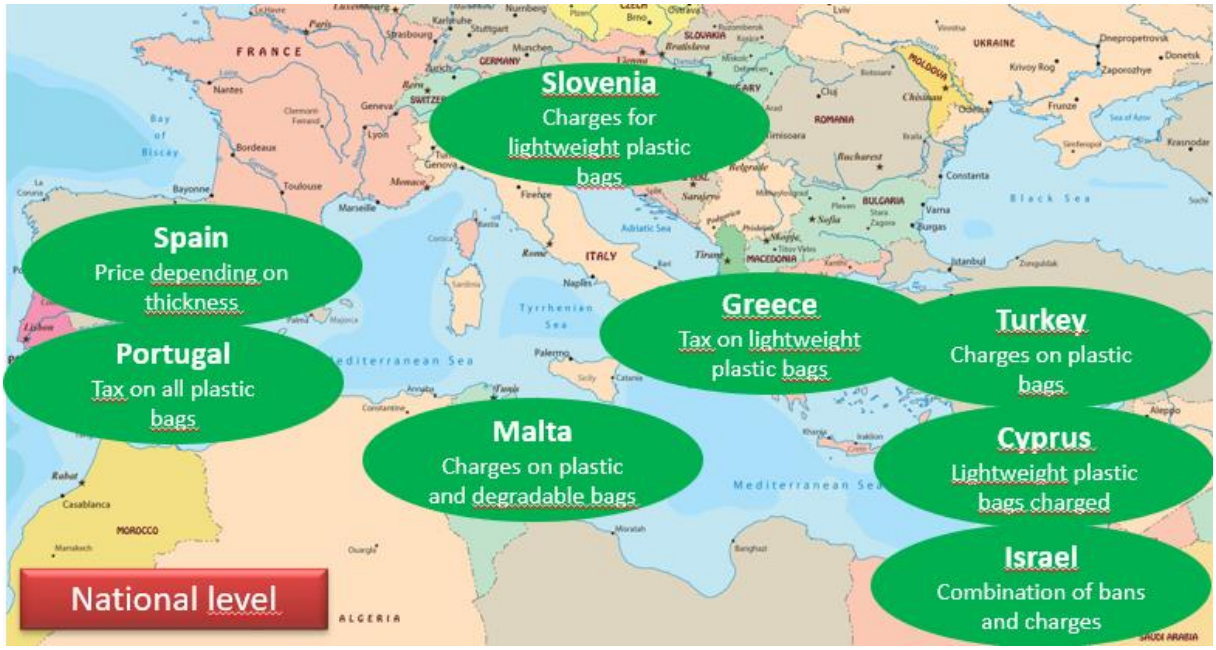
Taxes and charges on plastic bags are already in place in eight Mediterranean countries, and namely: Cyprus, Greece, Israel, Malta, Portugal, Slovenia, Spain and Turkey (Schnurr et al., 2018; Surfrider Foundation Europe, 2018). Taxes are imposed by the State, and revenues are paid to the Government and 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

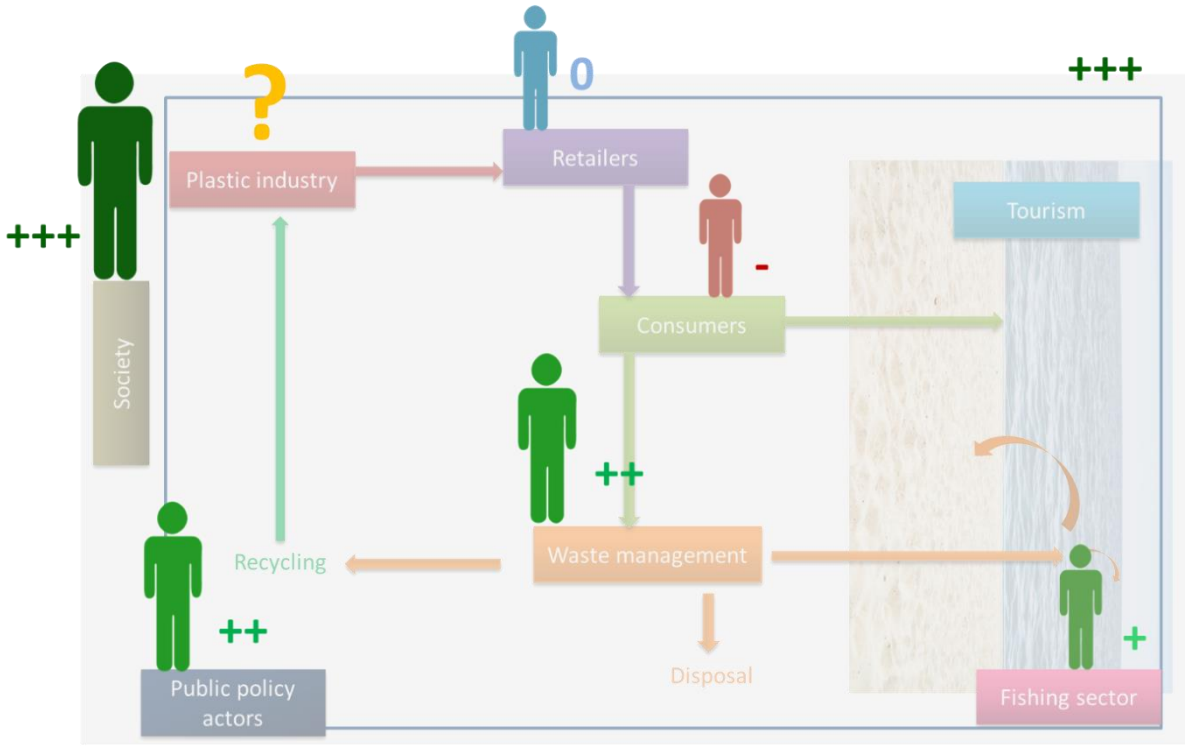


Table 21. Synthesis of score for distributional aspects

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**

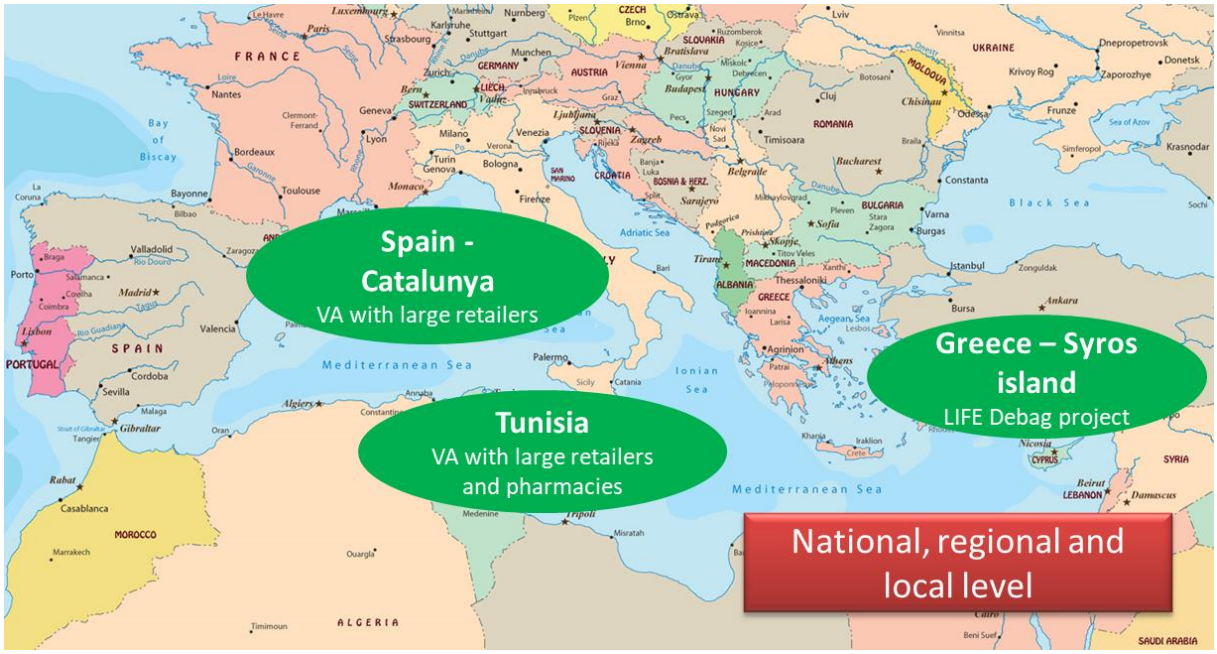
8. Voluntary agreements

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

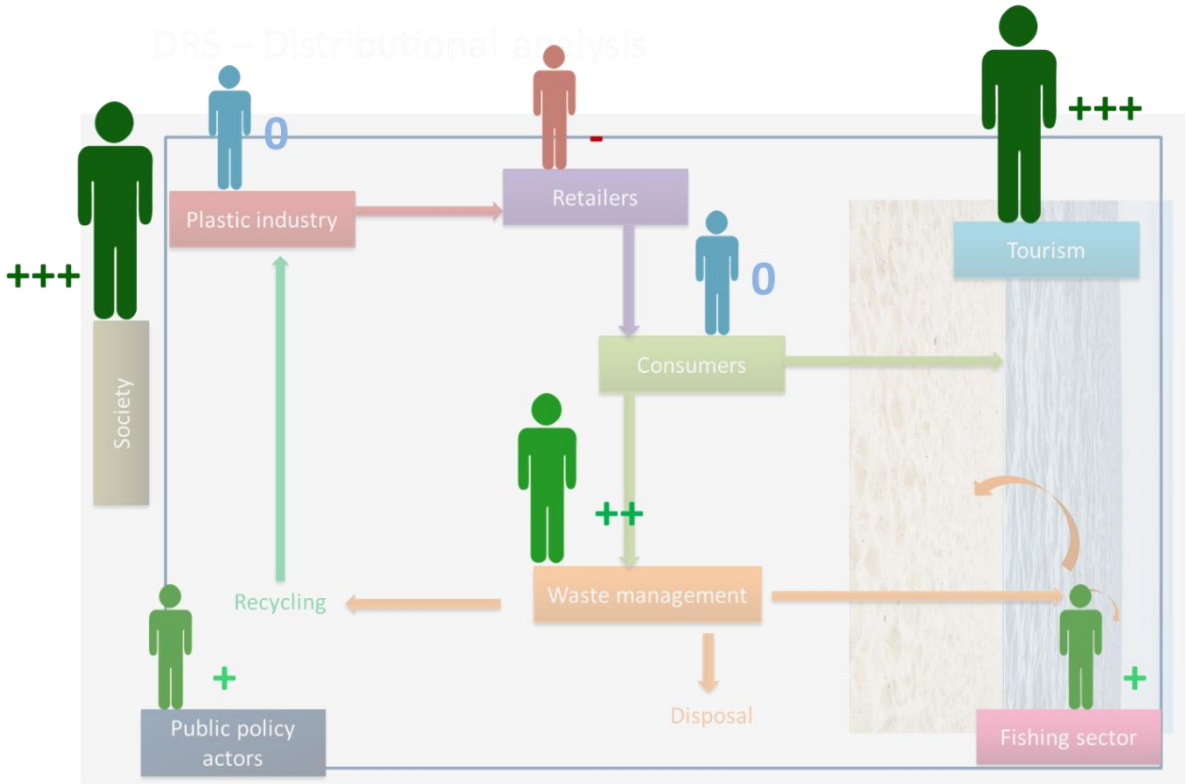


Table 26. Synthesis of score for distributional aspects

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

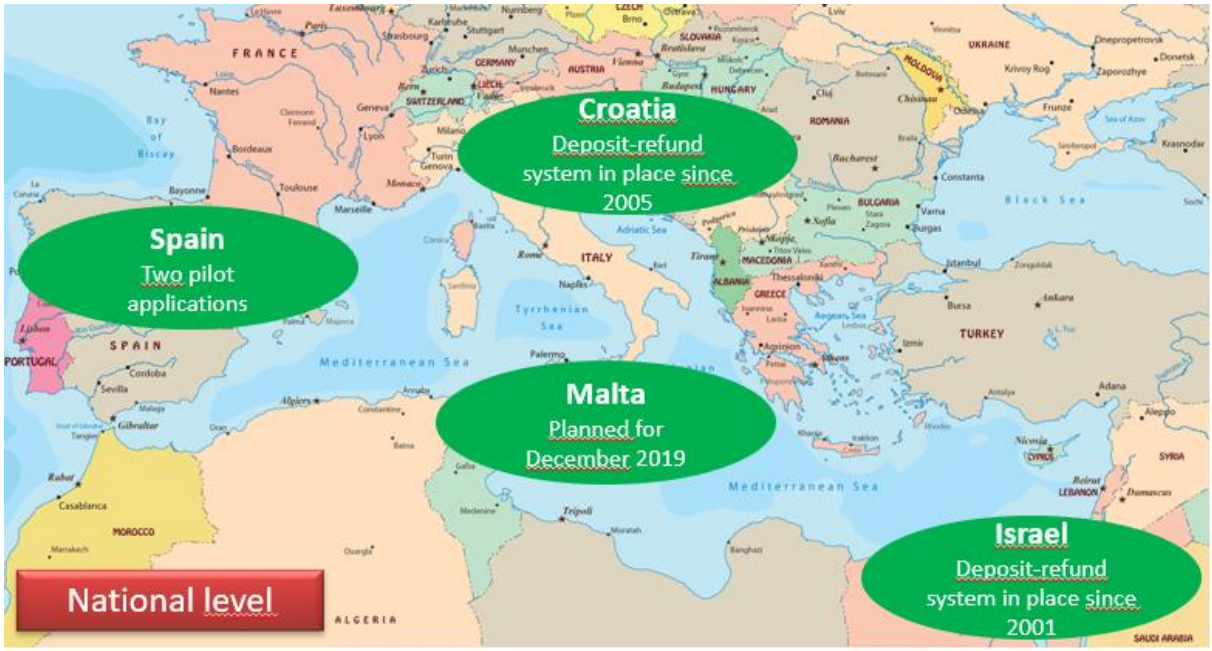
9. Deposit-Refund Systems

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.

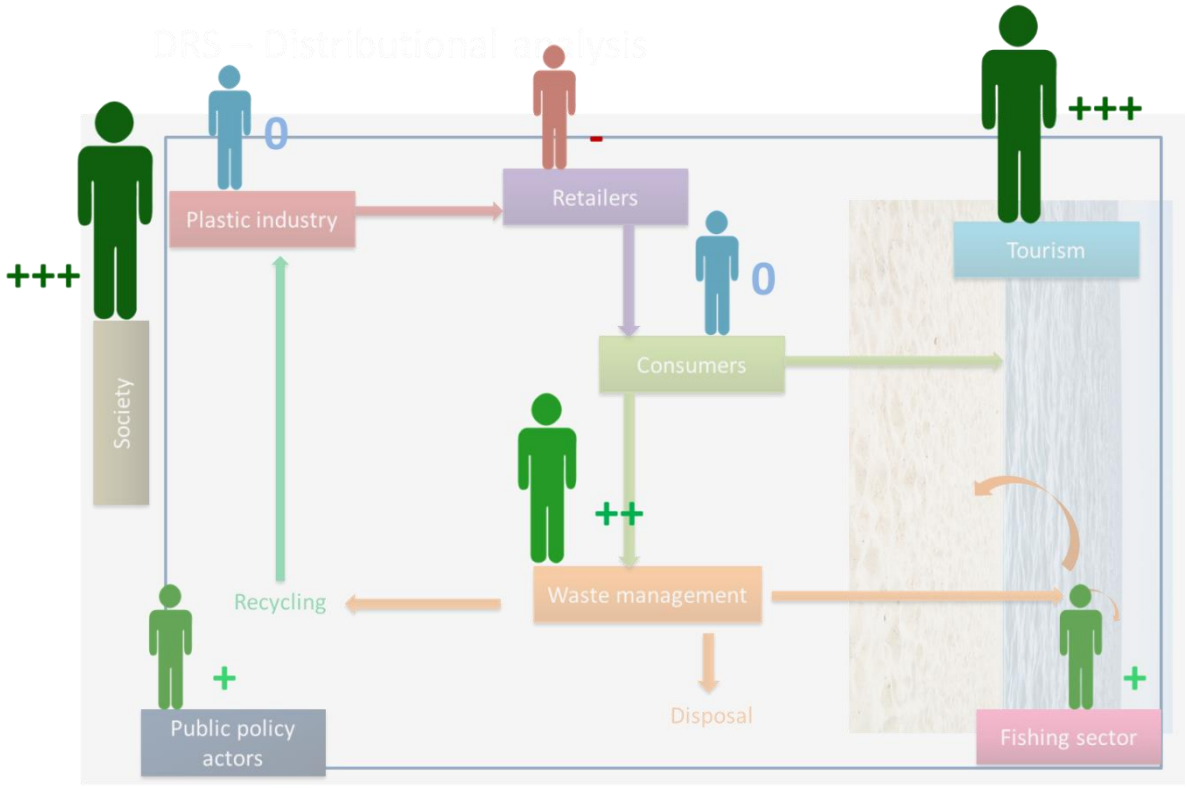
Table 30. Benefits and costs of Deposit-Refund Systems at the Mediterranean level: synthesis scores

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.

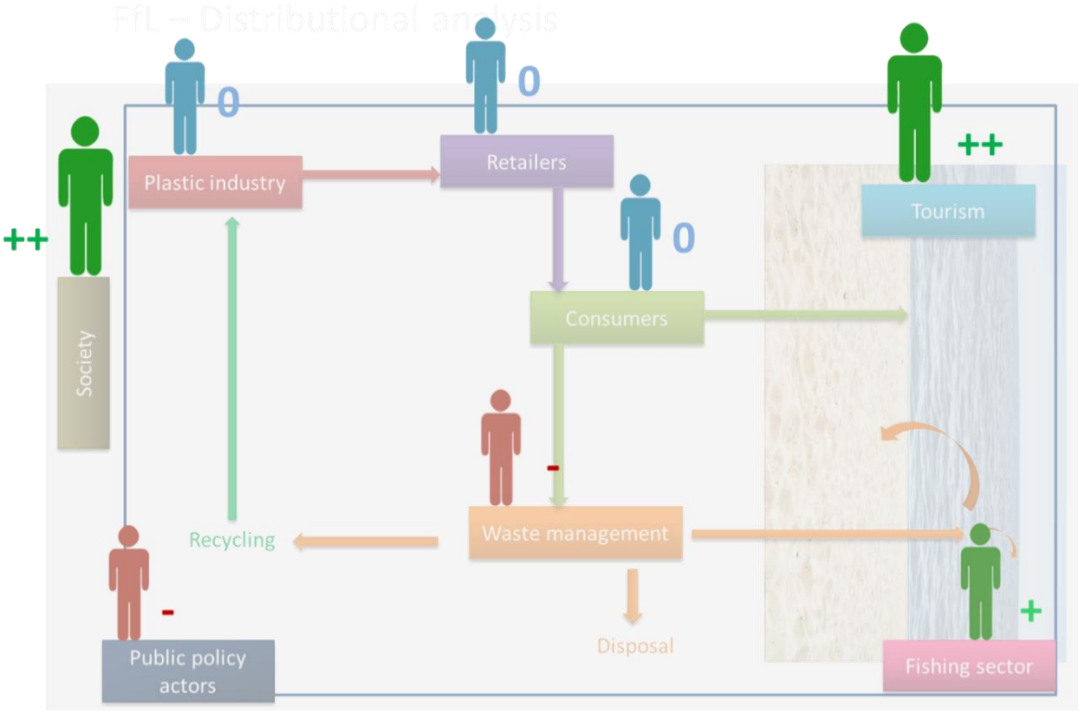
Table 35. Benefits and costs of Fishing for Litter schemes at the Mediterranean level: synthesis scores

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

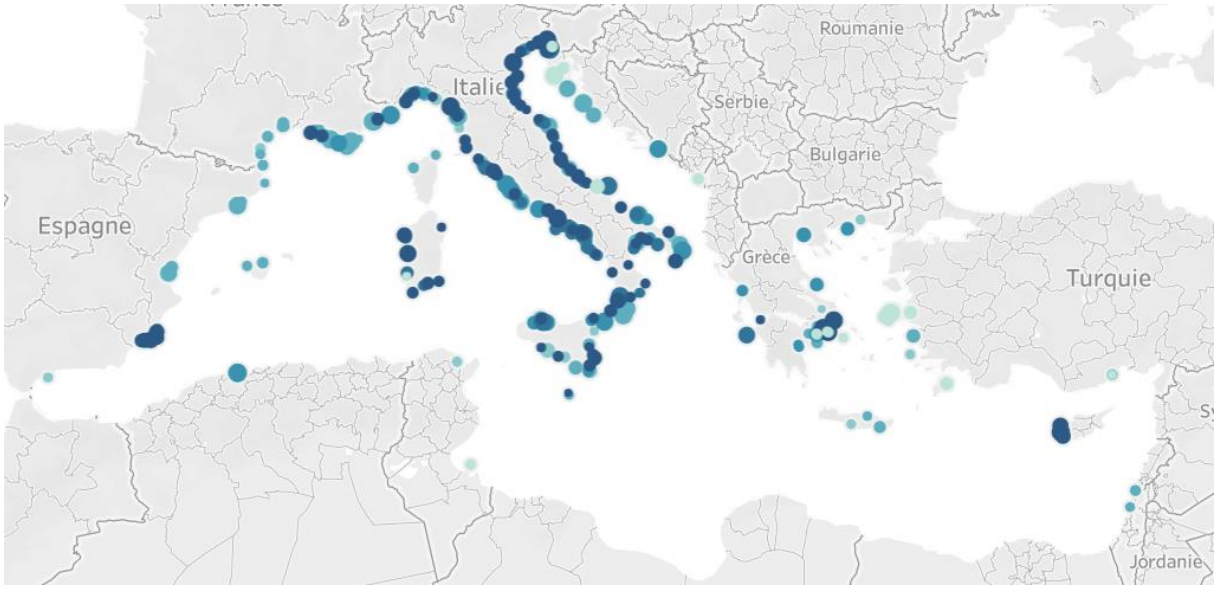
Acceptability	Some awareness raising work with fishermen is required, but normally it's well accepted				4	
Feasibility	Working with fishermen can be time consuming; the scheme needs appropriate port facilities and it might take a long time to set up large schemes			3		

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.

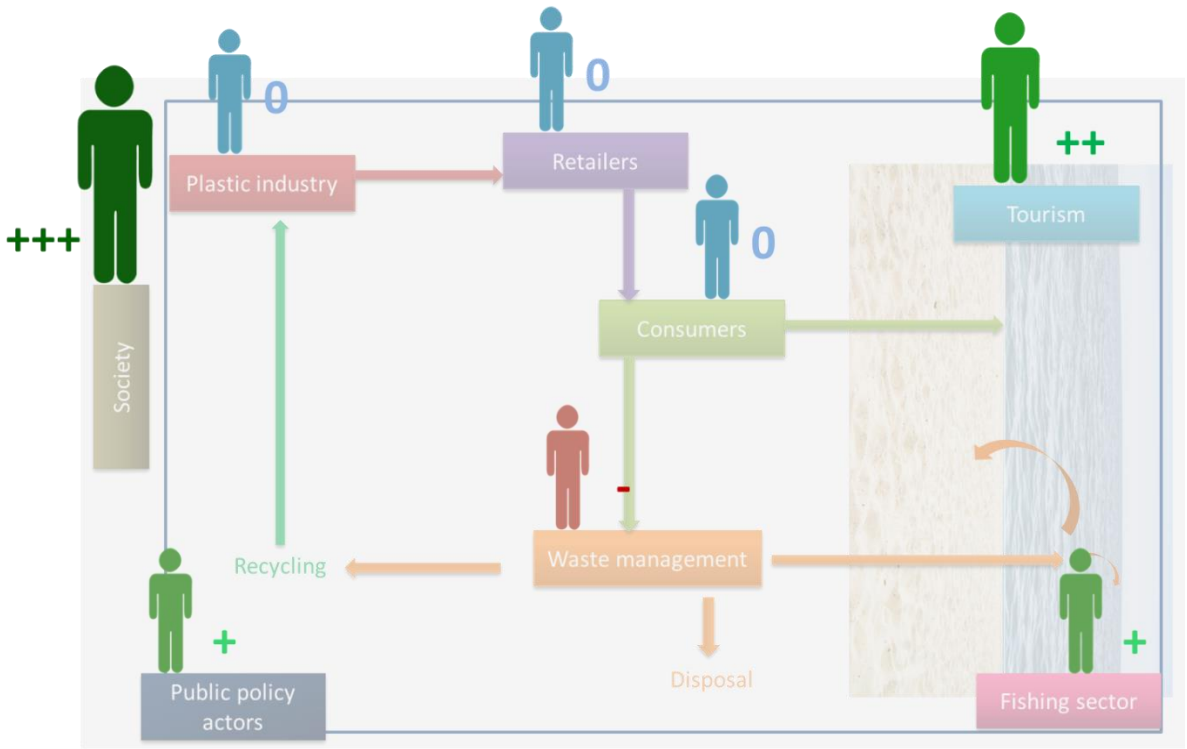
Table 39. Benefits and costs of Adopt a Beach initiatives at the Mediterranean level: synthesis scores

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.

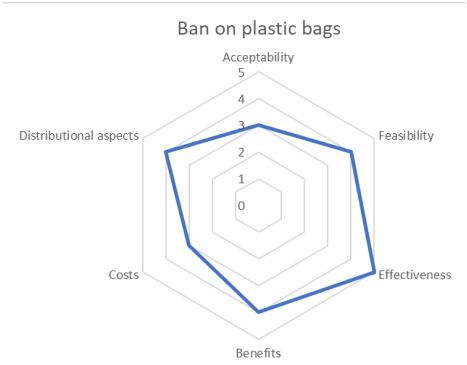
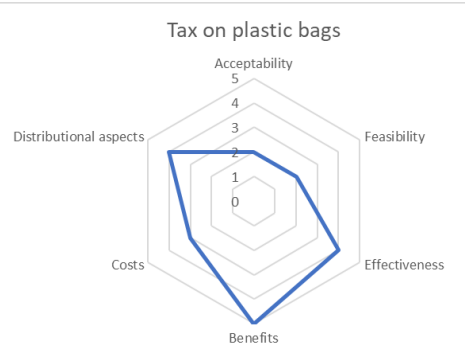
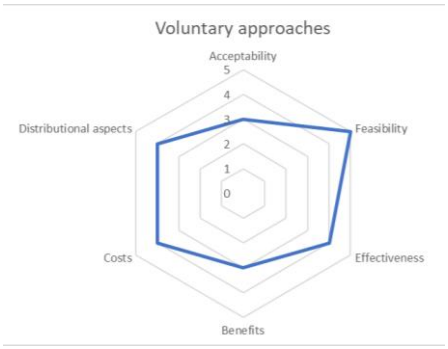
Table 40. Acceptability and feasibility of Adopt a Beach initiatives at the Mediterranean level: synthesis scores

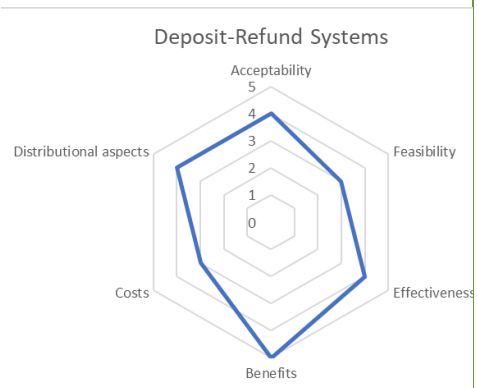
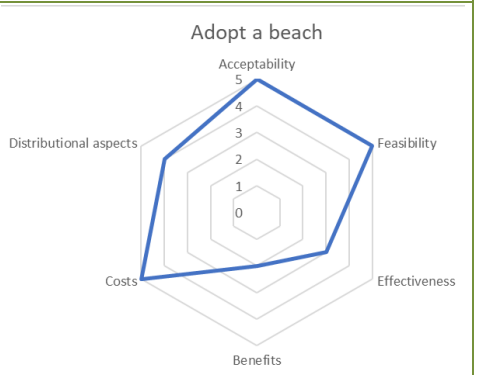
Acceptability	The measure is usually welcome by tourists and residents	5
Feasibility	Cleaning actions are very easy to organize and manage	5

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.

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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

MOROCCO : BAN ON PLASTIC BAGS

In 2015, Morocco was the second largest consumer of plastic bags.
The ban was enforced in 2016

The context

The Moroccan coastline is a pole of socio-economic attraction of national interest, towards which the pressures converge, namely (Khaoula 2019):

- Strong urbanization (49% in the Mediterranean);
- Attractiveness for tourism projects and secondary residences;
- Many industrial facilities (90% of industrial activities are along the coastline);
- Pollution due to ship traffic activities, and fishing;
- Waste left in large quantities in the wild, rivers, beaches and coasts and plastics represents about 70 to 90% of marine litter.

In 2015, Morocco was the second largest consumer of plastic bags (after USA) in the world: 800-900 bags/person/year (UNEP/MAP 2018) and according to the Ministry of the Environment, Moroccans use more than 26 billion plastic bags annually (HuffPost Maroc 2016a). Moreover, Morocco has an average percentage of collection coverage (82%) and a percentage of recycling of 10% - against, for example, 5% in Tunisia and 4.5% in Algeria (D-WASTE 2013). The regulatory framework until 2015 included:

- The law (No. 99-12, in 2014) on the National Charter on the Environment and Sustainable Development;
- The law (No. 81-12, in 2015) relating to the coast which aims mainly the protection and the integrated management of the coast;
- The law (No. 28.00, in 2006) on waste management;
- The law (No. 77-15, in 2015) on prohibiting the manufacturing, import, export, marketing and use of plastic bags.

Before the introduction of a ban, spontaneous initiatives in some cities in Morocco were also taking place to reduce the consumption of plastic, such as for example the city of Taounate, which was declared a few days before the start of the United Nations Conference on Climate Change "city without plastic bags" incinerating and final elimination of plastics accompanied by a collection campaign. In addition, a campaign to collect and destroy plastic bags was launched in the province of Taza and in the city of Berkane (HuffPost Maroc 2016b).

"The use of prohibited bags persists in the souks, itinerant and unorganized trade" (Department of Industry in a statement released July 1, 2018)

The process

In this context, in 2014, eco-tax of 1,5% on plastic products, both locally manufactured and imported, was introduced. Part of the revenues from this eco-tax contributes to the subsidy and / or the financing of plastic recycling units and the setting up of sorting centers (Khaoula 2019; UNEP/MAP 2018). On 1st July 2016, a ban on plastic bags became effective (law No. 77-15 of December 7, 2015) and the production, the import, the sale and the distribution of single-use plastic bags are forbidden. The ban does not apply to certain plastic bags for specific uses: agriculture, industry and waste collection (UNEP/MAP 2018). With this law, Morocco became the only country in South Mediterranean to enforce a national law on single use of plastic bag.

Implementing the measures

The ban was implemented through several decrees detailing: (i) the technical characteristics and the marking or printing of plastic bags excluded from the ban; and (ii) the raw material (polyethylene) under the import licensing regime to ensure the traceability and to avoid its use in the manufacture of banned plastic bags, particularly by the informal sector. Other decrees are being prepared in order to avoid law bypass and consist in the ban of industrial bags whose width is less than 50 cm in the market and non-woven polypropylene bags (grammage is less than 50 g/m²) (UNEP/MAP 2018). As established by the Decrees, several actors are involved in implementation: the Ministry of Interior for the control, the Ministry of Economy and Finance through Customs for border control, the Ministry of the Environment, the Administration of Customs and Indirect Taxes and the Ministry of Industry, Investment, Trade and Digital Economy for control of the industry. A control and penalty system is in place.

To support plastic bags producers, the Department of Industry set up a fund of 200 million MAD (18.5 million EUR) to finance industry restructuring and conversion. In addition, small business can gave a grant of up to 2 million MAD (around 185 000 EUR); a convention was also signed between the Ministry of Industry, the Ministry of Economy and the National Agency for the Promotion of SMEs introducing a grant to assist reconversion for a maximum of 10 million MAD (923 000 EUR). Nevertheless, these companies should make at least 30% of their activity in the production of plastic bags to have the subsidy. Other solutions available to plastic bag manufacturers is the production of alternatives bags (like wicker baskets) (HuffPost Maroc 2016b; UNEP/MAP 2018).

Moreover, other accompanying measures are in place (Khaoula 2019):

- A national public awareness campaign (Zero Mika) to support implementation of the ban. It consists mainly on awareness raising of the population and local actors and also on collection and disposal of littered plastic bags. This campaign is based on a communication and global awareness plan and a Consumer Oriented Substitution Communication Plan;

- A pilot project for the promotion of canvas bags, promotion of an ecologically viable alternative (woven cotton bags, paper bags...) and awareness raising activities of the population.

Pre-conditions for successful implementation

The main challenges faced in the implementation of the ban are the price and usability of alternatives to SUPBs, as well as the difficulty to change habits. It is thus necessary to propose, in parallel, alternatives at lower costs and adapted to products to be carried (especially wet products). Dialogue and collaboration with manufacturers are also crucial, especially small retailers which could be more impacted by the ban – and, as a reaction, could contribute to the development of an illegal market for plastic bags.

Main challenges to implementation

A first, important challenge to implementation deals with the availability of alternatives to SUPBs. In Morocco, available alternatives are considered too expensive and impractical; alternatives for packaging wet products are lacking (UNEP/MAP 2018). Moreover, the conventional bags have been mostly substituted with non-woven polypropylene bags which are more expensive to produce than conventional SUPBs (Le Monde 2018); in addition, due

Key facts

With the measure, Morocco became the only country in South Mediterranean with enforced national law on single use of plastic bag

The measure was implemented by the government and a control and penalty system has put in place

An aid fund of 18 million euros to help manufacturers in reconversion was also established

The measure

The ban on plastic bags became effective on July 1st, 2016

The ban does not apply to certain plastic bags for specific uses: agriculture, industry and waste collection

Accompanying measures include a national public awareness campaign (Zero Mika) and a pilot project for the promotion of canvas bags

to their very low grammage (< 50 g/m²), these bags are easily damaged and cannot be really considered as reusable (UNEP/MAP 2018; ConsoGlobe 2018). In addition, these bags are sometimes produced using toxic raw materials, the same used for packaging various industrial products (Le Monde 2018). As a result, the use of alternatives to plastic bags remains globally limited.

A second major challenge is that SUPBs are still distributed free of charge by most retailers in the informal market, representing a major obstacle to changing consumer behavior (ZeroZbel 2018). The illegal market existed already before the ban, but after since, it is playing a crucial role in maintaining single use of plastic bag in the market. Indeed, small shop tenders – the majority of fabric retailers in Morocco – are confronted with consumers' demand on plastic bags and inconvenient viable alternatives. Thus, afraid of losing customers, they purchase plastic bags from the illegal market and offer them for free to consumers. Small retailers tend to purchase small quantities of plastic bags, which makes it more difficult to track them. Thus, to be effective, enforcement of the ban must "hunt down" the informal sector, which is responsible for nearly 80% of the plastic bags on the market, and garners almost 8 times the 2.4 billion of turnover of the formal sector of the plastics industry, according to the figures put forward by the Economist (HuffPost Maroc 2016b).

Other obstacles include (UNEP/MAP 2018; ZeroZbel 2018):

- Lack of public awareness, not only on the effects of plastic bags, but more importantly on available alternatives.
- Lack of technical specifications, norms and standards on permitted bags at an earlier stage, both for bags exempted in the law (e.g. industrial, freezing bags) and reusable plastic bags (especially non-woven polypropylene bags, which have been the most abundant offered alternative).

Feasibility and acceptability

- *The ban must be accompanied by a strong awareness campaign at the national level targeting the consumers*
- *Propose alternatives at lower costs and adapted to the product (like wet products)*
- *Strengthen controls and sanctions against producers and wholesalers of illegal plastic bags*
- *Make an annual report to communicate on the efforts, the difficulties and the results obtained thanks to the ban*

Effectiveness of the measures and related benefits

After the ban, in July 2016, consumption of single use of plastic bag has decreased, and its positive effects on streets, beaches and landfills can be perceived (ConsoGlobe 2018). However, plastic bags did not fully disappear because of informal market supply. No recent consumption estimates exist (UNEP/MAP 2018).

The control and penalty system resulted in revenues for the government of around 452 000 EUR over the period 2016-2018.

73 companies were eligible to receive support from the fund supporting the restructuring of plastic bag producers, and 26 of them were granted a total sum of 136.7 million MAD (12.6 million EUR) for new investments and 71.7 million MAD (6.6 million EUR) for technical support (UNEP/MAP 2018). Thanks to this fund, 636 jobs were maintained and 650 news jobs have been created (UNEP/MAP 2018).

The annual production of alternatives to SUPBs is estimated at 8 billion paper bags, 1 billion woven bags, 1,8 billion million nonwoven bags, 1.500 tons of thermoforming products and 60 million of non-woven laminated bags (UNEP/MAP 2018). In 2017, 4.6 billion paper bags were distributed as well as woven bags.

In the first two years of implementation, the control and penalty system put in place by the Ministry of Industry showed some results, which led to the requisition of 1 510 tonnes of SUPBs and the imposition of fines for 4.9 million MAD (452 000 EUR) (UNEP/MAP 2018; Khaoula 2019, Le Monde 2018).

In addition, several positive direct impacts, as well as indirect benefits are expected; however, quantitative figures could not be found – and the lack of data on plastic use reduction made it impossible to make an estimate of at least some of these benefits.

Benefits: key figures

Consumption of single use of plastic bag has decreased – however, although the effects are perceivable, no recent consumption estimates are available.

636 jobs are maintained, and 650 news jobs have been created.

Negative impacts and related costs of the measures

Overall, information on costs is scarce and mostly qualitative.

Direct costs of the ban include:

- Regulators: costs of the supporting fund (18 million EUR), costs for establishing and maintaining the control and penalty system (in the years 2016-2018, 596 000 shops were visited for 4000 contentious cases, 83.1 tonnes of banned SUPBs were requisitioned) , implementation costs for accompanying measures;
- Plastic industry: costs for converting production to alternative bags – alternative bags are often more expensive to produce than plastic bags. On the other hand, the government subsidizes conversion.

The main direct negative impact concerns retailers, and deals with the free distribution of SUPBs on the informal market: in fact, this might result in a competitive advantage of informal small retailers with small retailers on the formal market, as consumers might tend to choose retailers distributing SUPBs for free (UNEP/MAP 2018).

Other costs, for which only qualitative information is available, are listed in the table below.

Costs: key figures

Plastic bags are still widely used and use of alternatives to plastic bags remains globally limited

The formal sector competes with SUPBs distributed on the informal market, and weight of the informal sector remains important

In synthesis…

Overview of costs, benefits and distributional impacts

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	Gains	Costs	Benefits		
Regulators	Investment in the supporting fund for restructuring of plastic industries – 18 million EUR Administrative cost of the establishment and maintenance of the control and penalty system Cost for accompanying measures (a national public awareness campaign and a pilot project)	Control and penalty system – Revenues from fines (2016-2018): 452 000 EUR			Savings linked to less beach cleaning and litter picking Cleaner public areas might increase recreational activities and expenses of tourists linked to it.	-
Plastic industry	Cost for the conversion and the production of alternatives bags: the alternatives are often more expensive to produce than the plastic bag	Grant for conversion and restructuring: the very small businesses of plastics can have a grant of up to 185 000 euros. The remaining SMEs have a conversion assistance reaching 923 000 euros maximum.	Economic losses with the new competition with the development of clandestine manufacturing facility Competitive advantage for informal small retailer as compared to legal small retailers	Investments in of substitute products: in 2017 4.6 billion paper bags were distributed as well as woven bags.	The polypropylene bags has been manufactured in very low grammage resulting in short-term health-damaging and they can not be reused	0
Retailers	Investment in alternative products more expensive		Loss of clients because the informal sector is still distributing free of charge to customers plastic bag of single use	Savings linked to largely reduced purchase of plastic bags and linked storage costs		-
Consumers			New charge for the investment in alternatives bags			-
Waste management				Savings for waste management due to less waste to be managed		+

Overview of costs, benefits and distributional impacts (cont'd)

…iety			Loss of employment for the companies, especially for those whose activity was mainly the production of single-use plastic bags	636 jobs are maintained, and 650 news jobs have been created Consumption of single use of plastic bag has decreased	Saving of resources (mainly hydrocarbons, water and energy needed in the manufacturing process of plastic bags) Provisioning services: decreased ingestion of marine plastic bag waste by animals; Cultural services: aesthetic and recreational services	+
Other sector: fisheries					Additional earnings in the fishing sector due to improved health and biodiversity of marine species; Savings in the fishing sector due to less cleaning /repair	+
Other sector: tourism					Increase in revenues in the recreation and tourism sector due to cleaner beaches	+
Overall balance (+/0/-)	**0**		**0**		**+**	

In conclusion…

Morocco has shown strong political will and commitment as well as efficient administrative arrangements to enforce the single use of plastic bag ban. Although apparently effective in reducing consumption of SUPBs, the law was probably issued at too early a stage, when few alternatives already available on the market – and this might have reduced its effectiveness.

The government keeps on deploying efforts to enforce the law, notably in the fight against illegal market and the development of technical specificities for alternatives. However, in the long-term, the level of surveillance and prosecution may not be sustainable and therefore complementary actions should be boosted.

Want to know more?

ZeroZbel study (2018) on the use of SUPBs and alternatives

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Temporary implementation of a deposit and refund scheme in Cadaqués, Spain

In 2013, a pilot project on a deposit refund system was implemented in the city of Cadaqués, Spain, for single-use beverage containers.

"Deposit and Refund schemes promote reuse; they achieve a high level of recycling and entail important savings for local and regional bodies as they ensure a comprehensive implementation of extended producer responsibility" (Retorna, 2013).

The context

In Catalonia, nine million beverage containers are sold every day. Of these, only 3.5 million are separately collected through the integrated waste management system. The remaining 5.5 million end up in landfills, are incinerated or are littered to the environment. This situation entails not only an important environmental impact but leaves also many raw materials unused. In its regulation on packages and package waste (Act 11/1997), Spain envisages as the basic instrument of packaging waste management to implement an extended producer responsibility and to ensure a great level of recovery of used containers (Retorna, 2013).

The estimated annual consumption of beverage containers which would fall under a deposit and return system in Cadaqués is about 1,377,000 units. The average consumption per inhabitant is 1.26 units per day (Retorna, 2013). A weighted average of about 12% of separate packaging collection was subject to a deposit prior to the pilot test (Retorna, 2013).

The process

Within this context, Retorna, a non-profit organization that comprises the recycling industry, environmental NGOs, unions and consumers, proposed the City Council of Cadaqués to conduct a pilot test in order to gauge the effect of implementing a packaging waste management system complementary to yellow bins (Retorna, 2013). The advocated proposal was aimed in a first phase at one-way beverage containers, whereas the existing separate collection system (SIG) remains in place and continues recycling containers which are not included in the deposit and refund scheme (tin cans, the containers of dairy products, liquors, wines, plastic trays…).

This proposition had been taken up in the form of a pilot project, as part of which a deposit refund system (DRS) was temporarily introduced from April to June 2013. The DRS was applied for single-use, plastic and metal beverage containers smaller than 3 litres. Most of the retailer shops of the municipality of Cadaqués participated (Van Acoleyen et al. 2014).

The **objectives** of this pilot were (Van Acoleyen et al. 2014):

- to assess the feasibility of a DRS;
- to analyse the economic impact on municipal waste management;
- to serve as an example to different stakeholders;
- to assess the level of return of refundable containers, but also to determine the level of return with a deposit of EUR 0.05;
- to assess the level of interest with both shops and shoppers;
- and to measure the impact on the waste collection system and street cleaning.

Implementing the measures

The containers which were included in the Cadaqués Deposit and Return Scheme are beverage (water, beer, juices, soft and energetic drinks) plastic and metallic containers with a capacity not exceeding three litres. A deposit of 5 cents was applied to all these containers. Consumers were able to return beverage containers in any of the retail outlets that participated in the test. Depending on the type of retail outlet and the volume of returned containers, these were collected manually or using a machine (Retorna, 2013).

Supermarkets and small shops collect the amount paid as a deposit at the time of selling the beverage and refund that amount when consumers return the containers. Empty containers are stored until the system operator collects them (Retorna, 2013).

Pre-conditions for successful implementation

Several companies and organisations from the recycling industry have provided financial support, machinery, know-how and logistics to ensure that the pilot test was adequately conducted. The Catalonia Waste Agency monitored the conception and design of the test, its implementation and the analysis of results (Retorna, 2013).

A DRS can only correctly work if enough retail outlets participate. "In the case of Cadaqués, eight small shops and two supermarkets participated: they account for over 95% of beverage sales for home consumption" (Retorna, 2013).

Main challenges to implementation

Implementation challenges have mainly been reported with regards to fears of retailers in terms of loss of space, loss of income (decrease in beverages sales) and increased work load for staff. These fears have, however, been dissipated during the pilot test. All shopkeepers and retail outlet managers are in favour of implementing a DRS in Catalonia (Retorna, 2013).

Regarding the technical performance of the test, no problems have been detected in either manual or automatic return (Retorna, 2013).

Key facts

- *Deposit-refund system pilot project initiated by the non-profit organization Retorna*
- *April-June 2013 in Cadaqués, Spain*

The measures

Deposits are charged for single-use plastic and metal beverage containers.

Feasibility and acceptability

A well accepted pilot test which benefited from the support of the recycling company and the local decision makers. After the test, 85% of the population agreed with the implementation of a Deposit and Refund system (Retorna, 2013).

Effectiveness of the measures and related benefits

In case such a DRS is implemented at a large-scale (i.e. at the regional or national level), all beverage containers (excluding those originating from foreign countries) would be covered by the system regardless where they are sold and where they are deposited. Two indicators were used to assess the level of return to the participating outlets, considering influxes of containers that do not come from participating outlets (Van Acoleyen et al. 2014).

• **Total return of containers**: during the test period, the participating retail outlets sold about 106,000 beverage containers under the deposit scheme. About 81,000 containers were returned, accounting for 77% of the sales. The return rates increased during the test, up to 91% in the last week (Retorna, 2013).

• **Return of labelled containers**: in the final weeks of the test the level of return increased up to 67% of labelled containers during the final week. This growth suggests that the level of return had not reached its peak and would have been higher if the test had lasted longer (Retorna, 2013).

Based on the results of the test, economic and environmental effects of implementing a DRS have been calculated and are presented in the following:

Direct benefits

Revenues from unclaimed deposits

Considering the actual return rate during the test period (81,000 containers returned out of 106,000) and the deposit amount of 5 cents per container, an extrapolation of the unclaimed deposits for a period of one year amounts to EUR 6,000.

Reduced collection and processing costs

When implementing a DRS, **collection costs** would be reduced in the municipality, entailing savings between about EUR 24,000 and EUR 35,000 per year. This represents between 6.5 and 9.5 % of the annual cost of light packaging and refuse collection (Retorna, 2013).

Increase in separate collection quantity and quality

The deposit-refund system allowed a fivefold increase in separate collection of packaging in the municipality of Cadaqués, from a level of 12% to a level of 66.6% (Retorna, 2013).

"Comparing the materials separated at a packaging selection plant and those obtained from the processing of the reject fraction, the bales of material recovered through the Deposit and Refund system (DRS) in Cadaqués have the highest standards of quality in the recycling sector" (Retorna, 2013). This means on the one hand that they receive higher selling prices (between 20% and 40% higher-depending on the materials – than in the case of the existing separate collection system) (Retorna, 2013), and on the other hand this has a positive effect for the environment, as more raw material can be recycled.

Direct economic impacts (positive impacts)

The DRS scheme provides for the availability of high-quality recycling raw material.

Reduction in bin weight and volume occupation

Benefits: key figures

Reduced collection costs lie between EUR 24,000 and EUR 35,000 per year.

- The DRS reduces volume occupation in bins and, consequently, economic costs and environmental impact can be reduced by readjusting collection frequencies. Therefore, less materials are sent to landfills.
- A projection of the results obtained in Cadaqués yields an estimation of a reduction in occupation between 18 and 25% in the case of light packaging bins and between 4.7 and 6.6% of volume in the case of the refuse bin (Retorna, 2013).
- As about 2% of the weight of dumping (6.6% in volume) would not go to the landfill, **maintenance costs** would be reduced as well. Based on the current, these savings have been estimated to be between EUR 1,700 and EUR 2,400 per year (Retorna, 2013)

Indirect benefits

- It was not possible to quantify in economic terms the proportional part of **street cleaning** attributable to the packaging under the study. However, it can be assumed that the implementation of a DRS would have a positive impact (Retorna, 2013).
- Surveys have been carried out to accompany the pilot test, one prior to the test and the other on completion of the test. Results of the final survey indicate a perception of **greater cleanliness of public spaces** during the weeks where the DRS was in place (61% of respondents). This applied particularly on streets, but also in other leisure areas of the municipality (Retorna, 2013). No dedicated beach surveys were carried out to assess the impact on marine litter. However, "it is assumed that the significant increase in collection and therefore reduction in improper disposal of beverage containers reduced the likelihood that this type of item ended up as marine litter" (Van Acoleyen et al. 2014). In general terms it can be expected that cleaner public areas might increase recreational activities and expenses of tourists linked to it.
- Both retailers and the plastic industry gain through a better public image due to their participation in the pilot test. At the same time, consumers benefit from the feeling of doing "something good" for the environment.
- The society benefits from the saving of resources: mainly hydrocarbons, water and energy needed in the manufacturing process of beverage packaging.
- In terms of **ecosystem services**, provisioning services from the sea increase due to decreased ingestion of marine plastic debris by animals. At the same time there is a positive effect on cultural ecosystem services (aesthetic and recreational services) through cleaner public spaces.

Negative impacts and related costs of the measures

Direct costs

- Regulators normally have to carry launching costs, information campaigns, implementation and enforcement costs. These have not been quantified in the Cadaqués case study and it can be assumed that they were at least partly taken over by Retorna.
- The plastic recycling industry provided financial support, machinery, know-how and logistics. These costs were, however, not quantified.
- Bigger stores have to pay the costs for reverse vending machines, for which they were supported by the recycling industry.
- Consumers carry the costs of unclaimed deposits. Given the observed rate of return they amount to about EUR 6,000 per year.
- Regarding the waste management sector, currently waste collected through the separate waste collection system receives compensations by the organisation

Costs: key figures

Income through sales of material collected through the separate waste collection system decrease by EUR 1,200 to EUR 1,800 per year but are compensated by cost savings.

Ecoembes. The amounts of the compensation would decrease by about EUR 1,200 to EUR 1,800 per year through the introduction of a DRS. Net savings for the municipality by comparing the reduced compensation by Ecoembes and the reduced collection costs lie between EUR 23,000 and EUR 33,600 (Retorna, 2013).

Direct economic impacts (negative impacts)

- The Catalonia Waste Agency monitors the conception and design of the test, its implementation and the analysis of the results. Costs – e.g. in terms of additional staff needs – have, however, not been estimated.
- Besides the costs of unclaimed deposits, consumers have the inconvenience of bringing beverage packaging back to the retailers.

In summary, deposit-refund systems are known to be expensive mainly for their investment costs (installation of the system, purchase of machines which take the empty beverage packaging back). Due to the (financial and material) support of the recycling sector in the case of Cadaqués, these costs did not seem to be a hindering factor and have not been reported.

The only costs which have been reported are those linked to reduced compensation from material collected and sold through the separate waste collection system (see above). These are, however, widely compensated in the municipal budget by reduced collection frequencies. The costs linked to the transport of the containers collected through the DRS do not seem to be considered.

In synthesis…

Overview of costs, benefits and distributional impacts

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
Regulators	Launching costs, information campaigns, implementation costs, enforcement costs. Not quantified, it can be assumed that they were at least partly taken over by Retorna.	Unclaimed deposits: 6,000 EUR per year.	Monitoring of the conception and design of the test, its implementation and the analysis of results by the Catalonia Waste Agency. No quantification of e.g. additional staff time.		Savings linked to less beach cleaning and litter picking. Cleaner public areas might increase recreational activities and expenses of tourists linked to it.	+
Plastic industry	Provision of financial support, machinery, know-how and logistics from the recycling industry. No quantitative information.			Availability of high-quality recycling raw material.	Improved image through participation in the pilot test.	+
Retailers	Purchase of reverse vending machines for bigger stores – but supported by the recycling industry.		(Fears in terms of loss of space, decrease in sales and increased work load for staff have been dissipated during the test.)		Improved image through participation in the pilot test.	+
Consumers	Unclaimed deposits: 6,000 EUR per year.		Inconvenience of bringing beverage packaging back to the retailers.		Feeling of doing something “good” for the environment.	+

…nagement	Reduced compensations for waste collected through the separate waste collection system: decrease by about EUR 1,200 to EUR 1,800 per year.	Reduced collection costs: EUR 24,000 to EUR 35,000 per year, corresponding to 6.5 - 9.5 % of the annual cost of light packaging and refuse collection. Recycling material recovered through the DRS has the highest quality standards. Selling prices are 20% to 40% higher - depending on the materials (compared to the existing separate collection system).		Savings for waste management (maintenance costs) due to less waste quantities. Reduction in occupation between 18 and 25% in the case of light packaging bins and between 4.7 and 6.6% of volume in the case of the refuse bin. Estimated savings: EUR 1,700 to EUR 2,400 per year.		+
Society					Saving of resources (mainly hydrocarbons, water and energy needed in the manufacturing process of beverage packaging) Provisioning ecosystem services: decreased ingestion of marine plastic debris by animals; Cultural ecosystem services: aesthetic and recreational services through cleaner public spaces	+
Overall balance (+/0/-)	+		+		+	

In conclusion...

The temporary introduction of a deposit-refund system in Cadaqués was very successful, both regarding the technical effectiveness and from an economic perspective. The test received positive feedback both from the population, which perceived greater cleanliness of public spaces during the test, and the retailers.

Want to know more?

www.retorna.org

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Marviva fishing for litter project in Catalonia, Spain

The Marviva Project is a fishing for litter scheme targeting the Catalonian coast

"It is a project we don't spend a lot of money on, but the impact in terms of communication are very good. […] The image of the fishermen changed in the public opinion"

Coordinator of the project at the Catalonian Waste Agency

The context

The Catalonian coast is especially stroken by marine litter pollutions. High population density and tourism drive a lot of waste potential. The Institute of Environmental Science and Technology of the Universitat Autònoma de Barcelona estimates that 200.000 to 450.000 items of litter/km² are left daily on Barcelona's beaches during the touristic season, which corresponds to the upper average of EU Mediterranean touristic coasts. Plastic items and cigarette butts respectively account for a third of the items found. (ICTA-UAB 2018)

The Agència de Residus de Catalunya (ARC) or Catalan Waste Agency is responsible for managing the waste generated throughout Catalonia. Prior to the Fishing for litter project, it suffered from a lack of knowledge and data on the status of marine litter pollutions.

The Fishing for litter scheme came up in a context of raising awareness around plastic consumption reduction. Since 2009, the Plastic Bag Agreement has been seeking voluntary agreements of actors involved in products distribution to reach consumption reduction targets. A pilot deposit-refund system has also been tested in Cadaques, Catalonia (see corresponding case study).

The process

The Fishing for litter scheme was launched on the basis of a **partnership between three major actors: the ARC, volunteering fishermen of Barcelona and the Authority in charge of the port of Barcelona**. The project started in 2016 with a pilot scheme targeting the Port of Barcelona and was extended in 2017 to 13 ports in Catalonia.

The three stakeholders were interested in the project for specific reasons:

- The fishermen, to improve their image in the public opinion: according to them, they used to be mostly perceived as damaging the marine environment (overfishing).
- The ARC, to collect data on the quantity, type and sources of marine litter.
- The Port Authority of Barcelona, to reduce the amount of litter in the port and thus the coast of picking it up.

As the project was extended in 2017, two partners joined the project: the Catalonian Fishing Authority and Upcycling the Oceans, an initiative supported by three private organizations (Foundation Ecoalf, Foundation HAP and Ecoembes) aiming at recycling marine litter into textile products.

Implementing the measures

During the pilot project, 4 trawler boats out of 12 in Barcelona were involved. Fishermen collected the litter caught in their nets and brought it back ashore, where the Port Authority was in charge of collecting the waste in containers gathered and sent to recycling plants or landfills by the ARC.

The scheme is based on fishermen's voluntary participation. There exists yet no economic incentive for them to get involved.

Pre-conditions for successful implementation

The pilot project led since 2015 has been built on several key mechanisms:

- **Costs and benefits perceived as fairly shared across partners**: the three first actors to take part in the Marviva project had interest in its outcomes: reducing marine litter in the port, improving fishermen's image in the public opinion, raising public awareness on marine litter and collecting data on the extent of marine pollution. As such, they shared the costs of the project (administration, waste collection, waste management) in a manner which was perceived as fair by all the stakeholders. In this respect, compensation mechanisms to share the economic benefits generated by the valorization of litter recycling as part of the project extension should be investigated.
- **Insure a minimal additional workload for fishermen**: in the pilot project, litter brought back to the Port by fishermen was directly collected by the Port Authority. The monitoring of the litter type and quantity was insured by the ARC.
- **Insure media coverage of the initiative**: in the case of Barcelona, public opinion was targeted with two purposes: first to improve fishermen's image regarding environmental issues, second to raise public awareness on marine litter. For both the ARC and fishermen, the impacts on public opinion are considered the main outcome of the project.

Main challenges to implementation

Two main challenges were identified by the ARC

- **Collaboration between the ARC and fishermen**: the ARC was not used to fishermen working routines in the first place and had to adapt to start the collaboration.
- **Avoiding associating fish and plastic in the public opinion**: fishing for litter schemes shed light on both fishermen and marine litter. It was feared that this may lead to confusion in the public opinion regarding fish sanitary quality (such as "fish full of plastic"). The issue was especially touchy as fishermen's first interest in the project was to polish their public image. A lot of effort was invested in the management of the project media coverage to insure there would be sent no misleading messages.

Key facts

- *Implementation : Catalonian Waste Agency*
- *Target : fishermen and public opinion*
- *Date of implementation: 2016*

The measures

A fishing for litter scheme is based on a partnership between fishermen, waste management and port authorities

Feasibility and acceptability

- *Challenge on the involvement of the fishermen into the scheme: a carefull balance between the costs (additional work) and benefits (better image in the public opinion) is necessary*
- *Interest of waste management and port authorities*
- *Technically and economically aforadable*

Effectiveness of the measures and related benefits

During the 2015-2016 pilot campaign, the 4 trawler boats involved in the campaign collected some 2700kg of marine litter, containing 56% of plastic. Plastic bottles and bags made up 30% of the plastic litter. According to Ecoalf, as the project was extended in 2017 to 13 additional ports of the Catalonian costs, 235 trawler boats were involved which collected some 50,4 tons of trash.

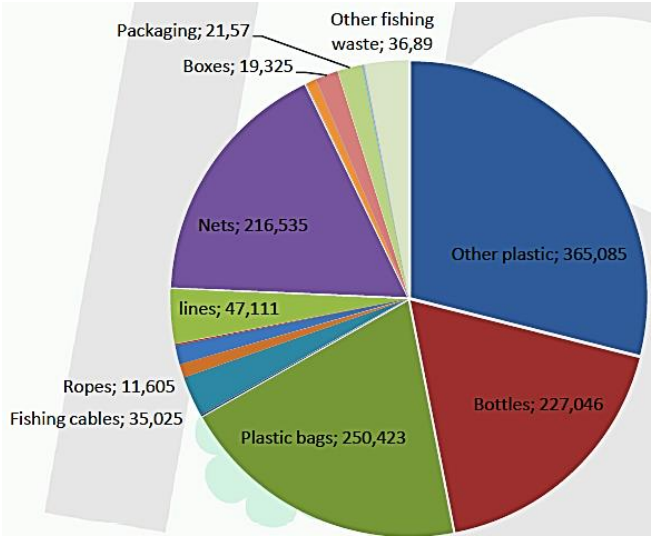

Figure 1 Composition of plastic collected during the Marviva 2015-2016 Fishing for litter campaign (Agencia de Residus de Catalonia 2017b)

Direct benefits

- One purpose of the initiative was to **improve fishermen's public image** and public awareness on marine litter. According to an ARC representative the initiative has been very successful in terms of media coverage, with significant impact on public awareness regarding marine litter, and on the perception of fishermen.
- For the ARC, the purpose of the fishing for litter scheme was more focused on **data collection**: it allowed exploring the type and quantity of marine litter collected by fishermen, and thus to upgrade the knowledge base on the extent of marine litter pollution.
- **Generating economic value with the collected waste**, was not an aim of the pilot project launched in 2016. With the extension of the Fishing for litter scheme to other ports in Catalonia however, private stakeholders joined the partnership, recycling the marine litter collected to turn them into textile products, thus generating additional value to the activity. It must be noted however, that not all the litter collected can be valued through recycling. The remaining share is sent to landfills or incinerator plants.

Direct economic impacts

- Revenue and employment generation (no quantitative data)

Indirect impacts

- The measure effectiveness regarding the status of marine and coastal environment is unknown. As a curative measure, it cannot fully address the issue of marine litter. Positive effects on ecosystem services (e.g. provisioning and cultural services).

Benefits: key figures

- *Litter retrieved from the sea : 2.7 tons in 2016; 50.4 in 2017*
- *Of which about a third of plastic bags and bottle items*
- *A large media coverage*
- *Revenue generated from litter recycling*

- Reduced costs of port cleaning up: the potential for the 14 ports involved can amount up to 4.36 million EUR/year.

Negative impacts and related costs of the measures

Direct costs

The costs of the measure are shared across the actors involved in the Fishing for litter scheme:

- **Collection costs**: fishermen are in charge of bringing back marine litter to the port. As such, there may not be a direct economic cost for them in a Fishing for litter initiative but additional time and effort to be spent to pack and unload the litter ashore. The ARC is seeking a way to compensate economically the fishermen for this effort, especially because it has become clear to fishermen that private businesses generate revenues from the litter they collect.
- **Waste management costs:** the Port Authority of Barcelona funds the management of the waste collected by fishermen hiring private companies to handle and recycle or dispose it (depending on the type of waste). With the extension of the project, Upcycling the Oceans has become the main actor of plastic waste management.
- **Administration costs**: the ARC is in charge of coordinating the project, but also monitoring the results (amounts and types of waste collected), collect the data and treat them to upgrade the knowledge base on marine litter. Since the extension of project, this monitoring activity is performed by the company in charge of waste recycling, which forwards the data to the ARC. The ARC is also in charge of mainstreaming the initiative to increase public awareness on marine litter, which means press releases, organization of punctual events with local stakeholders, schools, etc. (UNEP, MAP, et Plan BLeu 2017) socio-economic study of fishing for litter schemes evaluates administration costs to around 900€/ton of litter retrieved from the sea.

The litter collected and not recycled is managed as the rest of municipal waste. This should very few additional management costs given the very small amount of litter retrieved from FFL schemes (2.5 tons in 2016 and 50 in 2017) compared the amount of waste treated yearly in Catalonia (3.8 million tons) (Agencia de Residus de Catalonia 2017a). This is estimated between 5.400 to 15.000€ for the 2017 campaign (based on World bank figures on waste collection (World bank 2012))

Costs: key figures

- *Additional work for fishermen*
- *Administration costs for the scheme coordinator*
- *Waste management costs*

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits linked to environmental improvement	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
Regulators (Catalunyan Waste Agency)	Administration costs regarding the project implementation and follow-up Costs of monitoring the marine litter retrieved from the sea during the pilot project	Increased knowledge base on the extent of marine litter pollution Increased public awareness on marine litter pollution				0
Waste management	Additional costs of waste management: estimation 2017: 5.400 to 15.000€ Based on high income countries costs of landfilling : 108 to 302€/ton (Worldbank, 2012)					0
Society					Provisioning services: Reduced death, illness, intoxication and injury of fish, shellfish and turtles caused by marine plastic bag waste; Cultural services: aesthetic and recreational services and non-use value increased	+
Other sector: Fishermen	Additional time and energy spent	Better image in the public opinion			Less damages to fishing vessels and materials, prevent reduction of catches by marine litter : negligible	0

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits linked to environmental improvement	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
	collecting and packing waste					
Other sector: Port Authority	Costs related to waste collection in the port Project management costs				Reduced costs in port cleaning up: potential for the 14 ports involved : up to 4.36 million euros reduction for complete port clean-up by FFL schemes	0
Other sector: Plastic waste recycling companies	Recycling costs of plastic litter	Sale of textile products made of plastic marine litter		Revenue and employment generation		+
Overall balance (+/0/-)	+		+		+	

In conclusion...

The outcomes of the Marviva project in Catalonia are focused on improvement of public awareness and of the knowledge base on marine litter in the environment (and not in terms of direct reduction of waste into the environment).

The costs of the project are mostly related to the monitoring and management of the waste collected by fishermen, while the benefits are mostly related to media coverage and data collection. Their distribution between the different stakeholders is perceived by them as fair. The upscaling of the pilot project to 12 other ports of the Catalonian Coast and the involvement of private actors can affect this balance in both directions depending on the ability to fairly share the additional benefits generated by litter recycling.

Want to know more ?

Visit the project page on the website of the Catalonian Waste Agency

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ISRAEL PLASTIC BAG LAW

Israel introduced in 2017 a set of ban and levy measures on plastic bags in large retail outlets

The context

Prior to the Plastic Bag Law (2017), the total annual consumption of plastic bags in Israel was 2.7 billion bags (Israel Ministry of Environmental Protection 2017b). The average Israeli used 325 bags/year; the average household 1,200 bags(Israel Ministry of Environmental Protection 2017b). These figures were in line with EU Mediterranean countries not having implemented plastic bags reduction mechanisms (e.g. Greece or Bulgaria, respectively 269 and 421 plastic bags/year/person (Kerstens 2017)) but far above Western European countries with reduction mechanisms (e.g. Ireland 18 bags/year/person). In Israel, a large share of these plastic bags was distributed by supermarkets: 1.6 billion plastic bags/year prior to the Plastic bag Law(Israel Ministry of Environmental Protection 2017b). A quarter of all plastic bags were estimated to be thrown away immediately after use. Supermarket bags made up 25% of municipal waste volume and 10% of its weight(Israel Ministry of Environmental Protection 2017b).

Before 2017, the Clean Coast Programme was the main instrument in Israel to combat plastic litter in the marine environment.. It was launched in 2005 at the initiative of the Ministry of Environmental Protection following the observation that coastal municipalities legally in charge of beaches cleanliness were not maintaining the beaches correctly. The Plastic Bag Law also followed a more general law on the Protection of the Coastal Environment (2004) which introduced more stringent measures against damages to the coastal environment (inspections and penalties).

The Clean Coast Programme included several complementary components aiming at generating a change in public awareness of the importance of beach cleanliness : routine cleanup activities by local authorities responsible for the beaches and volunteers; enforcement measures against polluters and authorities that fail to comply with their obligations; information and public media campaigns and educational efforts by NGOs and communities; educational activities in Israeli schools and other information and publicity campaigns. (Israel Ministry of Environmental Protection 2018).

While the programme helped improving beaches cleanliness, it mostly failed to address the sources of plastic litter. Despite its implementation in in 2005, the annual average Clean Coast index[1], that is, the share of Israeli beaches which can be considered clean, remained below 50 %. Pasternak et al. (2017) state that 90% of the litter found on Israel beaches between 2012 and 2015 was plastic. Food wrappers, disposable plastic bags and cigarette butts were constituting the bulk of the plastic debris.

[1] The Clean Coast Index measures the degree of beaches cleanliness on the basis on the amount of debris found by surface (Alkalay, Pasternak, et Zask 2007). Following this indicator, beaches are ranked in five categories of cleanliness. Israel ministry for Environemental protection generally bases the evluation of its plastic reduction programs on the number of beaches considered clean and very clean by the Clean Coast Index.

The process

From 2013 onward, specific attention has been paid to plastic bags In order to review the most relevant instruments to tackle plastic bag use, the Ministry of Environmental Protection set out a survey in 2013. The survey examined different alternatives for the reduction of carrier bags including a complete ban on the use of carrier bags in retail stores; a ban on the free distribution of disposable carrier bags in retail stores; imposition of a levy on the sale of carrier bags; and development of cooperative programs aimed at launching an educational process that would change public attitudes toward packaging waste in general and disposable carrier bags in particular.

Furthermore, the Ministry conducted a public opinion poll in2013 which showed that a majority of Israelis was concerned with the indiscriminate use of carrier bags and was willing to pay for a reusable bag as an alternative to the single-use carrier bag (Israel Ministry of Environmental Protection 2015). In July 2014, following consultations with stakeholders including consumers, plastic bag producers, supermarkets, government officials and other stakeholders, the Israeli Parliament approved the bill (Israel Ministry of Environmental Protection 2015).

Implementing the measures

The Plastic Bag Law came into effect on January 2017 and targeted exclusively "carrier bags". It thus excludes plastic bags that come in direct contact with food. It relies principally on four measures:

1. Prohibition of the distribution or sale of single-use carrier bags less than 20 microns thick to consumers by a retailer, including internet sales.
2. Prohibition on the distribution to a consumer of a single-use carrier bag, between 20 and 50 microns, by a large retailer, including in internet sales, unless a minimal fee is collected which is not less than the rate of the levy (minimum of 0,1 Local Currency Unit or LCU). A large retailer may collect a sum higher than this rate for each bag.
3. Requirement that invoices issued by large retailers, including for internet sales, list the number of single-use carrier bags bought and the price paid.
4. Obligation for large retailers to pay a levy of 0.0854 LCU or 0.02135 euro (i.e. 0.1 LCU or 0.025 euro with inclusion of the VAT) for each single-use carrier bag sold.

Between the approval of the Plastic Bag Law and its enforcement (i.e. 2014 to 2016), the Ministry of Environmental Protection launched the distribution of 6.5 million multi-use carrier bags to Israeli households. The measure was funded by the contribution of supermarkets for a cost totaling their expenses for the free distribution of plastic bags before the Law (i.e. 80 millions LCUs, i.e. 20 milion euros). It was supported by a national public awareness campaign on the effects of the Law on consumers.

The funds collected from the levy are deposited in the **Maintenance of Cleanliness Fund** of the Ministry of Environmental Protection and are managed in a separate account for encouraging the reduction of single-use carrier bags and for reducing the negative environmental impacts associated with such use by the following means:

- Encouraging the use of multi-use carrier bags with less environmental impact;
- Education and information on the aims of the law;
- Clean-up activities aimed at removing plastic bag waste from beaches and coastlines;

The Plastic Bag Law has been enforced at a time when the budget for the Clean Coast program was being tripled to over 2 million USD. The Plastic Bag Law thus came as a good complement to the existing marine litter reducing scheme: on the one hand it came into effect within a public opinion already aware of the issue, on the other hand the revenue generated by the levy allowed fund raising for cleaning and awareness campaigns.

Furthermore, in response to opposition by lightweight carrier bag manufacturers, the Ministry proposed that part of the funds generated by the levy would be used to assist carrier bag producers in adapting themselves to the law's provisions "to transition to more environmentally-friendly production." (Israel Ministry of Environmental Protection 2015)

Key facts

Implementation : Ministry of Environmental Protection

Target : End consumers (levy) and supermarkets (ban, reporting)

Approved in 2014

Enforced in 2017

The measures

1. **Prohibition on the distribution or sale of single-use carrier bags less than 20 microns thick**
2. **Mandatory fee on the distribution of other carrier plastic bags**
3. **Mandatory reporting of plastic bags sales by supermarkets**
4. **Mandatory levy for large retailers on the sale of plastic bags**

Feasibility and acceptability

- *Involvement of the stakeholders in the design of the mechanism*
- *Generated revenues feed the management of environmental damages caused by plastic pollution*
- *Public: Awareness campaigns and free handouts of multi-use carrier bags*

Pre-conditions for successful implementation

The implementation of the Plastic Bag Law in Israel highlights several key features of implementation for a mixed ban and levy measure on plastic bags:

- **Involvement of the economic actors affected by the measure**: supermarkets are the main target of the Law and were involved since the very beginning in the process of designing the plastic bag reduction mechanism.
- **Synergies with already existing policies**: the revenues generated by the levy are partly used to increase the funding of the Clean Coast Program, thus supporting more beach cleaning operation and awareness campaigns.
- **Support alternatives to plastic bags**: prior to the enforcement of the law, free multi-use bags were handed over to consumers as a substitute to plastic bags.
- **A particular attention paid to public awareness and acceptance**: since 2005, the Clean Coast Programme runs information campaigns on plastic litter on the marine environment. In 2013, a survey on the social acceptance of different design for plastic bag reduction mechanisms was launched. An information campaign took place in 2014 to explain the impacts of the Law on consumers

Main challenges to implementation

The design of the law does not allow it to fully address the plastic bag issue. Because it solely covers downstream actors (retailers, excl. small retailers from the levy and "non-carrier" plastic bags, consumers), its maximum reduction potential (somewhat 40% of the annual plastic bag consumption) is limited and will soon be reached. The Plastic Bag Law does not contain mechanisms aiming at reducing small retailers plastic bag consumption.

The choice of a levy for part of plastic bags induces the need for close monitoring of its enforcement for retailers. For small retailers scattered across the country, this could be extremely difficult and/or costly to implement. Thus, the choice has been made to target only large retailers (mainly supermarkets) which leaves part of the plastic bag distribution out of scope.

The levy only targets end-consumers behavior. Because the level of the levy for retailers is fixed at a rate equal to the minimum fee paid by consumer on plastic bags, the cost of the measure is entirely passed through to consumers. Thus, there is no economic incentives for large retailers to reduce the distribution of plastic bags. Plastic bag producers and small retailers are not targeted by the law.

Benefits: key figures

- *80% drop in single-use plastic bags distributed by large retailers – potential savings for retailers: 20 million EUR*
- *Revenues from the levy: to 57.5 million EUR/year*
- *Increase in beaches cleanliness (at least 15 points)*
- *Waste management costs reduction between 0,2 to 0,6 million EUR*

Effectiveness of the measures and related benefits

Direct benefits

- Within the first quarter of 2017, large retailers generally reported **reductions in plastic bag consumption ranging from 80% to 90%**, The difference in the number of bags distributed in the last quarter of 2016 and first quarter of 2017 was about 230 million, corresponding to **2.000 tons of plastic waste** (Israel Ministry of Environmental Protection 2017a). The 80% level of reduction has remained consistent during all quarters of 2017. The potential impact on the total number of plastic bags distributed in Israel in 2017 could therefore be a 40% drop.

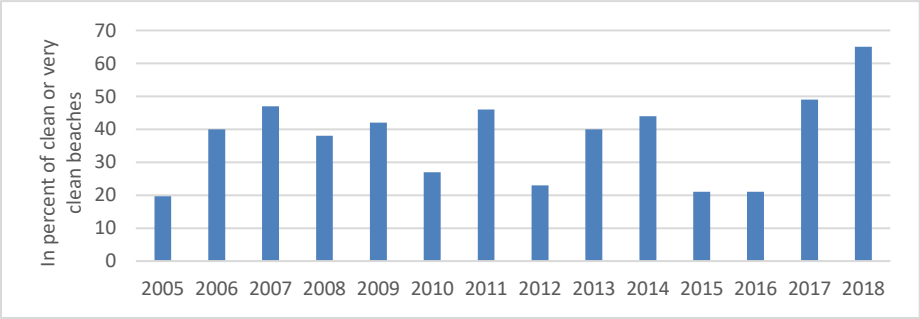
- While the direct impact of the plastic bag reduction on the quantity of plastic ending up on the beaches can be assessed as rather small (since plastic waste is composed not only of plastic bags), the **revenue generated by the levy - 57.5 milion EUR/year** – is used to increase the funding of the Clean Coast Program, thus participating in higher beaches cleanliness.
- This would be a **net benefit for large retailers**. Before 2017, they used to pay a yearly 80 million LCU for plastic bag handouts (i.e. **20 million euros**), which they will now save, aside of their initial obligation to deliver multi-use carrier bags to customers (about 40 million LCU, i.e. 10 million euros).

Direct economic impact

- Another positive impact of the Plastic Bag Law is **that waste management costs are potentially reduced** by the drop in plastic bag consumption. It so far succeeded to decrease the total amount of bag consumed by about a quarter (80% of the large retailers distribution), which constitute somewhat 2.5% of the total weight of waste treated in Israel prior to the Law. Based on national landfilling cost figures collected by the Worldbank, the reduction in waste management cost reduction can be assessed to have reached 0,8 to 2.4 million LCU in 2017 (i.e. 0,2 to 0,6 million €).

Indirect benefits

- **It is not clear to what extent the Plastic Bag Law has impacted the state of Israel's beaches**. However, beaches cleanliness has improved during the period following the Law's introduction. The Ministry of Environmental Protection's Clean Coast Index found that beaches across Israel were cleaner than they have been since the monitoring began in 2005. 65% of beaches were defined as "clean" or "very clean" at least 70% of the time in 2018 (Israel Ministry of Environmental Protection 2019). As Figure 1 shows between 2005 and 2016, the index annual average was ranging between 20 and 47% with high year-to-year variability; and went up to 54.5% in 2017.



The index shows the percentage of beaches considered clean or very clean

Figure 1 Israel Clean Coast Index 2005-2018 (Source : Ministry of Environmental Protection)

- **Beaches cleanliness is an important factor of beaches frequentation** (Krelling, Williams, et Turra 2017; Botero, Cervantes, et Finkl 2017) and thus of local tourism revenues. Tourism is an important sector of the Israeli economy. It contributed directly to 1.9% and indirectly to 6.8% of the country's GDP in 2016 and to 7.2% of the employment. (World Travel and Tourism Council 2017). The sector has been growing in the last years : from 2006 to 2016, about 3 million tourists arrival were registered yearly, they grew to 3.5 and 4.4 million in 2017 and 2018 (Central

Bureau of Statistics 2019a). Since the Blue Flag Program began in Israel in 2013, the number of beaches labelled has increased from 9 to 36 (Ecoocean 2017), showing the interest of beach tourism actors to communicate on beaches environmental quality. In the last years, the country has been trying to diversify its tourism strategy from religious to more leisure and touring oriented activities.(OECD 2018). **The positive impact of reduced litter on beaches is thus an asset to Israel Tourism strategy** increasingly relying on its landscape and leisure sites. According to own estimates, the avoided costs of beach cleaning range between 1 600 and 5 300 EUR/ year

- **The impact on marine wildlife is difficult to assess** in Israel. At the Mediterranean Sea level, 134 species are assessed to be victims of plastics ingestion, including 60 species of fish, all 3 species of sea turtle, 9 species of seabird and 5 species of marine mammal (WWF 2018). Some 344 species are been further found trapped into plastic litter. In Israel coastal waters, high levels of micro plastic are found on marine biota (Vered et al. 2019). Addressing the source of plastic bag litter into the sea thus has a direct impact on wildlife exposure to plastic pollution.

Negative impacts and related costs of the measures.

Direct costs

- **Retail chains have been obliged to fund the distribution of reusable shopping bags** to the public for a limited time period before the enforcement of the Plastic Bag Law. This cost was however entirely covered by the funds saved on the purchase of single-use plastic bags, which were distributed for free to customers before (i.e. 80 million LCUs, that 20 million euros). Large retailers were financially supported by the Ministry for Environmental Protection in the distribution of free multi-use carrier bags, based on defined criteria relating to size, recyclability, durability, and washability of the bag distributed to the consumers.

- **The levy on plastic bags is paid by Israeli households** (a minimal fee of 0.1 local currency unit/bag). Considering the total consumption of carrier bags concerned by the levy under the Plastic Bag Law, it can be approximated that the measure costs about 16 LCUs (i.e. 4 euros) per household per year. This represents about 0.08% of the annual gross average household income or 0.10% of the average annual household expenditures (Central Bureau of Statistics 2019b). The fee retrieved on consumers fully covers the levy paid by supermarkets on the distribution of plastic bags.

Large retailers and the Ministry for environmental protection have been bearing the cost of monitoring plastic bags sales to customers. This additional administrative cost is however not estimated.

Costs: key figures

- *Increased monitoring costs for large retailers and the administration*
- *Levy paid by consumers: 57.5 million EUR/year, corresponding to about 4 EUR/household/year or 0.08% of annual household gross average income – the impact on households can be considered as negligible*

In synthesis…

Overview of costs, benefits and distributional impacts

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	Gains	Costs	Benefits		
Regulators	Monitoring of the fee and ban enforcement Bargaining costs on the design and implementation of the Plastic Bag Law Studies and awareness campaigns prior to the Law implementation	Progress toward policy objectives: protecting the coastline and marine environment from marine litter Revenues for the Clean Coast Programm from the fee on plastic bags: 230 million LCU (i.e. 57.5 millon euros)		Avoided costs of beach cleaning: 1.600 to 5.300euro/year		+
Plastic industry	Bargaining costs on the design and implementation of the Plastic Bag Law	Economic compensation funded by the revenues stemming from the fee	Loss of activity (plastic bag production)			-
Retailers	Bargaining costs on the design and implementation of the Plastic Bag Law <u>Small retailers :</u> Not targeted			<u>Large retailers:</u> Savings linked to the end of single use carrier bags handouts : 80 million LCU/year (i.e. 20 million euros)		0
Consumers	Payment of fee on single use carrier bags (at least 1 LCU/bag ,i.e. 0,25€) : about 230 million LCU/year (i.e. 57.5 million EUR) representing an insignificant share of households annual revenues Behavioral change regarding	Free multi-use carrier bags before Plastic bag law implementation				0

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	Gains	Costs	Benefits		
	the consumption of plastic bags					
Waste management				Savings linked to a reduction in plastic carrier bag waste (potential of a 4% reduction in the weight of waste managed): from 0.2 to 0.6 million euros savings/year 108 to 302€/ton of trash avoided (World bank 2012)		+
Society			Unknown		Saving of resources (mainly hydrocarbons, water and energy needed in the manufacturing process of plastic bags) Reduction of the consumption of plastic carrier bags : potential for reduction of plastic bags in the environment Potential positive effect on provisioning services: Reduced death, illness, intoxication and injury of fish, shellfish and turtles caused by marine plastic bag waste; Potential positive effect on	+

In synthesis…

Overview of costs, benefits and distributional impacts

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	Gains	Costs	Benefits		
					cultural services: aesthetic and recreational services and non-use value increased along the coastline	
Other sector: Tourism					Potential positive impact on beaches cleanliness (important factor of beaches frequentation) through : the reduction of plastic bags consumption AND the higher revenues for cleaning up activities (Clean Coast Program) Potential positive effect on cultural services: aesthetic and recreational services and non-use value increased along the coastline; in a context of a reorientation of Isreal tourism strategy toward landscape and touring tourism	+
Other sector: multi-use carrier bag producers				Higher demand for multi-use carrier bags		+
Overall balance (+/0/-)	**-**		**0**		**+ +**	

In conclusion…

Although it only covers one aspect of the full value chain, the Plastic Bag Law leads to decreasing consumption of plastic bags in Israel, decreasing waste management costs and reduction of damage to the coastal environment. The levy also raises revenues for the Clean Coast program, improving the capacity to address the impacts of marine litter on the environment.

The costs of the measure especially fall on the end-consumer, but this is balanced by the distribution of multi-use carrier bags. The costs induced for large retailers (monitoring) are compensated by the funds saved on the free distribution of plastic bags.

There is still room for improvement with about 60% of plastic bags not being addressed by the Plastic Bag Law. “Non-carrier” bags are not targeted, neither does a large part of carrier bags handed out at small retailers shops.

Want to know more?

Visit the website of the Ministry of Environmental Protection

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Awareness campaign and a voluntary agreement in Greek Islands – Life Debag project

Integrated Information & Awareness Campaign for the Reduction of Plastic bag in the Marine Environment in the Aegean Sea, especially on the Syros island

"These were the first surveys of marine litter in the Aegean and Ionian archipelagos" (Professor George Papatheodorou, leader of the Greek LIFE DEBAG project)

LIFE DEBAG project has a lot of potential for replicability.

The project contributed to the introduction of a fee for single-use plastic bags in Greece.

The context

According to EU data, Greece has an average consumption of 269 plastic bags (of which 242are single-use and 27 multi-use bags) are consumed per person per year (LIFE DEBAG project 2016). It is one of the EU Member States with the highest per capita consumption of single-use plastic carrier bags. The production of the "plastic bag" category products (sacks, bags and cones) in Greece represents 1,374% of the total EU production for 2012 (LIFE DEBAG project 2016). Greece consumes about 0,6 million tons of plastics per year and recycles 20% thereof (WWF 2018). The respective EU-27 average per capita consumption of single-use plastic bags is 175 plastic bags per year. A clean-up survey in 80 beaches in Greece showed that the most abundant litter material was plastic (43–51%), followed by paper (13–18%) and aluminum (7–12%) (Kordella et al. 2013). Top items found on Greek beaches are cigarette butts, bottle caps, straws and stirrers, plastic bottles, food wrappers and plastic bags (UNEP/MAP 2015). Greece has a target of 65% plastic packaging recycling by 2020.

The process

Plastic waste management and recycling are included in Greece National Solid Waste Strategy and National Strategic Solid Waste Prevention Programme. Plastic bags are partly collected by three systems operating in packaging recycling: (1) The Hellenic Recovery Recycling Corporation (HE.R.R.Co.), (2) the Rewarding Recycling (RR) and the individual collection system of the AB Vassilopoulos super market chain, as well as by informal recycling (garbage collectors and temporary storage yards). However, solid waste management needs to be consolidated (LIFE DEBAG project 2016, 1). Plastic bags escaping the three systems or informal recycling often end up in the Mediterranean Sea. For example, the project considers the consumption of 269 plastics bags per capita in Greece as rather underestimated. According to two different methodological approaches, based on 2012 data, plastic bag consumption (thin, very thin, large, bag) would actually range between 475-560 bags per person per year (LIFE DEBAG project 2016, 1).

The important amount of plastics in the Mediterranean Sea, the caveats of the waste collection system and the lack of legislation/initiatives in Greece led to the implementation of the LifeDebag project with the contribution of the European Union's LIFE financial instrument and funds of the Green Fund (Hellenic Ministry of Environment and Energy), with a budget total of 1,26 million euros. The LIFE DEBAG project directly aims to provide supporting activities to help achieve the goals set-out in Directive (EU) 2015/720 as regards reducing the consumption of lightweight plastic carrier bags (LIFE DEBAG project 2017a). The main objective of the LIFE DEBAG project is to « raise public awareness of the prevention and reduction of pollution of plastic bags in the marine environment, with particular emphasis on changing their behavior to reduce their use » (LIFE DEBAG project 2016). The project was coordinated by the Oceanus and supported by several partners.

Implementing the measures

This project was developed in the Aegean Sea with the Cyclades islands and the island of Syros was chosen as the project's pilot area. The Syros island was choose because is the capital of the Cyclades islands and "*a tourism hub, it has an educated population and a very supportive mayor*" (TOMEI-GAYINA 2018). Indeed, the tourist industry is one of the most important economic activities in Greece. In 2016, 24.8 million international tourists came to Greece. Direct gross value added of tourism was 9.6 billion euros in 2016, or 6.4% of GDP. Tourism is also an important source of employment, employing 366,000 people directly, representing 10% of total employment (Veille Info Tourisme 2018).

As part of this project, several measures were identified and evaluated in order to (1) significantly reduce the use of plastic bags and (2) adapt to the Greek island context. The main measure was an awareness and information program, addressing the general public and professionals. This measure was chosen following a study carried out as part of the LifeDebag project aiming at capitalizing on the international experience in order to select the most suitable and effective policy measures to significantly reduce plastic bag use in Greece (LIFE DEBAG project 2016). LifeDebag project organized an awareness and education campaigns with a series of events and activities (concerts, educational lectures and games, exhibition of artworks…) supported by national media campaign (on TV, radio, social media, newspaper…). In addition to all these activities, an awareness campaign was organized each year over 3 weeks with the slogan "Plastic bag free weeks" and a door- to- door awareness campaign where 11,800 cotton reusable bags was distributed to local inhabitants and visitors (TOMEI-GAYINA 2018). Finally, campaign for the replacement of plastic bags was organized, in cooperation with the local compagnies (hotels and room rental facilities). In parallel of this measure, the monitoring of the marine environment in Syros island was conducted for the beach stranded litter and benthic litter. Surveys of supermarket customers was carry out and 15 bi-monthly beach clean-ups was carried out using the Marine Strategy Framework Directive's protocols and the new technologies with drones to monitor litter on remote beaches and underwater cameras for seafloor litter monitoring (TOMEI-GAYINA 2018). One another measure was the implementation of the voluntary agreements with supermarket and retailers.

The LifeDebag project targets also stakeholders on a national level mainly through a series of forum (in total 7 forums were held between 2015 and 2018). These forums attracted more than 50 representatives stakeholders, from plastics producers to supermarkets, and with the support of the Greek Ministry of Environment and Energy. The main objective of the consultation process was to end up with a series of policy measures that can be effectively implemented to significantly reduce plastic bag use in the country.

Pre-conditions for successful implementation

When developing awareness campaign and actions to reduce the use of plastic bags, it is important to involve the all stakeholders. For example, the project's public events and activities are supported by the Municipality of Syros and other local authorities. For the implementation of voluntary agreements, it is important to create a participatory process with the various actors of the sector over a long period of time (several months or years).

Main challenges to implementation

Involve all stakeholders (general public, retailers, supermarket, tourism sector, fishing sector...) and make "the project live" over time so that awareness and actions are sustainable.

Key facts

Implementation : University of Patras, the Ecological Recycling Society, the Mediterranean SOS Network, Terra Nova LTD, and the Institute of Urban Environment & Human Resources of Panteion University

Funding : co-financed by the European Commission's LIFE Program and the Hellenic Ministry of Environment and Energy

Target : end consumers, supermarket/retailers and shop holders of tourism sector

Pilot place : Aegean Sea (Syros and Cyclades Islands)

Project duration : 2015 - 2018

The measures

The main objective of the LIFE DEBAG project is to develop and implement :

1. *an integrated information and awareness-raising campaign and*
2. *voluntary agreements*

The aim is to change consumers' behavior and preserve marine environment.

Feasibility and acceptability

- Involvement of the stakeholders for their expertise and contribution to the effective implementation of the measures
- Examine the roles and interests of political structures in the field of waste management
- Voluntary agreements must be accompanied by another measure, as awareness campaigns

Effectiveness of the measures and related benefits

The most important point – and the most challenging – is the monitoring of the project impact : "*it is the first time that an intensive marine litter awareness and information campaign has been systematically monitored for its impact on the natural environment*" (TOMEI-GAYINA 2018).

- **Direct benefits**

The behavioral change surveys show that the level of awareness of residents of Syros has risen since the start of the campaign in 2015. Indeed, the survey shows a slight decrease in average plastic bag consumption and increase in awareness of the plastic bag environmental problem and more than half of those surveyed are agree with the idea of plastic bag fee (LIFE DEBAG project 2017a, 2). This project gave the example and now there are a lot of plastic bag reduction campaigns taking place all over the Aegean Sea. Nevertheless, it is still difficult to assess the long-term impact of this awareness-raising measure: "there is no doubt that changing people's environmental behavior is the most challenging part of the project" (TOMEI-GAYINA 2018). Improving the coastal water quality and environmental status may presumably also appeal to parts of the island's population that initially never intended to use the area (LIFE DEBAG project 2017b).

- **Direct economic benefits**

The LifeDebag project has contributed significantly to the implementation of EU legislation in Greece and the resulting Joint Ministerial Decree (ΦΕΚ Β' 2812/10.8.2017). Indeed, the project defined with all relevant stakeholders, the policy agreements for single-use plastic bags. Then, they took those recommendations for legislation on lightweight plastic carrier bags to the Greek Parliament's Special Permanent Committee for Environmental Protection. Many of the recommendations, like the levy to the use of disposable plastic bag and the increase in plastic bag recycling, the were incorporated into the law that came into effect at the beginning of 2018. This set an ecotax of €0,04 tax in place for lightweight plastic bags. The tax will rise to €0,07 as of 2019 and kiosks and open air markets are exempted (Surfrider 2018; IUCN 2017). Since the law came in, there has been a 50% reduction in single-use plastic bags across Greece (LIFE DEBAG project 2017b). This reduction in the use of plastic bags will bring to an increase in the production of replacement products (compostable bags, cotton bags, low-density polyethylene bags etc.) (LIFE DEBAG project 2016). The project's proposals, especially on policy measures and implementation of voluntary agreements on several business (hotels, supermarket chains, retailers and open-air markets) were submitted to the different legislative bodies and were presented to the Hellenic Parliament's Environmental Committee. In Syros island, 220 voluntary national agreement were signed with retailers. The advantage of these voluntary agreements is that they can be quickly implemented, and modifications can be made during its implementation.

- **Indirect benefits**

One of economic benefit of the project involves the reduction of cost paid by the Local Authorities for the cleanup of their natural environment from plastic bag waste, as well as reduction of the cost required for the collection, transportation, shorting and final management of this type of waste in waste management facilities and recycling centers. The local economies could benefit by establishing Social Cooperative Enterprises (SCE) producing alternative to the plastic bag's products (e.g. reusable

Benefits: key figures

Contribution to the introduction of a fee for single-use plastic bags in Greece

Project that has served as a model for the development of many other plastic bags reduction campaign on the other islands of the Aegean

70% reduction in plastic bags on the beaches of Syros in the first two years of the project

cotton bags) thus increasing local employment. Finally, shop owners that stop providing plastic bags to their customers could save money by minimizing the cost of the plastic bags they buy and in the same time they could attract a new clientele wishing to be more respectful of the environment (LIFE DEBAG project 2017a).

The project succeeded to reach its set targets and to achieve its main objectives by delivering significant impact to the marine environment of the project's pilot area. There has been a 70% reduction in plastic bags on the beaches of Syros in the first two years of the project, as well as a 33% reduction in plastic bags on the seafloor of Ermoupolis Bay. In the case of Ladopoulos beach, the change is impressive : from 72 471 litter items (mostly fragments) in November 2015 to 2462 litter items in November 2016, stating a 96.6% rate of reduction (LIFE DEBAG project 2017a). This is caused by the intense cleaning effort put by the Ermoupolis municipality, following at the awareness campaign developed by the LifeDebag project. More specifically: 60,000 litter items was collected and recorded on the beaches, 3,100 litter items was detected and classified on the seafloor videos and 550 beach litter items was identified in the aerial drone imagery (Greek LIFE Task Force 2018).

A reduction in plastic bags will improve key ecosystem services and strengthen the competitiveness of the tourism sector and recreational activities which generates important revenues for the local economy (LIFE DEBAG project 2017b). Another benefits it is for the fisheries, which is spread across the island of Syros and is very reliant on seawater quality to maintain fish stocks. Despite its limited contribution (less than 3.1 %) to the GDP, Greek fisheries represent a sector of significant socio-economic importance, particularly in coastal, traditionally fisheries-dependent areas. In 2014, the Greek commercial fishing fleet comprised 15 693 vessels (with 94 % of these relating to the small-scale coastal fisheries segment of less than 12 meters). In terms of employment, 19 396 full-time positions were reported in small-scale fisheries and 4 548 in large-scale fisheries, respectively (European commission 2014). The revenues of recreational fishing are relevant and significant to the residents and population of the island of Syros (LIFE DEBAG project 2017b) : "A*ccording to the satellite data, the total number of recreational fishing vessels was about 24,650 in the 462 ports of the Aegean Sea and 7000 in the 200 ports of the Ionian Sea; this adds up to a total number of around 31,650 recreational fishing vessels in Greek waters* […]" (Keramidas et al. 2018). Thus, measures that stabilize and preserve fish populations could result in increasing the total fishing catch in the long-run and economic benefit.

Negative impacts and related costs of the measures

- **Direct costs**

Costs for the regulators include launching costs, information campaigns, implementation costs and monitoring costs. The total budget was EUR 1,257,545 for 4 years. with EU financial contribution of 754,527 €.

- **Indirect costs**

Indirect economic impact includes the decrease in sales/ production of single use of plastic bag with the new tax in 2018 of €0,04 for lightweight plastic bags and to €0,07 in 2019.

Indirect costs for the plastic industry and retailers relate to their participation in participatory and consultation processes established for the design and implementation of the schemes.

Costs: key figures

Total budget: 1,257,545 € for 4 years

In synthesis…

Overview of costs, benefits and distributional impacts

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	Gains	Costs	Benefits		
Regulators	Launching costs, information campaigns, implementation costs and monitoring costs. The budget total was 1,257,545 € for 4 years	Pioneer study : it is the first time that an intensive marine litter awareness campaign has been systematically monitored for its impact on the environment		*Indirect benefit: Progress toward policy objectives: contribution significantly to the implementation of EU legislation in Greece on single-use plastic bags with a new tax*	Savings linked to less beach cleaning and litter picking. Improve the ecosystem productivity and functioning and improve human health Cleaner public areas might increase recreational and fisheries activities and expenses of tourists linked to it.	+
Plastic industry	Participatory process of consultation for the voluntary agreement over a long period of time. No quantitative information.		*Indirect economic impact: decrease in sales/ production of single use of plastic bag with the new tax in 2018 of €0,04 for lightweight plastic bags and to €0,07 in 2019.*	*Indirect economic impact: possibility to develop replacement products (compostable bags, low-density polyethylene bags…)*	Improved image through participation in national consultations	-
Retailers	Participatory process of consultation for the voluntary agreement and on the design and implementation of the tax over a long period of time. No quantitative information.			Savings linked to largely reduced purchase of plastic and bags and linked storage costs and attract a new clientele wishing to be “more respectful” of the environment	Improved image through participation in the pilot test	+
Consumers	Payment of fee on single use carrier bags (0.04 €/bag in 2018 and 0.07 €/bag in 2019) representing an insignificant share of households annual revenues		Used and pay for replacement products (compostable bags, cotton bags…)		Feeling of doing something “good” for the environment.	0

Waste management				Savings for waste management due to less waste to be managed (e.g 70% reduction in plastic bags on the beaches of Syros).		+
Society			Unknown		Saving of resources (mainly hydrocarbons, water and energy needed in the manufacturing process of plastic bags) Improving the coastal water quality can can attract new population wishing to settle on the coastal Provisioning services: decreased ingestion of marine plastic bag waste by animals; Cultural services: aesthetic and recreational services through cleaner public spaces	+
Other sector: Fisheries				Saves time in cleaning/repairing nets and preserve fishing stock	Additional earnings in the fishing sector due to improved health and biodiversity of marine species Potential positive effect on provisioning services: reduced death, illness, intoxication and injury of fish, shellfish and turtles caused by marine plastic bag waste	+

Other sector: Tourism					Increase in revenues in the recreation and tourism sector due to cleaner beaches Potential positive effect on cultural services: aesthetic and recreational services and non-use value increased along the coastline; in a context of a tourism development strategy in Greece	+
Overall balance (+/0/-)	-		+		+	

In conclusion…

Through the implementation of LIFE DEBAG's, important actions improve the social well-being along with the creation of more jobs and economic progress, while reducing serious environmental risks.

The project managed to affect national legislation on single-use plastic bags and the LifeDebag project has a lot of potential for replicability. Already several areas and islands (i.e., Kea, Sifnos, Astypalaia, Mykonos, Litochoro, Vari-Voula-Vouliagmeni, area around Korinthiakos Gulf, Patras) in Greece have expressed interest in implementing the project's tools and methodology in their area. University of Patras has developed and signed a memorandum of understanding with: (1) "Association of Kea's Isl. friends" (Σύλλογος Φίλων Κέας) and (2) Municipality of Vari-Voula-Vouliagmeni for the replication of LIFE DEBAG (LIFE DEBAG project 2017).

The next step is to try to build an association or a network, combine the project activities with others initiatives in the Greek and Mediterranean area . (TOMEI-GAYINA 2018) .

Want to know more ?

Visit the project website :
http://www.LifeDebag.eu/

And contact the professor George Papatheodorou, leader of the Greek LifeDebag project :

george.papatheodorou@upatras.gr

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Adopt a beach

Adopt-a-beach schemes link beach clean-up and marine litter monitoring under local communities engagement

Why this measure?

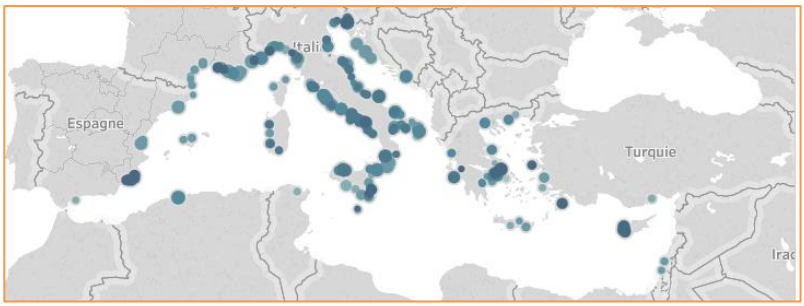
Mediterranean beaches are particularly impacted by marine litter. A study conducted by MIO-ESCDE on 23 sites in five EU countries finds average litter densities ranging from 0.04–6.66 items/m². At least two thirds of this litter is made of artificial polymer. The top 5 items recorded includes plastic pieces, cigarette butts and filters, plastic caps/lids from drinks, cotton bud sticks, polystyrene pieces and straws and stirrers (Vlachogianni 2019). Litter from shoreline sources, such as tourism and recreational activities and poor waste management practices account for 38% of all litter collected. These results are consistent with other studies conducted on Mediterranean beaches. In this context, **Contracting Parties to the Barcelona Convention set the reduction goal of 20% on beach marine litter by 2024.**

Tourism is an important activity for most Mediterranean countries, offering consistent employment (11.5% of total employment in 2014) and economic growth (11.3% of regional GDP). Taking into account exclusively coastal areas, tourism represents over 70% of Production Value and Gross Value Added (Plan bleu pour la Méditerranée 2017). **Beaches are an important asset of Mediterranean coastal areas and their cleanliness is an important factor of beaches frequentation** (Krelling, Williams, and Turra 2017). Keeping beaches clean is thus a major issue for coastal areas depending on tourism. **Tourism is also a major contributor to beaches litter pollution** : as a study from the University of Barcelona shows, litter left behind by tourists on Mediterranean beaches can triple in summer (ICTA-UAB 2018)

The measure in the Mediterranean and beyond

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. Furthermore (Vlachogianni 2019) find 8 recent assessment studies of marine litter on Mediterranean beaches, covering some 11 countries. However, there is no consistent follow-up of adopt-a-beach initiatives overall at Mediterranean level. One pilot project is currently being implemented in Montenegro under the UNEP/MAP in collaboration with local partners.

Figure 1 Map of Marine Litter Watch communities events 2013 -2018 (source: Marine litter Watch)



Implementing the measures

Adopt-a-Beach is a concept when **a school, or local community, or an NGO, or a group of volunteers "adopt" (not in a legal sense) a beach and takes care of that beach by regular cleanup events**. In a way, they are "guardians" of that beach. This will also contribute to 'citizen science'. The "Adopt-a-Beach" measures comprise of actions related to beach cleaning/ disposal and marine litter surveying programmes with an overall scope to help Mediterranean people to care about their coastline and clean it; to raise public awareness on the threat posed by marine litter; as well as to support the national marine litter monitoring programmes.

According to UNEP Regional Plan on Marine Litter Management in the Mediterranean "Adopt-a-Beach" measures aim to:

- Keep beaches clean and marine litter-free in the Mediterranean;
- Raise public awareness on the problem of marine litter;
- Educate citizens about the sources of marine litter and how they are generated;
- Enhance public support at country level, for national and international action to clean up coastal environments; and
- Collect valuable data and information to assess the quantities and stranding fluxes of beach marine litter in the Mediterranean and to help achieve the reduction goal of 20% on beach marine litter by 2024 agreed by the Mediterranean countries Contracting Parties to the Barcelona Convention by COP19

(UNEP/MAP 2018)

As such, Adopt-a-beach schemes appear as a mixing of beach clean-up and marine litter monitoring programs; operated in a decentralized manner by local groups of citizens.

Pre-conditions for successful implementation

- **Facilitate communities' engagement**: as adopt-a-beach initiatives rely principally on local communities for cleanup operations and litter monitoring, the implementation of a common framework describing how to engage is a key factor of success. In this respect, the implementation of a web platform allowing to easily uploading data gathered during cleaning operations and Overall, the regulator must implement a robust institutional framework which allows decreasing the costs of engagement for local communities, especially because they often perform clean-up operations for free.
- **Appointment of beach coordinators**: beach coordinators allow linking the regulator framework (data collection, awareness campaign, communication material) and the local communities. They also coordinate the organization of cleaning events and the communication around them;
- **Insure media coverage**: as change in perception of local communities toward marine litter is an expected output of adopt-a-beach initiative, events and their results must be mainstreamed through the media. Similarly awareness raising campaign can be conducted during along adopt-a-beach projects.

Key facts

- *since 2013: 312 cleanup events registered under MLW*
- *monitoring of marine litter pollution is a growing field of study, especially in the EU*

The measure

- *Engagement of local communities in marine litter cleanup and data monitoring events*
- *Expected outcomes: positive impact on beaches frequentation, awareness raising of local communities, data collection on marine litter*

Feasibility and acceptability

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.

Effectiveness of the measure and related benefits

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 (Vlachogianni et al, 2017; Vlachogianni, 2019). On this basis, it can be 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. The total length of Mediterranean beaches is 24235 km (Wolff et al, 2018; CIA data[1]). Thus, it is estimated that, if the measure were applied in the Mediterranean basin as a whole, it would have a **potential of removing around 56 800 tonnes/year of plastic stranded on beaches** (own estimation).

Direct economic impacts

- The presence of marine litter on beaches is expected to reduce tourism arrivals. It is assumed that the current value of **tourism receipts** (based on WTO data)[2] is 3% less than what it would be in the absence of beach litter[3]. On this basis, it is estimated that the reduction of marine litter following clean-up actions at the Mediterranean level would correspond to an avoided impact on the tourism sector of 1 574 million EUR/year.
- As clean-up measures, adopt a beach scheme are also valuable for their **contribution to the awareness of local communities** toward marine litter issues (Belin et al. 2017). Another important achievement of adopt-a-beach schemes is the monitoring of marine litter on beaches. They allow to feed databases such as Marine Litter Watch to closely follow the current state of marine litter pollution in the Mediterranean.

Indirect benefits

- Cleaning up of beaches through voluntary actions will correspond to savings for regulators, who will thus be able to **save on beach cleaning operations**. Van Acoleyen et al. (2014) estimate the average cost of litter removal at 8170 EUR per km per year. If the measure were applied to the whole length of the Mediterranean coastline, and based on the expected effectiveness of the measure, it was estimated that total cost savings for beach cleaning amount to about 42 million EUR/year (own estimations based on Van Acoleyen et al., 2014[4]).

- This study estimated the increased recreational value of coastal environment consequent to marine litter reduction (based on Brower et al, 2017 – see final report for full methodology). According to these estimates, based on the expected marine litter reduction of 56 800 tonnes per year, the **increased recreational value of Mediterranean coasts** would amount to 51 million EUR/year.
- This study estimated the total value of improved ecosystem services following the implementation of the measure at the Mediterranean level, based on the expected marine litter reduction and on the economic costs of marine plastics as related to the natural capital estimated by Beaumont et al (2019 – see final report for full methodology). The **improvement in marine ecosystem services** following the introduction of Adopt a Beach schemes at the MED level would amount to 928 million EUR/year.

- Reduced littering leads also to benefits for the **fishing sector**, in terms of avoided costs of removing litter from fishing gear, avoided costs of reduced catch revenue, avoided costs of broken gear and fouled propellers as well as avoided costs of rescue services. According to

Benefits: key figures

- *Potential effectiveness at the MED level: removal of 56 800 tonnes of stranded plastic/year*
- *Avoided impact on the tourism sector: 1 574 million EUR/year*
- *Avoided costs of beach cleaning: 42 million EUR/year*

[1] https://www.cia.gov/library/publications/resources/the-world-factbook/fields/282.html
[2] WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - please refer to the final report of this study for more detail on the estimation method
[3] Calculations based on UNEP, 2017, and WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - Please refer to the final report of the study for more detail on the methodology
[4] For the full methodology, please refer to the final report of the study

own estimations (based on Van Acoleyen et al. 2014), total benefits in this regard for the Mediterranean Sea would amount to 3 million EUR per year.

Negative impacts and related costs of the measures

Direct costs

These administration costs fall principally on two actors:

- **Regulators** which implements the monitoring framework which allows communities to report and mainstream the results of their cleanup. This includes administration costs related to the follow-up of the initiative.
- **Local communities engaged in beach cleanups**: i.e. public and non-public organizations, and citizens. Adopt-a-beach community organizers face administration costs related to the organizations of beach cleanup events, the collection and reporting of data regarding marine litter and the mainstreaming activities (media coverage, awareness campaigns).
- **Costs of waste collection** at the beach gate and waste management must also be considered. The additional costs to collect and process the extra plastic waste generated by clean-up operations are approximated by the minimal and maximal cost of landfilling 1 tonne of waste generated; the indicator is built on World bank data[5] on waste generation and management, based the income level of the country. Based on the estimated plastic return rate at the Mediterranean level, these additional costs were estimated at 7 million EUR/year (average value).

Indirect negative impacts

No indirect negative impacts are foreseen.

Organizations involved in combating marine litter warn that clean-up measures can be important to locally and temporarily address marine litter on vulnerable areas for tourism and wildlife, but that their long term capacity to tackle marine litter is fairly limited. Adopt-a-beach initiatives should not distract funding from other important measures that directly address plastic flowing into the seas. The example of the pilot project currently implemented in Montenegro shows that adopt-a-beach initiatives should go hand-in-hand with other instruments. In this case, the development of a Management Plan for the collection and recycling of plastic PET packaging including a deposit –refund system is discussed.

Costs: key figures

- *Some costs for the regulators involved in administering the schemes*
- *Some additional costs for waste collection, estimated at 7 million EUR*

[5] https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-334852610766/What_a_Waste2012_Final.pdf

In synthesis…

Overview of costs, benefits and distributional impacts

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits linked to environmental improvement	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
Regulators	Administration costs: implementation of the adopt-a-beach framework, data monitoring, results mainstreaming				Cleaning up of beaches through voluntary actions will correspond to savings for regulators, who will thus be able to **save** on beach cleaning operations - total cost savings for beach cleaning are estimated at around 42 million EUR (average value)	+ +
Waste collection and management	Additional costs of waste management: 7 million EUR/year (based on World Bank estimate of the costs of handling one tonne of waste, by country)					-
Local communities adopting a beach	Administration costs related to the organization of beach cleanup events					0/-
Society				Contribution to the awareness of local communitieqss	Improvement in marine ecosystem services following the introduction of Adopt a Beach schemes at the MED level would amount to 928 million EUR/year. Increased public awareness toward marine litter issues Provisioning services: Reduced death, illness, intoxication and injury of fish, shellfish and turtles caused by marine plastic bag waste; Cultural services: aesthetic and recreational services and non-use value increased	+ + +

In synthesis…

Overview of costs, benefits and distributional impacts

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits linked to environme improvem	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
Fishing sector					Less damages to fishing vessels and materials, prevent reduction of catches by marine litter: 3 million EUR/year Provisioning services: Reduced death, illness, intoxication and injury of fish, shellfish and turtles caused by marine plastic bag waste;	+
Tourism				It is estimated that the reduction of marine litter following clean-up actions at the Mediterranean level would correspond to an avoided impact on the tourism sector of 1 574 million EUR/year	The increased recreational value of coastal environment consequent to marine litter reduction is estimated at around 51 million EUR/year. Potential positive impact on the frequentation of sites impacted by marine litter (coastline) E.g. up to 75 million euros annual value of Greek beaches Cultural services: aesthetic and recreational services and non-use value increased	+ + +
Overall balance (+/0/-)	-		+ + +		+ + + +	

*Marine Litter Watch

In conclusion...

Advantages and challenges to implementation

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.

Want to know more?

Consult the UNEP/MAP regional action plan for Marine litter and its guidelines for adopt-a-beach initiatives

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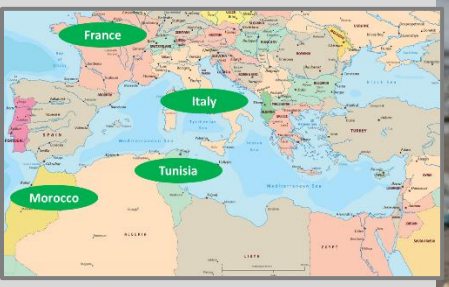

BAN ON SINGLE USE PLASTIC BAGS

In some cases, the ban on single-use plastic bags include all types of SUPBs, in other cases biodegradable SUPBs are allowed as an alternative to non-biodegradable plastic SUPBs

Why this measure?

Due to the undesirable effects associated with the widespread use of single-use plastic bags (SUPBs), efforts to reduce the consumption of single use of plastic bags have taken various forms worldwide in the last two decades. Studies have shown that consumer education alone does not achieve significant reductions in SUPBs consumption: on average, awareness campaigns managed to achieve a 5% decrease only (Equinox Center 2013).

At the EU level, the environmental challenges posed by SUPBs consumption were first broadly addressed as part of the Packaging and Packaging Waste Directive (Directive 94/62/EC). The Directive was eventually amended, with the adoption of Directive 2015/720, to address the specific challenges posed by the use of light-weight plastic bags. It requires Member States to adopt measures to reduce the consumption of non -biodegradable plastic carrier bags with a thickness below 50 microns, as these are less frequently reused than thicker ones, and often end up as litter. The 2015 Directive requires that: (i) annual consumption level does not exceed 90 lightweight plastic carrier bags per person by 31 December 2019 and 40 lightweight plastic carrier bags per person by 31 December 2025; (ii) MS adopt instruments to ensure that, by 31st December 2018, lightweight plastic carrier bags are not provided free of charge – very lightweight plastic carrier bags may be excluded from those measures.

Action has already been taken in a number of countries in the North and South of Mediterranean, including the total ban of certain types of plastics or certain applications of single-use plastics.

In Mediterranean, the ban is in place in Italy, Morocco, France and Tunisia

The measure in the Mediterranean and beyond

More and more countries, regions and cities have introduced a ban on plastic bags (e.g. in Switzerland, China, South Africa, Kenya, Rwanda, Congo, Washington DC and San Francisco in the United States, several states of Australia and India) (European Commission 2013) or have considered its introduction - this number is still rising. In 2002, Bangladesh became the first country to ban plastic bags, after they were found to have choked drainage systems during devastating floods.

In the Mediterranean, several countries banned the single use of plastic bag. All types of lightweight plastic bags are banned in Morocco (the world's second largest plastic bag consumer after the USA) since 2016; all types of SUPBs, with the exception of the ones made out of biodegradable plastics, are banned in Italy (since 2011) and Tunisia (since 2016). Beyond the Mediterranean area, in Romania the introduction on the market of carrier lightweight and very lightweight plastic bags (under 50 microns) is prohibited.

Implementing the measures

Bans can target all SUPBs, certain types of SUPBs, all uses or certain applications only or the use of single-use plastic bags in certain conditions. Several countries have already passed laws banning single use of plastic bag under certain conditions and under different criteria (e.g. source of material, width, purpose, etc.) (UNEP/MAP 2018). The design of the ban must take into account the ban's effectiveness in reducing plastic bag use, consumer behavior once the ordinance is enforced, the ordinance's ability to limit overall environmental damage associated with single use bags, and the negative economic impact bans might have on affected consumers and retailers" (Equinox Center 2013).

The different actors concerned by the prohibition are: manufacturers, importers of raw materials and equipment, resellers (especially in the countries in the south of Mediterranean), end-consumers and public authorities.

Pre-conditions for successful implementation

A progressive introduction of the ban is recommended, to allow sufficient time for manufacturers and retailers to adapt their processing and commercialization. In Los Angeles Country (US), for example, the legislation banning SUPBs was approved in 2010; the first phase entered into force in 2011, targeting only large retailers and supermarkets, whereas the second phase became effective in 2012 targeting the remaining smaller food stores (UNEP/MAP 2018). In France, the ban on single-use plastic bags has been applied to all businesses since July 2016 and the law provides for a proportion of bio-sourced bags of 30% in 2017, 40% in 2018, 50% in 2020 and 60% in France. % in 2025.

To avoid significant economic impacts, it is also recommended that the State supports companies in converting production by means of technical and financial support – for example setting up a specific fund for it. Small and medium-size enterprises whose main activity is the production of SUPBs would particularly benefit from this support. For example, the government of Morocco set up a fund of 18.5 million euros to finance end support restructuring; very small businesses producing SUPBs can have a grant of up to 185 000 euros, whereas larger SMEs can have a conversion assistance reaching 923 000 euros maximum (HuffPost Maroc 2016; UNEP/MAP 2018).

In addition, the introduction of a ban should be accompanied by awareness-raising campaigns, to prevent strong opposition from citizens and manufacturers. These campaigns should focus not only on the negative impacts of single use of plastic bag, but they should also promote available alternatives (UNEP/MAP 2018). In Italy, for example, the introduction of a consumer charge on light and ultra-light compostable bags for food packaging in 2018 – not coupled with an awareness campaign – provoked quite some mediatic opposition, as groups of citizens perceived the ban as an unfair and abusive norm (Markonet, 2018).

It is important not only to raise awareness on the negative impacts of single use of plastic bag but also to inform and promote available alternatives. The latter is especially important in the case of bans (UNEP/MAP 2018).

Key facts

The actors concerned by the prohibition are manufacturers, importers of raw materials and equipment, resellers (especially in the countries in the south of Mediterranean), end-consumers and public authorities

The measure

Bans can target different types of SUPBs – for example, bans can target lightweight carrier bags, but might exclude very lightweight carrier bags used for food products. Similarly, some types of uses might be excluded from the ban.

Indeed, when it comes to banning the production and consumption of SUPBs, a key aspect to bear in mind is the type of alternatives being put forward. A wise approach, taken by many countries is to allow reusable bags, regardless of the material, or to allow SUPBs for specific uses (e.g. agriculture, industry, etc.). Another approach is to allow compostable bags – as for example in Italy – but this would only make sense when bio-waste is collected and treated separately. In France, as an alternative solution, plastic bags with a thickness of 50µm or greater, paper bags, compostable and bio-sourced plastic bags are allowed.

The ban could be combined with a levy to avoid overconsumption of some alternatives (e.g. paper bags). In Morocco, for example, one year after implementing the ban production of substitute products increased significantly: the annual production is estimated at 8 billion paper bags, 1 billion woven bags, 1,8 billion million nonwoven bags, 1.500 tons of thermoforming products and 60 million of non-woven laminated bags (UNEP/MAP 2018).

In terms of enforcement, it is necessary to adopt inter-institutional arrangements for the control and surveillance of ban implementation. (UNEP/MAP 2018). In Morocco, for example, in the first two years the government earned 450 000 EUR from fines, collected by the control and penalty system established to enforce the ban.

On a technical level, clear specification must be made on minimum thickness or grammage of plastic bags, and inspection authorities have the means for verification. For that, clear norms and compulsory labelling are of great support.

Main challenges to implementation

In some Mediterranean countries, the informal sector is still large, and it could even grow as a result of the ban implementation. In this case, informal small retailers may have a competitive advantage as compared to legal small retailers, like it happened in Morocco.

Feasibility and acceptability

- *Awareness campaigns accompanying the ban are recommended, as both retailers and consumers could perceive a ban as excessive and disproportional, especially in light of the experiences in Member States having taken less stringent measures*
- *Supporting measures for plastic and SUPBs manufacturers are recommended, especially for SMEs*

Effectiveness of the measure and related benefits

The estimate of the potential effectiveness of the measure – assuming it is implemented in all Mediterranean countries – can only be based on existing effectiveness data from countries where the measure is in place; unfortunately, in this case only data on the ban in Italy were available. In Italy, after the ban SUPBs consumption decreased by 42 500 Tonnes/year, around 50% of previous SUPB consumption. However, this data refer to consumption, while what we also want to know the corresponding reduction of incremental plastic marine litter per year. From the EC study (2013) we know that non-biodegradable SUPBs used in the EU are 85.3 billion per year, and that 8% of those are littered. The average consumption of non-biodegradable SUPBs in the EU is 171 bags/person; non-biodegradable bags weigh 8.6 grams each. All these data allowed for calculating the expected potential reduction of plastic marine litter, corresponding to 27 700 tonnes/year.

- **Direct benefits**

No significant direct benefits are expected following the implementation of the ban.

- **Direct positive economic impacts**

Both the **plastic industry and retailers** benefit from increased sales of bin liners and reusable bags. Retailers benefit in addition from savings linked to largely reduced purchase of single-use plastic bags as well as linked to smaller storage costs (Plan Bleu, 2017). In turn, retailers would no longer incur any costs in providing bags to their customers, while charging for multiple use plastic bags, at least at cost-recovery prices. In the EU, this would translate into net savings nearing € 890 million per year between 2015 and 2020 (European Commission 2013).

In case plastic manufacturers are able to convert to the production of multiple use carrier bags, in the medium term they could obtain net benefits and quickly offset initial investments, as for example in Tunisia in the industries of paper bag and bio-sourced products (Ministère des Affaires Locales et de l'Environnement 2018). In EU, producers of multiple use plastic bags, paper bags and bin liners would experience a considerable rise in their profits (€ 156 million in 2015) (European Commission 2013). In municipalities in California, plastic bag bans increased reusable bag usage by 40% (UNEP/MAP 2018).

The plastic industry, provided that it can convert to the production of alternative bags, would then save some money as for this type of production less energy is required, and less solid waste is generated.

Overall, according to EC (2013), in the EU28 the combined savings and profits by public authorities, manufacturers and retailers amount to € 792 million per year, on average, between 2015 and 2020. However, it is not possible to transfer the results at the EU level to the Mediterranean basin – in fact, the 28 member states include a range of country with mostly high income, with a small or almost non-existent informal sector and with a well developed plastic industry, which is not the case for some MED countries.

The public **waste management sector** (including landfills) saves money as a significant part of the plastic bag-related waste would disappear. The **avoided costs of collecting and processing the plastic waste** not used as a consequence of the tax are approximated by the minimal and maximal cost of landfilling 1 tonne of waste generated; the indicator is built on

Benefits: key figures

One important benefit of the ban of plastic bags is the important reduction of plastic bag in marine environment

"No sustained negative impact to retailers." (UNEP/MAP 2018)

Plastics manufacturers can be negatively impacted but in the medium term, producers of multiple-use carrier bags could obtain net benefits

World bank data[1] on waste generation and management, based the income level of the country. Based on the estimated decrease in yearly SUPBs use at the Mediterranean level, these additional costs were estimated at 41 million EUR/year (average value).

The presence of marine litter on beaches is expected to reduce tourism arrivals. It is assumed that the current value of tourism receipts (based on WTO data)2 is 3% less than what it would be in the absence of beach litter3. On this basis, it is estimated that the reduction of marine litter following clean-up actions at the Mediterranean level would correspond to an **avoided impact on the tourism sector** of 768 million EUR/year.

In terms of **societal benefits**, jobs are created in the manufacturing of reusable bags and bin liners and in the administration of the tax (Plan Bleu, 2017).

- **Indirect benefits from environmental improvement**

- Cleaning up of beaches through voluntary actions will correspond to savings for regulators, who will thus be able to **save on beach cleaning operations**. Van Acoleyen et al. (2014) estimate the average cost of litter removal at 8170 EUR per km per year. If the measure were applied to the whole length of the Mediterranean coastline, and based on the expected effectiveness of the measure, it was estimated that total cost savings for beach cleaning amount to about 21 million EUR/year (own estimations based on Van Acoleyen et al., 20144).
- This study estimated **the increased recreational value of coastal environment** consequent to marine litter reduction (based on Brower et al, 2017 – see final report for full methodology). According to these estimates, based on the expected marine litter reduction of 27 700 tonnes per year, the increased recreational value of Mediterranean coasts would amount to 25 million EUR/year.
- This study estimated the **total value of improved ecosystem** services following the implementation of the measure at the Mediterranean level, based on the expected marine litter reduction and on the economic costs of marine plastics as related to the natural capital estimated by Beaumont et al (2019 – see final report for full methodology). The improvement in marine ecosystem services following the introduction of a tax on SUPBs at the MED level would amount to 453 million EUR/year. provisioning services (fish, shellfish, turtles) are supposed to increase due to decreased ingestion of marine plastic bag waste by animals. A positive effect can also be expected for cultural services: aesthetic and recreational services and non-use value (Plan Bleu, 2017).
- Reduced littering leads also to benefits for the **fishing sector**, in terms of **avoided costs** of removing litter from fishing gear, avoided costs of reduced catch revenue, avoided costs of broken gear and fouled propellers as well as avoided costs of rescue services. According to own estimations (based on Van Acoleyen et al. 2014), total benefits in this regard for the Mediterranean Sea would amount to 1 million EUR per year.

[1] https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-334852610766/What_a_Waste2012_Final.pdf

[2] WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - please refer to the final report of this study for more detail on the estimation method

[3] Calculations based on UNEP, 2017, and WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - Please refer to the final report of the study for more detail on the methodology

[4] For the full methodology, please refer to the final report of the study

Negative impacts and related costs of the measures

- **Direct costs**

- Regulators: costs for enforcement and compliance checking, costs for accompanying awareness-raising campaigns;
- Retailers: compliance costs are possible
- Consumers: For consumers, UNEP/MAP (2018) estimates a cost per household of EUR 6.9 during the first year for the purchase of reusable bags, which would mean 1 Billion EUR in total, considering all MED countries[5] – 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;
- Waste management sector: some compliance costs might occur, linked to the management of alternative carrier nags such as bioplastic bags;

- **Direct negative economic impacts**

The most important negative effects of the ban concern plastic bag **manufacturers and importers**, as the decrease in the use of plastic bags significantly reduces their revenues, and might also lead to employment losses in the plastic bag manufacturing and importing industry. Regulators might set up a fund to support the plastic bag producers to change their production line and to produce either reusable bags or for example bin liners. As illustrated in the main report of this study, the impact on the plastic industry depends not only on the expected lost production/revenues, but also on the capacity of firms to reconvert and innovate: many variables are involved, and estimating this impact was out of the scope of this study.

Costs: key figures

- *Enforcement and compliance checking costs for regulators*
- *Negative impact on the plastic industry is possible, but it depends on many factors, including ability to convert to other types of bags*

[5] 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

In synthesis…

Overview of costs, benefits and distributional impacts

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	Gains	Costs	Benefits		
Regulators	Administrative charge in terms of enforcement and compliance checks Cost for other accompanying measures like a public awareness campaign				Avoided costs for beach cleaning: 21 million EUR/year	+
Plastic industry			Decrease in production and sales of single-use plastic bags.	In the medium-term producers which converted to the production of multiple-use carrier bags could obtain net benefits and quickly offset initial investments Increased sales (and thus production) of bin liners and reusable bags Available information mostly allows for some qualitative appreciation of the direct benefits.		?
Retailers	Compliance costs			Savings linked to largely reduced purchase of plastic bags and linked storage costs		0/-
Consumers	Cost per household of EUR 6.9 during the first year for the purchase of reusable bags, which would mean 1 Billion EUR in total, considering all MED countries			The costs should decrease due to long lifespan of reusable bags and the consumption of single use of plastic bag decrease.		0/-
Waste management	Compliance costs for the management of alternative bags, like bioplactic bag		Investments in new recycling facilities	Savings for waste management due to less waste to be managed: 41 million EUR/year		+ +
Society				Employment gains for the production of alternatives	Improvement in marine ecosystem services: 453 million EUR/year (Provisioning services: decreased ingestion of marine plastic bag waste by animals; Cultural services: aesthetic and recreational services) Saving of resources: reduced use of resources embedded in the production of single-use plastic carrier bags, and	+ + +

Overview of costs, benefits and distributional impacts (cont'd)

					corresponding greenhouse gas emissions Increased public awareness toward marine litter issues	
Other sector: fishery					Avoided costs for the fishing sector: 1 million EUR per year. Additional earnings in the fishing sector due to improved health and biodiversity of marine species	+
Other sector: tourism				Avoided impact on the tourism sector: 768 million EUR/year	increased recreational value of Mediterranean coasts would amount to 25 million EUR/year	+ + +
Overall balance (+/0/-)	-		0		+	+

Advantages and challenges to implementation

The ban is obviously the most effective measure to reduce consumption of SUPBs and, consequently, marine litter.

To avoid or mitigate impacts on the plastic industry, the following is recommended:

- Progressive implementation of the measure, to allow sufficient time for converting to other types of production – e.g. alternative bags;
- Setting up of a supporting public fund, especially for SMEs.

The existence of a large informal sector in a country is likely to reduce its effectiveness, even substantially (depending on the extent of the informal sector).

Want to know more?

Check the Study of the European Commission (2013)

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Deposit-refund systems for single-use beverage packaging

In short

Deposits are charged for beverage packages which consumers get back when they return empty packages to the retailer.

"Deposit-return systems (DRS) are a proven tool to collect high quantities of empty beverage containers for reuse and high-quality recycling, and are vital to achieving a circular economy" (CM Consulting and Reloop 2016).

Why this measure?

Studies show that over 80% of ocean plastics derive from land-based sources. Hereof, close to 40% are beverage container (bottles/cans) or beverage container related (caps/straws) items (Morgenstern 2017). It is in particular in the Mediterranean (and Black) Sea that beverage containers tend to be among the most common marine litter items found (Van Acoleyen et al. 2014).

Deposit-refund systems (DRS) put value on waste and provide economic incentives to consumers to return beverage packages to retailers. Deposit-refund schemes are basically a combination of two instruments: a tax on the purchase of a certain product, and a refund (the subsidy), upon returning the used can or bottle to a designated collection point, for not polluting the environment. As such, consumers carefully returning single-use cans or bottles will not pay anything extra.

In other words, consumers have an incentive to not pollute. This is called a pull incentive as the consumer is encouraged to show good behaviour. Because paying for subsidies may become very expensive for the policy makers and can have some negative distributional effects, the refund offer is linked to a deposit (a tax) that must be paid up front. This tax also serves as an incentive to not pollute. This is called a push incentive as the consumer is encouraged to not have bad behaviour. Upon buying a good, susceptible to DRS, the consumer must pay an extra deposit on top of the normal price. If a consumer decides to dispose of the good in a polluting way, he/she will not acquire a refund. The already paid deposit is at that moment a tax on the consumer for polluting, following the polluter-pays principle. Most DRS are government-initiated, although there are examples of market-initiated DRS.

DRS are a proven tool to collect high quantities of empty beverage containers for reuse and high-quality recycling (CM Consulting and Reloop 2016). A study made by Van Acoleyen et al. (2014) for the EU territory estimates that the total number of beach litter items would be reduced by about 12% for the Mediterranean Sea coast in case of implementing a DRS for single-use beverage packaging in all Mediterranean EU countries.

The measure in the Mediterranean and beyond

Among Mediterranean countries, deposit-refund systems are in place in Israel (since 2001) and Croatia (since 2005). In both countries, the beverage packaging system model includes plastic (in particular PET), metal (in particular aluminum), and glass. A deposit refund system is planned to be introduced in Malta by December 2019 (Maltese Ministry of Environment, 2018). The scheme will apply to metal cans, plastic and glass bottles.

Furthermore, pilot applications have been conducted in Catalonia, Spain: in the city of Cadaqués, and in the University of Barcelona.

In the EU, in addition to Croatia, a mandatory deposit-refund system for PET and other single-use beverage packaging is in operation in another seven countries (Drab and Slučiaková 2018), which are home to over 130 million people (CM Consulting and Reloop 2016). DRS are furthermore in place in parts of the US, Canada and Australia.

The establishment of mandatory deposit, return and restoration systems for beverage packaging forms part of the measures for preventing marine litter which have been identified by the United Nations Regional Plan for the Marine Litter Management in the Mediterranean (UNEP/MAP, 2013; Article 9).

Implementing the measures

Most deposit-refund systems include PET, cans and glass, some schemes involve reusable packaging. Systems differ from each other for example regarding the type of beverages which are concerned. Most countries exclude packaging with milk and fruit juices, due to hygienic reasons. Very small (less than 0.1 litres) and very big (over 3 litres) beverage packaging are usually excluded as well. Deposit amounts in Europe vary from EUR 0.07 in Croatia to EUR 0.40 for certain beverages in Finland (Drab and Slučiaková 2018).

Existing systems are not always directly mandatory for producers. In some cases, environmental taxes are used to indirectly motivate producers to include their packaging into the deposit-refund system. In Finland, for example, producers are obliged to pay an environmental tax of EUR 0.51/litre unless they are involved in the system (Drab and Slučiaková 2018).

Implementing a DRS affects several stakeholders: individual consumers (which pay the deposit and are asked to return packaging to the retailer), retailers, producers of beverages and beverage packaging, and entities/companies in charge of recycling the collected material. There is also a social effect of the measure, as evidence shows that non-deposited bottles are picked up to recover the deposit.

All deposit-refund systems have a so-called "**central system**". It is an organisation coordinating the activities of individual actors. Its powers differ depending on the country. In the Scandinavian countries, for example, it is also the accounting unit, in Germany it does not balance the deposits and has no records of actually returned bottles (Drab and Slučiaková 2018).

The retail has a central role in the DRS. Individual schemes pay to the retail a **handling fee**, which covers the costs linked to collection. For bigger stores, collection takes place through reverse vending machines. In Norway, their purchase costs are included in the handling fee. In Sweden, one machine per shop is reimbursed, whereas no compensation takes place in Finland. In Lithuania, the central system leases the machines (Drab and Slučiaková 2018).

In Croatia, unlike traditional deposit systems, the system operates with fees which are paid by producers. Consumers do not pay a deposit on beverage containers, but they do receive compensation from sellers when they return the empty containers (Container Recycling Institute 2011).

Key facts

In many cases return rates for packaging material subject to deposit-refund systems are over 90%, making the measure very effective in preventing littering.

The measure

Within deposit-refund systems customers pay a deposit in addition to the product price when buying a beverage in a PET bottle or can. The shop pays the money back when the empty packing material is returned. Subsequently it is recycled.

Pre-conditions for successful implementation

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).

To ensure that cross-border movement of beverage packaging is not accompanied by littering of the imported packaging, care should be taken to ensure coherence between different schemes (Van Acoleyen et al. 2014).

A way to further increase the effectiveness of DRS to avoid littering would be to extend them to bottle caps/lids. In this case the refund would be valid only when the bottle includes its lid/cap, or alternatively a premium can be paid for bottles with lids/caps. This could be expected to have a positive impact on the occurrence of this type of litter item (which is among the top items in every regional sea) (Van Acoleyen et al. 2014).

The main objective of systems of redemption and recycling of beverage packaging is usually attaining high return rates and recycling rates as well as a high quality of the collected packaging material. When introducing such systems, existing recycling markets, but also the political will to extent recycling markets, constitute hence important framework conditions (Albrecht et al. 2011). In addition, in order to ensure the efficiency of the plastic bottle deposit system, this system must be combined with other economic instruments, in particular recycling subsidies and packaging taxes (Djemaci 2011).

Main challenges to implementation

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 (Drab and Slučiaková 2018; RPA, Arcadis, and ABPmer 2013). These costs are often only partly covered by revenues through uncollected deposits as well as by selling the collected raw materials.

In addition, concerns of retailers can be expected at least in the first phase of the DRS implementation. However, according to the experience made in Cadaqués, Spain, “concerns regarding the loss of space due to the storage of empty containers have almost entirely dissipated, as have concerns related to an increased workload. Fears of a decrease in sales have also been reduced, with the prevailing position that the system would not have a negative effect and that it would not affect the number of customers. […] All shopkeepers and retail outlet managers interviewed support the implementation of the system in Catalonia” (Van Acoleyen et al. 2014).

Feasibility and acceptability

A survey on the deposit system for plastic bottles of mineral water was conducted in Algeria in 2010 with 165 participants. It showed that the majority (89%) supported a deposit system for this type of bottle (Djemaci, 2011).

Furthermore, a survey made in the pilot case of the city of Cadaqués, Spain, to assess the level of acceptance and public perception showed that 61% of the respondents perceived improved cleanliness in a number of public spaces and streets during the pilot and 85% of the respondents supported the implementation of a DRS (Van Acoleyen et al. 2014).

Effectiveness of the measure and related benefits

Applications of deposit-refund systems show high return rates (e.g. 89% in the Danish system, and 98% in the Norwegian system). Therefore, low rates of littering of single-use beverage packaging can be expected when a DRS is in place. The system encourages on the one hand people not to throw their used containers or bottles out, and at the same time provides incentives to collect undeposited or "stray" bottles (Van Acoleyen et al. 2014). In the end, the effectiveness of the DRS depends on the applied deposit tax level.

Based on existing experiences, the implementation of DRS at the MED scale could result in a total reduction of marine litter of 12% per year (Van Acoleyen et al., 2014). On this basis, it was estimated that the application of DRS system to the Mediterranean as a whole could reduce the inflow of plastic litter into the sea by 32 000 tonnes/year, which represents the 12% of yearly incremental marine litter into the Mediterranean.

Moreover, recycling rates in deposit refund systems can be almost 40 % higher compared to systems not using it. These do, however, not only depend on the quantities collected, but even more on the quality of the materials. High quality secondary materials are needed in order to produce a product with the same quality as the original one (bottle to bottle recycling). With a mix of different rigid plastics, as in common separate waste collection, it is harder to guarantee this.

Van Acoleyen et al. (2014) emphasise that assessing the impact of a DRS requires assessing the amount by which the recycling of this kind of packaging is increased. In countries where current recycling levels are already quite high due to existing separate waste collection systems, the effect of introducing a DRS will be lower than in countries which do not have separate waste collection systems in place. A report from 2014 states that in the southern shores of the Mediterranean there is virtually no sorting of waste at source, and recycling rates for municipal waste are quite low, compared to EU countries (8% in Morocco in 2010; 7% in Algeria in 2012) (Boudra 2014). The room for improvement is hence very high in these countries. In the following, different benefits of DRS are listed:

Direct benefits

- DRS generate **revenues** consisting in the amount of unclaimed deposits (about 10% of total deposits).
- Revenues from the secondary raw material will increase, as the collected PET and aluminium cans have a positive market value in contrast to many other waste types. In addition, the collection system allows for high quality recycling material, as the packaging material is presorted. This will increase its market price.
- Depending on how the system is made, the **plastic industry** may save other waste processing fees or environmental taxes through their involvement in the DRS (e.g. in Germany or in Finland).
- **Retailers** may receive handling feeds to cover the costs linked to collection.

Benefits: key figures
The rate of return of deposit-refund systems often reaches more than 90%.

- **Consumers** have the possibility to collect bottles thrown away by others and to receive the deposit.

Direct economic impacts (positive impacts)

- **Reduction of bin volume occupied by plastic bottles**, which leads to lesser costs for waste collection. In the Cadaqués pilot application, the decrease of collection costs has been estimated to be between 6.5-9.5% of the annual cost of collection of light packaging and undifferentiated waste (Van Acoleyen et al. 2014). In addition, waste is better sorted and less collected waste ends up in landfills.
- The plastic industry potentially benefits from the availability of **cheaper raw material** through the waste collection process, as higher quantities will be on the market. In addition, the material provided will be of higher quality for recycling.
- In the case of previously existing separate collection points for plastic bottles, **consumers** will need to bring smaller volumes to these sites. They will gain time as they bring bottles back to retail at the same time as shopping is done.
- DRS systems reduce the amount of waste to be collected and processed at disposal and landfilling sites, with corresponding avoided costs 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[1] on waste generation and management, based the income level of the country. Based on the estimated plastic return rate at the Mediterranean level, these savings were estimated at 35 million EUR/year (average value).
- Positive effects on **employment** can also be expected, through additional jobs created in the central administrative system, the collection system, as well as linked to reprocessing / recyclers. For the UK, the additional employment benefit from a country-wide DRS implementation was estimated to lie between 3,000 and 4,300 full-time equivalents (Hogg et al. 2011).
- The presence of marine litter on beaches is expected to reduce tourism arrivals. Based on the methodology outlined in the main report of this study, it is assumed that the current value of **tourism receipts** (based on WTO data)[2] is 3% less than what it would be in the absence of beach litter[3]. On this bases, it is estimated that the reduction of marine litter following implementation of DRS systems at the Mediterranean level would correspond to an avoided impact on the tourism sector of 887 million EUR/year.

Indirect benefits

- DRS will lead to **less costs for cleaning**. Van Acoleyen et al. (2014) estimate the average cost of litter removal at 8170 EUR per km per year. Beach cleaning is not necessarily performed by municipalities alone, voluntary organisations can also play a large role in removing litter. According to Van Acoleyen et al. (2014), the total number of beach litter items would be reduced by about 12% for the Mediterranean Sea coast in case of implementing a DRS for single-use beverage packaging in all Mediterranean EU countries. As a rough estimate, litter removal costs for beaches would be reduced by about 980 EUR per km, based on the combined estimates of litter reduction and cleaning costs per km. If applied to the whole

[1] https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-334852610766/What_a_Waste2012_Final.pdf
[2] WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876
[3] Calculations based on UNEP, 2017, and WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - Please refer to the final report of the study for more detail on the methodology

length of the Mediterranean coastline, total cost savings for beach cleaning amount to about 23.8 million EUR (own estimations based on Van Acoleyen et al. (2014)). This figure is only a lower end estimate of the total benefits for society, as a DRS would reduce litter not only on beaches, but everywhere. In a study carried out by Drab and Slučiaková (2018) it is estimated that introducing a mandatory DRS in Slovakia would lead to (potential) saved costs of litter removal between EUR 630,000 and EUR 2,710,000, considering the cleaning of protected areas, roads, streets and rivers.

- **Public spaces** (streets, banks and beaches) will become cleaner due to less littering, which is beneficial both for visitors of the sites and for the environment (e.g. preventing animal suffering through plastic ingestion). The region will benefit from a better reputation through improved cleanliness of public spaces, which might also translate in higher incomes from an increasing number of tourists. Jang et al. (2014) and Leggett et al. (2014) clearly demonstrate the value people place in the clean marine and coastal environments and potential costs to communities. Leggett et al. (2014) showed that marine debris had a significant impact on residents' beach choices, and that a 75 % reduction in marine litter at six popular beaches generated millions of euros on additional benefits over a few months.
- Linked to the above, this study estimated the increased recreational value of coastal environment consequent to marine litter reduction (based on Brower et al, 2017 – see final report for full methodology). According to these estimates, based on the expected marine litter reduction of 32 000 tonnes per year, the **increased recreational value of Mediterranean coasts** would amount to 29 million EUR/year.
- Nearly all mandatory deposit-refund systems work with barcode-based recording systems, which allow exactly **monitoring** how many products were placed on the market, and how many were collected (Drab and Slučiaková 2018; CM Consulting and Reloop 2016).
- Both the plastic industry and the retailers might also benefit from a **better image** due to their participation in the circular economy, whereas consumers have the feeling of doing "something good" for the environment.
- The **society** benefits from getting closer to a circular economy: Resources are saved (mainly hydrocarbons, water and energy needed in the manufacturing process of cans and plastic bottles) as fewer raw materials are needed for new production processes. In comparison to primary PET, recycling can reduce the **use of primary energy** by 54 % and **emissions of greenhouse gases** by 23 % (Kuczenski and Geyer 2009, in Drab and Slučiaková 2018). The total impact on CO_2 emissions is usually evaluated as positive, but has to be opposed to additional costs of transport which causes additional emissions of CO_2 (Drab and Slučiaková 2018).
- In terms of **ecosystem services**, provisioning ecosystem services benefit from a decreased ingestion of marine plastic waste debris by animals, whereas cultural ecosystem services, in particular aesthetic and recreational services, are enhanced by cleaner public spaces (streets, banks, beaches). This study estimated the total value of improved ecosystem services following the implementation of the measure at the Mediterranean level, based on the expected marine litter reduction and on the economic costs of marine plastics as related to the natural capital estimated by Beaumont et al (2019 – see final report for full methodology). The **improvement in marine ecosystem services** following the introduction of DRS system at the MED level would amount to 523 million EUR/year.

- Reduced littering leads also to benefits for the **fishing sector**, in terms of avoided costs of removing litter from fishing gear, avoided costs of reduced catch revenue, avoided costs of broken gear and fouled propellers as well as avoided costs of rescue services. According to

own estimations (based on Van Acoleyen et al. 2014), total benefits in this regard for the Mediterranean Sea would amount to 1 million EUR per year.

- **Shipping and Yachting**: The shipping and yachting industries also experience economic impacts as a result of marine litter pollution, with harbors and marinas incurring the cost of removing marine litter from their facilities in order to keep them safe and attractive to users, and vessels experiencing interference with propellers, anchors, rudders and blocked intake pipes and valves (Mouat et al. 2010). Mouat et al. (2010) estimated that removing marine litter costs U.K. ports and harbors on average EUR 2.4 million per year. A DRS would be a good incentive for boat owners to not dump bottles and cans in sea but to keep them on board and deposit upon return in the harbor.
- Other positive environmental effects based on less littering are stated in WWF (2018): Polythene, which is used for example in plastic bottles, accumulates more organic pollutants than any other type of plastic. These pollutants can then be absorbed by marine animals which ingest pieces of plastic. Reducing the input of plastic bottles in the sea reduces the risk of plastic ingestion by marine animals.

Negative impacts and related costs of the measures

Direct costs

- In the context of a DRS, **regulators** must finance launching costs, information campaigns, implementation costs and enforcement costs.
- Depending on how the system is made up, the **plastic industry** may pay administrative fees as well as additional transport costs, as the collected bottles must be transported to a more centralized collection point where they can be counted and recycled. In the case of Slovakia, a feasibility study estimated that total producers' costs of packaging collection would more than triple from the current annual costs (Drab and Slučiaková 2018).
- Several collection points must be designated. Consumers will only return their used bottles if their return costs are lower than their littering costs. Therefore, enough collection points must be designated, as travelling costs are a substantial part of return costs. These **collection points** need to install Reverse Vending Machines (RVM). RVMs cost over EUR 15 000 and have some fixed operating and maintenance costs, whilst occupying a lot of space. Installing RVMs signifies a large financial effort for the retailers. According to a recent feasibility study carried out for Slovakia, three quarter of the total installation costs (about EUR 80 million) would concern the purchase, installation and service of reverse vending machines. The rest will cover the costs of system security, and manual collection, but also the establishment of the central system (Drab and Slučiaková 2018). In Scotland, one-off/setup costs have been estimated to be around EUR 42 million (Hogg et al. 2015).
- **Consumers** pay the costs of unclaimed deposits.

Direct economic impacts (negative impacts)

- For **regulators**, costs for a potentially existing separate waste collection system might become higher, as valuable resources (e.g. PET and metal) are removed from the system and less selling prices for collecting recycling material can be reached.

Costs: key figures
Important costs are linked to the installation and operation of reverse vending machines

- **An increase in collecting costs** results of the increase in the returned volume of cans and bottles, as **retailers** must reserve more storage space. In addition, the implementation of a DRS may cause a decline in sales, as the deposit leads to an elevated product price. The standard level of the deposit amounts 25 cents per bottle and the average beverage costs are less than € 1, implying that there is at least a 25 % increase in purchasing price (although one will get the money back). This could result in a decreased demand for beverages, especially for households that are less well-off, having more need of cash money in the short run. These costs for suppliers could result in heavy opposition and lobbying of suppliers against a DRS. There are some ways to mitigate these costs, however. One way would be to allow the retailers to keep the unredeemed deposits as profits. Another way would be that the government pays a handling fee to the retailers in proportion to the volume they collected.
- **Consumers** experience **opportunity and inconvenience cost**: because of the DRS the consumer must bring his used bottles or cans to the collection points in order to earn back his deposit. This requires money for the transportation and time that could be used differently. Nevertheless, this can be relativized as DRS transport can occur at the same moment as shopping for new goods. Because of the technical needs of the DRS, the consumer needs to pay attention not to damage the used good so that the barcode is still readable by a barcode scanner upon return. This might imply that the consumer will lose some of his refunds due to a damaged good on the one hand and that he will lose some storage space due to an increase in volume needed to keep the bottles undamaged. As a result, a much larger space is needed to store the same number of used bottles or cans that could fit in one trash bag when there was no DRS implemented. These inconvenience costs are of course minor costs for the consumer.
- The **waste management sector** potentially needs to invest in new recycling facilities.
- From a societal point of view, it needs to be considered that introducing DRS for single-use packaging risks to reduce the use of reusable beverage packaging.

In summary, the main disadvantages of DRS are the high costs to install the system. Revenues from uncollected deposits and raw material sold are not enough to cover the costs of its operation (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). Benefits from an improved collection and recycling rate depend in particular on whether a separate collection system has already been in place before (and how it performs). The adequacy of introducing a DRS in a country needs hence to be evaluated case by case.

Regarding the distributional effects of a DRS, they depend on how the system is organized. Consumers which bring back the beverage packaging to the retail have no other costs than some inconvenience of transporting empty packaging. But depending on the system in place, investment and maintenance costs can be shared differently between the municipality (responsible for waste collection), packaging producers and retailers. Also, both the unclaimed deposits and the benefits from high quality recycling raw material (higher selling prices) are not necessarily benefitting the same stakeholders in the DRS of different countries.

In synthesis…

Overview of costs, benefits and distributional impacts

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
Regulators	Launching costs, information campaigns, implementation costs, enforcement costs. No quantitative information is available.	Municipalities may gain the amount of unclaimed deposits (about 10% of total deposits). If the municipalities are the ones selling the recycled material, they can receive higher selling prices compared to material collected through separate waste collection systems.	Potentially higher costs for existing separate waste collection systems, as valuable resources (e.g. PET and metal) are removed from the system and less selling prices for collecting recycling material can be reached. No quantitative estimations were found.	Additional jobs created in the central administrative system of the DRS.	Avoided costs of beach cleaning: 23.8 million EUR/year. Better reputation of the region through improved cleanliness of public spaces. Barcode systems in DRS allow better monitoring of product use. If tourism is promoted through cleaner public spaces, including beaches, municipalities are benefitting from higher tourist numbers.	+
Plastic industry	Compliance costs – depending on how the system is made up, the plastic industry may pay administrative fees. Potentially transport costs.	The plastic industry may save other waste processing fees or environmental taxes through their involvement in the DRS (e.g. in Germany or in Finland).		Potentially availability of cheaper raw material through the waste collection process (higher quantities on the market), providing at the same time high quality material for recycling.	Improved image through participation in the circular economy.	0
Retailers	Compliance costs – purchase of reverse vending machines (> EUR 15,000) and maintenance costs for the machines. Potentially transport costs.	Retailers may receive handling fees to cover the costs linked to collection. Potentially income from unclaimed deposits.	Potentially additional staff time and increased need for storage space. Risk of reduction in sales.		Improved image through participation in the circular economy.	-
Consumers	Costs of unclaimed deposits.	Possibility to collect bottles thrown away by	Opportunity and inconvenience costs: Consumers need to	In case of previously existing separate collection with collection points: Reduced	Feeling of doing “something good” for the environment.	0

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
		others and to receive the deposit.	store bottles at home and to transport them back to the retail.	volume of waste brought to the collection points; bottles are brought back to retail at the same time as shopping is done.	More beautiful public spaces, including beaches. Higher recreational value.	
Waste management			Potentially investments in new recycling facilities.	Savings for waste management due to less waste to be managed: 35 million EUR/year Reduced waste collection frequencies due to reduced volume of bin occupation also reduces costs – in the Cadaqués pilot application: annual costs of collection reduced by 6.5-9.5%. Better sorted collected material which provides higher quality for recycling. Increased employment through additional collection/transportation.		+ +
Society			Introducing DRS for single use packaging risks to reduce the use of reusable beverage packaging.	Employment gains. For the UK, the additional employment benefit from a country-wide DRS implementation was estimated to lie between 3,000 and 4,300 full-time equivalents (Hogg et al. 2011).	The value of the expected improvement of ecosystem services is estimated at 523 million EUR/year (Provisioning ecosystem services: decreased ingestion of marine plastic waste debris by animals; Cultural ecosystem services: aesthetic and recreational services: cleaner public spaces) Getting closer to a circular economy: Saving of resources (mainly hydrocarbons, water and energy needed in the manufacturing process of cans and plastic bottles).	+ + +

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
					Recycling rates in deposit refund systems can be almost 40 % higher compared to systems not using it. In comparison to primary PET, recycling can reduce the use of primary energy by 54 % and emissions of greenhouse gases by 23 % (see above).	
Fishing sector					Benefits in terms of avoided costs (with regards to removing litter from fishing gear, reduced catch revenue, broken gear and fouled propellers as well as rescue services) linked to less litter in the sea: estimated at 1 million EUR per year for the Mediterranean.	+
Tourism sector				The reduction of marine litter following implementation of DRS systems at the Mediterranean level would correspond to an avoided impact on the tourism sector of 887 million EUR/year.	Increase in revenues in the recreation and tourism sector due to cleaner beaches The increased recreational value of Mediterranean coasts would amount to 29 million EUR/year.	+ + +
Overall balance (+/0/-)	-		+ + +		+ + + +	

In conclusion...

Advantages and challenges to implementation

- The outstanding advantage of a mandatory deposit-refund system for single-use beverage packaging is its provable performance. The rate of return often reaches more than 90%. This makes the measure very effective.

- However, costs of introducing and operating the system are high, in particular linked to reverse vending machines.

- The decision on introducing the system in a country needs to consider the current recycling rates of material included in the system (in particular PET and aluminum).

Want to know more?

The existing system in Croatia: http://www.bottlebill.org/legislation/world/croatia.htm
The planned DRS in Malta: www.bcrs.gov.mt
Estimated costs for a DRS in Spain: http://www.retorna.org/mm/file/Implementing%20a%20Deposit%20Refund%20System%20in%20Spain%20Technical%20Appendix.pdf

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Fishing for litter

FFL schemes involve fishermen in marine litter collection

Why this measure?

Plastic items constitute a large share of marine litter found in the Mediterranean. An assessment of marine litter composition as part of the DeFishGear project found that, in the Adtiatic and Ionian Sea, the majority of litter items were artificial polymer materials accounting for 91.1% of all beach litter; 91.4% of all floating litter; 30 to 89.4% of all seafloor litter (bottom trawl surveys); 98% of biota. (Vlachogianni et al. 2017). These results are consistent with the extent of plastic pollution at the Mediterranean level (UNEP et MAP 2015). Plastic bottles (including caps) and bags belong to the "top 20" items found in the marine and coastal environment. Their degradation into microplastic can further affect the environment.

Marine litter is also a threat to economic activities in the Mediterranean, especially triggering : litter cleaning costs, losses to different economic sectors related to the sea (tourism, fisheries, aquaculture), costs to shipping as a result of vessel damages, costs to power station (UNEP et MAP 2015).

The measure in the Mediterranean and beyond

In Europe, FFL schemes have been principally developed in the Atlantic Ocean and North Sea, especially under Recommendation 2010-19 on common principles for the reduction of marine litter of the OSPAR Convention in the North Atlantic. (UNEP, MAP, et Plan BLeu 2017). In this area, during the 2016-2017 campaign, some 470 trawler boats retrieved 936 tons of litter from the sea as part of the KIMO FFL scheme (KIMO 2019). **In the Mediterranean, 9 FFL projects have been found, involving 435 boats since 2008**. As a matter of comparison, the fishing fleet in the Mediterranean is estimated to about 92.700 vessels (FAO 2016).

Project	Ports	Effectiveness	Period	Area
DeFishGear	15	144 tons of litter retrieved	2014-2016	Italy, Slovenia, Croatia, Montenegro, Greece
Upcylcing 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
Marilsco	3	5 garbage collection boats engaged in 3 municipalities	2005-2012	Turkey

Table 1 Inventory of FFL schemes in the Mediterranean

Implementing the measures

Fishing for litter is a litter removal measure. According to the organization which first implemented this measure in 2004:

"Fishing for Litter aims to reduce marine litter by involving one of the key stakeholders, the fishing industry. Fishing boats are given large bags to collect the plastics, ghost gear and other debris that gathers in their nets during normal fishing activities. When the fishing boats come into port, they can unload the bags of litter. These bags are collected regularly and the rubbish is recycled or disposed of on land. All the fishermen who participate in the project are volunteers. On a daily basis, they are out at sea removing rubbish from the ocean. " (KIMO 2019)

Fishing for litter initiatives have a **twofold aim: to remove marine litter from the marine environment and to raise awareness of marine litter issues**, particularly within one of its main stakeholders – the fishing sector – where the measure helps to prevent littering due to Abandoned, Lost or otherwise Discarded Fishing Gear. The main actors in fishing for litter initiatives are the fishermen who are provided with bags and waste reception facilities at port to collect litter that accumulates in their nets and other fishing gear during normal fishing activities and to dispose of unwanted fishing gear. The collected waste is then either recycled or disposed of on land. Fishermen participate on a voluntary basis while harbors and ports assist with the handling of waste. One of the major advantages of this measure is the fact that it does not require any additional fishing activity or specific operations at Sea. This is why such fishing for litter initiatives are referred to as passive measures, in contrast to active measures such as active retrieval of litter through specific operations.(UNEP, MAP, et Plan BLeu 2017)

Fishing for litter scheme can be cost-effective measures to raising awareness around marine litter issues if they are "passive". In Catalonia for example, the Mariva projects has had positive impact on the media coverage of marine litter, while creating very little additional workload for fishermen. Port Authorities and Waste Management authorities supporting the project found their interest in the removal of marine litter in the port and collection of data on marine litter.

Pre-conditions for successful implementation

The successful implementation of FFL schemes depend their design that must take into consideration :

- **The size of participating fishing boats:** Fishing vessels involved in fishing for litter programmes need to have enough room on board to accommodate large bags or containers in which the waste is collected. This can potentially be a problem for artisanal small-scale fisheries which are prevalent in the Mediterranean. However, experience from the DeFishGear project (mentioned above) 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. Therefore, adequate port reception facilities are a requirement. These facilities are either already present at participating harbors or they are specifically set up to accommodate the fished waste. Communication plan.
- **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. Only convinced fishers will participate in an initiative that requires their volunteer work. Monitoring. To evaluate cost-effectiveness of a fishing for litter programme, it is important to monitor a number of parameters, such as the

Key facts

- *Since 2008, at least 9 FFL schemes, in 9 Mediterranean countries*
- *806 vessels involved*

The measure

- *Fishermen are involved in marine litter cleanup*
- *Expected outcome in terms of marine litter removal and increased awareness on marine litter (fishermen and public opinion)*

number of vessels and harbors involved, the weight of the collected marine litter and if possible its type (plastic, fishing gear, etc.).(UNEP, MAP, et Plan BLeu 2017)

- **Passive FFL schemes:** 'passive' Fishing for Litter schemes, where fishermen collect waste during their normal fishing trips and have very little negative effects. On the contrary, 'active' Fishing for Litter schemes, where fishermen are paid to go out to the sea and collect waste in dedicated trips. In the second instance, the negative environmental effects of getting a boat out to the sea, in particular regarding carbon emissions, largely outweigh the benefits of fishing out an extremely tiny proportion of the litter that has accumulated in the ocean (Belin et al. 2017)
- **Insuring fishermen willingness to participate:** smoothing fishermen's contribution in FFL schemes would improve their participation. This means minimizing the additional workload triggered by the scheme and thus insuring the organization of waste management.
- **Partnership for litter handling:** litter collection in the port, transport and disposal (recycling or incineration) can increase many fold the costs of the project for the regulator. Leaving these activities to specialized companies would decrease the costs of the project, and may (as in the case of the Marviva project) leave the room for innovative valuation systems.

Feasibility and acceptability

- *Strong commitment of the regulator is required to insure fishermen's participation*
- *FFL schemes must target very densely polluted areas to be efficient*

Effectiveness of the measure and related benefits

The KIMO scheme claims to have removed some 470 tons of marine debris during the campaign 2016-2017 for some 989 boats engaged, mostly in the North and Baltic Sea and the Atlantic Ocean. In the Mediterranean, upcycling the oceans retrieved 133 tons of litter in 2017 involving 235 boats, while the Defishgear project involving 124 boats retrieved 122 tons of litter. More examples of FFL schemes effectiveness are to be found in Table 1.

It is difficult to estimate the proportion of marine litter that can potentially be collected via fishing for litter initiatives. This is amongst others due to the considerable spatial variability of marine litter. In fact, UNEP-MAP (2015), states that marine litter accumulation rates vary widely and are influenced by many factors, such as the presence of large cities, shore use, hydrodynamics, and maritime activities. Fishing for litter initiatives would clearly only take place on fishing grounds where the vessels normally operate. (UNEP/MAP 2016) considers baseline values ranging between 3 to 5 items of floating litter/km², and 130 to 230 items of sea floor litter/km² for the Mediterannean, however studies such as those performed under the DeFishGear project suggest values can respectively reach 1203 and 1099 items/km² (Vlachogianni et al. 2017) in most vulnerable areas of the Adriatic and Ionian seas. In terms of weight, the same study finds an average 65 to 332 kg of marine litter/km² on the sea floor and 3 to 339 kg of surface marine litter/km² . FFL initiatives must be carefully designed so as to **address the most vulnerable areas** to marine litter, since **this can increase their effectiveness from five to a hundredfold** (considering floating or sea floor litter). This is consistent with Kimo data showing widespread effectiveness across participating countries.

Based on KIMO and FFL 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, for an average around 0.95 tons/boat). Reported FFL projects between 2008 and 2018 involved up to 806 vessels in the Mediterranean (somewhat less than one percent for the fishing fleet), and have thus a potential of up to 2.015 tons of marine litter removal/yearly, which represents less than one percent of the yearly flow of plastic into the Mediterranean. Mismanaged plastic waste likely to enter into the Mediterranean Sea is estimated to 311.000 tons yearly (Ritchie et Roser 2018).The fishing fleet in the Mediterranean, with some 92.700 vessels has thus a maximum potential of 230.000 tons of litter removal/year, **but is more likely to reach its limit at 88.000 tons** (average effectiveness of FFL schemes). It is thus unrealistic to think of FFL as sufficient measures to address marine litter issues.

Due to the characteristics of the scheme, no direct benefits are expected.

Indirect positive impacts

The presence of marine litter on beaches is expected to reduce tourism arrivals. Based on the methodology outlined in the main report of this study, it is assumed that the current value of **tourism receipts** (based on WTO data)[1] is 3% less than what it would be in the absence of beach litter[2]. On this basis, it is estimated that the reduction of marine litter following implementation of DRS systems at the Mediterranean level would correspond to an avoided impact on the tourism sector of 2 438 million EUR/year.

Benefits: key figures

- *Increased value of tourism receipts: 2 438 million EUR/year*
- *Avoided costs of beach cleaning: 65 million EUR/year*
- *Improved ecosystem services: 1 437 million EUR/year*
- *Increased recreational value of coastal environment: 79 million EUR/year*

[1] WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876

[2] Calculations based on UNEP, 2017, and WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - Please refer to the final report of the study for more detail on the methodology

Indirect benefits from environmental improvement

- Removal of marine litter by fishing boat will correspond to savings for regulators, who will thus be able to **save on beach cleaning operations**. Van Acoleyen et al. (2014) estimate the average cost of litter removal at 8170 EUR per km per year. If the measure were applied to the whole length of the Mediterranean coastline, and based on the expected effectiveness of the measure, it was estimated that total cost savings for beach cleaning amount to about 65 million EUR/year (own estimations based on Van Acoleyen et al., 2014[3]).
- This study estimated the **total value of improved ecosystem services** following the implementation of the measure at the Mediterranean level, based on the expected marine litter reduction and on the economic costs of marine plastics as related to the natural capital estimated by Beaumont et al (2019 – see final report for full methodology). The improvement in marine ecosystem services following the introduction of Fishing for Litter schemes at the MED level would amount to 1 437 million EUR/year.
- This study estimated the **increased recreational value of coastal environment** consequent to marine litter reduction (based on Brower et al, 2017 – see final report for full methodology). According to these estimates, based on the expected marine litter reduction of 88 000 tonnes per year, the increased recreational value of Mediterranean coasts would amount to 79 million EUR/year.
- Fishing for litter schemes can have a **positive impact on fishing and aquaculture activities**. Reduced littering leads thus to benefits for the fishing sector in terms of avoided costs of removing litter from fishing gear, avoided costs of reduced catch revenue, avoided costs of broken gear and fouled propellers as well as avoided costs of rescue services. According to own estimations (based on Van Acoleyen et al. 2014), total benefits in this regard for the Mediterranean Sea would amount to 4 million EUR per year. As fishing for litter programmes target both the cleaning up of waste present in the Sea and awareness raising of fishers leading to less dumping of waste by the fishing sector, fishing for litter can reduce both the amount of marine litter and hence the impacts caused by it. (UNEP, MAP, et Plan BLeu 2017).
- **Reduction and contamination of potential catches**. Marine litter can have a significant impact on fish stocks due to entanglement in floating plastics or in derelict fishing gear (ghost fishing), ingestion and exposure to toxic materials.
- **Aquaculture impact**. In the aquaculture sector, the economic impact of marine litter, has been estimated in a Scottish survey to represent around €580/operator and year (Mouat, Lopez Lozano, et Bateson 2010)
- **Ports** are also benefiting of FFL impacts and as such are often the first partners alongside regulators to propose FFL schemes. For the Port of Barcelona, cost of marine litter cleanup were assessed to reach some 8900€/ton/year (35t of litter/year/4km²).
- Effectiveness is also to be found in terms of **public awareness regarding marine litter**. Most FFL initiatives communicate widely in this purpose. Fishermen take interest in improving their public image regarding environmental issues through increased media coverage of FFL schemes. Similarly, FFL initiatives media coverage increases public awareness toward marine litter.

[3] For the full methodology, please refer to the final report of the study

Negative impacts and related costs of the measures

Direct costs

There are three major types of direct costs falling on FFL initiatives

- **Additional workload for fishermen** involved in the FFL scheme: investing their time and energy in the collection and packing of litter marine retrieved from the sea.
- **Design, monitoring and enforcement** costs of the FFL schemes for **regulators**. In order to involve fishermen in the scheme regulators must take care of all the activities related to the coordination of the project and waste collection in the port, which means a lot of administration costs. Regulator costs of fishing for litter activities can vary a lot depending on the design of the schemes. Data retrieved from 10 pilot projects by the Marelitt initiatives give estimates from 800 to 5.200€ per ton of litter retrieved. Factors of cost variation include the numbers of vessels in the FFL fleet and the inclusion of collected waste handling (incineration, recycling, etc.) as part of the project. (UNEP/MAP 2016). In line with these figures, we consider in our calculations the costs proposed by the well documented KIMO initiative in Scotland, which found a cost of 830€/ton of litter collected (Mouat, Lopez Lozano, et Bateson 2010). According to own estimate of potential effectiveness of the measure at the MED scale, the resulting costs for the regulators would amount to 73 million EUR/year
- **Waste collection and treatment cost**: these can be supported by different stakeholders depending on the design of the project: port authorities in charge of ports cleanliness, regulators in charge of FFL schemes, agencies in charge of municipal waste collection or businesses willing to valorize marine litter. World bank data suggest costs of waste collection and landfilling in high income countries (roughly, those involved in FFL schemes so far) range between 108 and 302 EUR/t (World bank 2012). Based on the estimated litter collection potential at the Mediterranean level, these additional costs were estimated at 11 million EUR/year (average value). Fully addressing yearly flows of plastic in the Mediterranean would induce a 19 to 50 million EUR additional waste management costs at region level. **The waste collected can however been valorized** either through energy generation, or, as iti the case in the Catalonian example (see case study factsheet) through recycling and production of new items (e.g. clothes).

Costs: key figures

- *For the regulator: 830 EUR/tonnes of litter removed, or 73 million EUR/year*
- *For fishermen : additional workload*
- *For waste management: 108-332€/ton (North-Med)*

49-116€/ton (South Med)
Of litter removed

In synthesis…

Overview of costs, benefits and distributional impacts

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits inked to environmental improvement Ecosystem Services	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
Regulators	Administration costs related to FFL schemes design, monitoring and enforcement: Around 830€/ton of litter removed / 73 million EUR/year	Increased knowledge base on the extent of marine litter pollution Increased public awareness on marine litter pollution			Progress toward policy objectives regarding marine litter Avoided costs of beach cleaning: around 65 million EUR/year	- -
Retailers						0
Consumers						0
Waste collection and management	Cost of additional waste disposal (incineration, landfilling: 108-302€/ton of waste treated, i.e. 11 million EUR/year at the MED level	Production of energy or products out of the litter		Revenue and employment generation from the sale of energy (incineration) or products (recycling)		-
Society					Increased public awareness toward marine litter issues The improvement in marine ecosystem services following the introduction of F4L schemes at the MED level would amount to 1 437 million EUR/year. (Provisioning services: Reduced death, illness, intoxication and injury of fish, shellfish and turtles caused by marine plastic bag waste; Cultural services: aesthetic and recreational services and non-use value increased)	+ + +

Overview of costs, benefits and distributional impacts (cont'd)

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits linked to environmental improvement	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
Other sector: Fishermen	Additional time and energy spent collecting and packing waste	Better image in the public opinion			Avoided costs for the fishing sector: 4 million EUR/year Provisioning services: Reduced death, illness, intoxication and injury of fish, shellfish and turtles caused by marine plastic bag waste;	+
Other sector tourism :				the reduction of marine litter following implementation of DRS systems at the Mediterranean level would correspond to an avoided impact on the tourism sector of 2 438 million EUR/year.	The increased recreational value of Mediterranean coasts would amount to 79 million EUR/year	+ + +
Other sector: Port Authority	Administration costs related to waste collection (either direct or indirect)				Reduced costs in port clean-up: 8900€/ton/year	0/+
Overall balance (+/0/-)	-		+ + + +		+ + + +	

In conclusion...

Advantages and challenges to implementation

As underlined by Belin et al (2017), fishing for litter initiatives may divert funding from other measures more cost-effective at decreasing the amount of marine litter. FFL schemes should be regarded only as a manner to address the stock of marine litter already in areas with very high density of marine litter. As to reduce the flow, economic (mainly taxes) and regulatory (mainly bans) instruments would be more cost effective.

Want to know more?

Visit the Website of KIMO, the first NGO to have launched FFL schemes

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Tax on single-use plastic bags

The plastic sac tax is a fixed environmental levy that customers must pay in shops or supermarkets for single-use plastic bags instead of receiving them for free.

A "decrease of overall incremental marine litter by at least 8% could be reached if a plastic bag tax was implemented correctly" (Plan Bleu, 2017).

Why this measure?

Lightweight plastic bags are often only used once, for a few minutes, whereas they remain about 20 years in the marine environment (Alessi et al., 2018). On average, a European uses 175 single-use plastic bags per year, although they could easily be replaced by long life alternatives (Surfrider Foundation Europe, 2018).

Although the proportion of marine litter attributed to plastic bags varies depending on the location and the sampling methodology applied, there is a "consensus that plastic bag litter is amongst the most visible and persistent components of litter pollution" (Plan Bleu, 2017). According to UNEP (2009), plastic bags account for 8.5% of the marine litter items found in the Mediterranean (40% of the items found are linked to cigarettes or cigars). They can be ingested by marine animals either as a whole, or when they disaggregated into fragments; this way they enter the food chain (Alessi et al., 2018). One way to significantly reduce the use of plastic bags is the introduction of environmental taxes for their use, which requires consumers to pay a certain amount for each plastic bag. Plastic bag taxes belong to the family of so-called market-based instruments for environmental policy. They have the double effect to provide incentives for consumers or producers to change their behavior and to use or produce less single-use plastic bags, and at the same time they generate revenues which can also be used for environmental purposes (e.g. awareness raising campaigns, investments in specific infrastructure, etc.). With the introduction of environmental taxes for single-use plastic bags, a decrease of 8% in overall (incremental) marine litter is expected (Plan Bleu, 2017).

The measure in the Mediterranean and beyond

Taxes on plastic bags are in line with the EU Packaging Waste Directive from 2015 which requires member states of the EU to reduce their annual consumption of plastic bags to 90 bags per person per year by the end of 2019 and 40 bags by the end of 2025." (Surfrider Foundation Europe, 2018). Plastic bag taxes are also in line with the UNEP-MAP Regional Plan on Marine Litter Management in the Mediterranean and are already in place in eight countries which are bordering the Mediterranean Sea. They are listed in the following table. Fees for plastic bags exist also in several other countries around the world (Schnurr et al., 2018).

Table 1 Existing taxes on single-use bags in Mediterranean countries

Country	Specifications
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.
Greece	Since January 2018, there is an ecotax of EUR 0.04 tax in place for lightweight plastic bags. The tax will rise to EUR 0.07 as of 2019. Kiosks and open-air markets are exempted.
Israel	Since 2017: Banned distribution of lightweight plastic bags <20µm and charges for bags between 20 and 50µm in all supermarkets.
Malta	Charges for bags since 2005. Biodegradable bags not taxed. Taxes for degradable bags EUR 0.14 and plastic bags EUR 0.16.
Portugal	A tax of EUR 0.10 on plastic bags is in place since February 2015
Slovenia	Since January 2019 it is prohibited to give lightweight plastic bags for free. The minimum price is the purchasing price by retailers.
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[1]. The same decree foresees a ban on lightweight and very lightweight plastic bags (except for compostable bags) as of 2021.
Turkey	Since January 1st, 2019, plastic bags are charged. A national zero waste program is being implemented. The objective is 90 plastic bags per person per year until 2020.

Sources: Schnurr et al. 2018; Surfrider Foundation Europe 2018

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

Implementing the measures

Taxes on plastic bags are usually introduced at national level and are legally binding. They can be collected either from the manufacturer or the importer, or directly from the consumers at the point of sale by the retailer. Some kinds of plastic bags might be exempted, e.g. those containing fresh fruit, unpackaged vegetables, meat and certain other products mainly for hygiene reasons.

As plastic bag taxes create revenues, their introduction is entirely funded by consumers of plastic bags, complemented by fines collected at the retailer level in case of non-compliance with the law. Costs related to the administration of the tax are easily outpayed by the revenues it generates (Plan Bleu, 2017).

Pre-conditions for successful implementation

The following factors of successful implementation have been identified by Plan Bleu (2017):

1) **The rate of the tax must be fixed at the right amount**: The tax rate must be 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.

2) **The definition of bags subject to the tax must be clear and as large as possible**: In order to avoid replacement with bags which have a similar negative impact on the environment, the "tax must specify the size and volume and materials of the bags subject to the tax, including different types of plastics and 'biodegradable' plastics" (Plan Bleu, 2017). Ideally, the tax applies to all types of retailers.

3) **The tax must be visible for consumers**: Taxes should be well indicated in shops as well as on invoices or receipts.

4) **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. This requires cooperation with the Ministry of Finance.

5) **The tax should be levied at the right level, in line with the country context**: 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 seems 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.

6) **The consultation process must be focused**: 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.

Key facts

Revenues created by taxes on plastic bags compensate easily costs linked to its introduction.

The measure

A tax is charged for single-use plastic bags and paid by consumers in retail stores. This measure provides financial incentives for consumers to change behavior (e.g. to use reusable bags) and at the same time generates revenues which can be earmarked for environmental purposes.

Feasibility and acceptability

With adapted consultation and communication processes which accompany the introduction of plastic bag taxes its acceptability is quite high. Given its revenue generating character, no issues of financial feasibility exist.

Main challenges to implementation

Objections from the plastic bag manufacturing industry will depend also on the specific situation in the country. Whereas “a strong plastic bag manufacturing industry can slow down the introduction of a plastic bag tax” (Plan Bleu, 2017), negotiations will be easier in countries which have a large share of imported plastic bags. As a flanking measure, revenues from the plastic bag tax could be used to help producers of plastic bags to change their production processes and to produce for example reusable bags (Plan Bleu, 2017).

Other challenges linked to the implementation of taxes for single-use plastic bags exist with regards to their acceptance by society, but also by specific economic sectors (the retail sector and the plastic bag manufacturers). As the tax implies a change of behavior from both, communication should take place to inform about the measure, its rationale and its objectives. Past experiences have shown furthermore, that communication efforts need to be repeated after some time (every one or two years), in order to avoid that effectiveness wears off and that plastic bag consumption increases again after some time (Plan Bleu, 2017).

Effectiveness of the measure and related benefits

Introducing a plastic bag tax around the Mediterranean Sea is estimated to lead to a 95% reduction of incremental plastic bag waste during the first year of implementation. The measure would lead to a decrease of overall incremental marine litter by at least 8% (without considering potentially already existing measures targeting the use of plastic bags) (Plan Bleu, 2017). If applying this share to the tons of litter produced, this would correspond to a total of about 21,400 tons[2] of littered waste avoided per year (based on figures provided in UNEP/MAP, 2015). Litter already discarded is not influenced by the measure. Financial incentives as provided by a tax can be expected to show their effectiveness quickly. Most of the "costs" for consumers are then available to the government in terms of net generated revenue through the tax. Additional revenues are generated through fines for non-compliance.

According to Plan Bleu (2017), the following economic sectors will benefit from improvements of the marine and coastal environment following the introduction of a plastic bag tax:

Direct benefits

- **Regulators** receive revenues from the tax which would amount to EUR 670 million per year for the Mediterranean region. This is complemented by revenues through compliance fines (Plan Bleu, 2017).

Direct economic impacts (positive impacts)

- Both the **plastic industry and retailers** benefit from increased sales of bin liners and reusable bags. Retailers benefit in addition from savings linked to largely reduced purchase of single-use plastic bags as well as linked to smaller storage costs (Plan Bleu, 2017).
- The public **waste management sector** (including landfills) saves money as a significant part of the plastic bag-related waste would disappear. The **avoided costs of collecting and processing the plastic waste** not used as a consequence of the tax are approximated by the minimal and maximal cost of landfilling 1 tonne of waste generated; the indicator is built on World bank data[3] on waste generation and management, based the income level of the country. Based on the estimated decrease in yearly SUPBs use at the Mediterranean level, these additional costs were estimated at 138 million EUR/year (average value).
- The presence of marine litter on beaches is expected to reduce tourism arrivals. It is assumed that the current value of tourism receipts (based on WTO data)4 is 3% less than what it would be in the absence of beach litter5. On this basis, it is estimated that the reduction of marine litter following clean-up actions at the Mediterranean level would correspond to an **avoided impact on the tourism sector** of 591 million EUR/year.

Benefits: key figures

- *Expected reduction of marine litter: 21 600 tonnes/year*
- *Yearly revenues for public authorities: 670 million EUR/year*
- *Avoided impacts on the tourism sector: 591 million EUR/year*
- *Total value of improved ecosystem services: 349 million EUR/year*

[2] The 8% share is calculated based on the number of litter items. Applying this same share to the weight of waste corresponds to a very rough estimate.
[3] https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-334852610766/What_a_Waste2012_Final.pdf
[4] WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - please refer to the final report of this study for more detail on the estimation method
[5] Calculations based on UNEP, 2017, and WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - Please refer to the final report of the study for more detail on the methodology

- In terms of **societal benefits**, jobs are created in the manufacturing of reusable bags and bin liners and in the administration of the tax (Plan Bleu, 2017).

Indirect benefits

- Cleaning up of beaches through voluntary actions will correspond to savings for regulators, who will thus be able to **save on beach cleaning operations**. Van Acoleyen et al. (2014) estimate the average cost of litter removal at 8170 EUR per km per year. If the measure were applied to the whole length of the Mediterranean coastline, and based on the expected effectiveness of the measure, it was estimated that total cost savings for beach cleaning amount to about 16 million EUR/year (own estimations based on Van Acoleyen et al., 20146).
- This study estimated **the increased recreational value of coastal environment** consequent to marine litter reduction (based on Brower et al, 2017 – see final report for full methodology). According to these estimates, based on the expected marine litter reduction of 21 400 tonnes per year, the increased recreational value of Mediterranean coasts would amount to 19 million EUR/year.
- This study estimated the **total value of improved ecosystem** services following the implementation of the measure at the Mediterranean level, based on the expected marine litter reduction and on the economic costs of marine plastics as related to the natural capital estimated by Beaumont et al (2019 – see final report for full methodology). The improvement in marine ecosystem services following the introduction of a tax on SUPBs at the MED level would amount to 349 million EUR/year. provisioning services (fish, shellfish, turtles) are supposed to increase due to decreased ingestion of marine plastic bag waste by animals. A positive effect can also be expected for cultural services: aesthetic and recreational services and non-use value (Plan Bleu, 2017).
- Introducing the measure also leads to **savings of resources**. This concerns mainly hydrocarbons, but also water and energy needed in the manufacturing process of plastic bags (Plan Bleu, 2017).
- Reduced littering leads also to benefits for the **fishing sector**, in terms of **avoided costs** of removing litter from fishing gear, avoided costs of reduced catch revenue, avoided costs of broken gear and fouled propellers as well as avoided costs of rescue services. According to own estimations (based on Van Acoleyen et al. 2014), total benefits in this regard for the Mediterranean Sea would amount to 1 million EUR per year.
- Less blocked intakes, less disruptions of operations as well as less required clean-up and repair can be expected in the **shipping sector**, as the measure leads to less plastic bag waste. The reduced need for clean-up operations also benefits the aquaculture industry (Plan Bleu, 2017).
- In **coastal power stations**, which use seawater for cooling purposes, marine Litter can cause blockage of cooling water intake screens, and requires increased removal of debris from screens and additional maintenance costs (Plan Bleu, 2017). However, it is difficult to determine to what extent these costs are linked to plastic waste (in comparison for example to natural debris such as seaweed) (Mouat et al. 2010).

[6] For the full methodology, please refer to the final report of the study

Negative impacts and related costs of the measures

Introducing taxes on single-use plastic bags is linked to costs for the regulator, as well as for consumers and economic sectors (retailers and plastic bag manufacturers and importers).

Direct costs

- For the **regulator**, costs are linked to communication campaigns, administration and enforcement needs (information material and distribution, control visits, management and administration of the tax, possibly software solutions, etc.). One-off costs for the first year are estimated to be about EUR 107 million, followed by estimated yearly costs of EUR 20 million for the implementation and coordination of the measure. Data for enforcement costs are not available, but it is expected that revenues collected from fines for non-compliance compensate for enforcement costs (Plan Bleu, 2017).
- The **consumers** are the ones paying for the tax – if they choose to use single-use plastic bags instead of reusable bags. Based on economic transfer of data via national GDP from the application of the tax in Ireland, the plastic sac tax in countries around the Mediterranean Sea would lie between EUR 0.01 (Palestine) and EUR 0.18 (France). This would lead to a total annual tax revenue for Mediterranean countries of EUR 670 million (Plan Bleu, 2017). When adding to the expenses for single-use plastic bags the expenses for reusable bags and additional bin liners, the annual per capita cost is estimated at 0.03% of GDP/capita.

Direct economic impacts (negative impacts)

- The most important negative effects of the tax concern plastic bag **manufacturers and importers**, as the decrease in the use of plastic bags significantly reduces their revenues, and might also lead to employment losses in the plastic bag manufacturing and importing industry. Regulators could think of using part of the revenues generated by the tax for helping the plastic bag producers to change their production line and to produce either reusable bags or for example bin liners. As illustrated in the main report of this study, the impact on the plastic industry depends not only on the expected lost production/revenues, but also on the capacity of firms to reconvert and innovate: many variables are involved, and estimating this impact was out of the scope of this study.
- For **retailers**, potential additional accounting and management efforts needed to administer the tax are counterbalanced by savings realised through decreased expenses for the plastic bags which have been given out for free (and their storage) as well as additional income from “permanent” bag sales and additional sales of bin liners (as single-use plastic bags are often used by consumers as bin liners) (Plan Bleu, 2017).

Costs: key figures

The highest negative effects of the introduction of plastic bag taxes occur to manufacturers or importers of plastic bags due to the significant reduction in the demand.

In synthesis…

Overview of costs, benefits and distributional impacts

Socio-economic groups	Direct costs and benefits: Implementation & Compliance		Direct economic impact		Indirect benefits	Overall impact on socio-economic group (+/0/-)
	Costs	Gains	Costs	Benefits		
Regulators	Launching costs: Information campaigns; exchanges with producers of plastic bags and retailers. Implementation and enforcement costs. EUR 107 million one-off costs (first year) and EUR 20 million/year.	Revenues from the tax (EUR 670 million per year for the Mediterranean region) as well as from non-compliance fines.			Avoided costs of beach cleaning: 16 million EUR/year Cleaner public spaces might lead to higher tourist numbers.	+ +
Plastic industry			Decrease in sales of single-use plastic bags.	Increased sales of bin liners and of reusable bags.		?
Retailers			Increased administrative and accounting effort	Savings linked to largely reduced purchase of plastic bags and linked storage costs. Increased sales of reusable bags and of bin liners.	Better image of the shop.	0
Consumers	Purchase of single-use plastic bags: EUR 670 million. Additional expenditure for bin liners and reusable bags. Total annual per capita cost: 0.03% of GDP/capita.				The satisfaction of doing something useful for the environment when using reusable bags.	-
Waste management				Savings for waste management: 95% reduction of incremental plastic bag waste. Reduced waste treatment costs: between EUR 138 million.		+ +

Overview of costs, benefits and distributional impacts (cont'd)

ciety			Employment losses in the plastic bag manufacturing and importing industry.	Jobs created in the manufacturing of reusable bags and bin liners and in the administration of the tax.	Total value of improved ecosystem services: 349 million EUR/year (Provisioning services: decreased ingestion of marine plastic bag waste by animals, e.g. fish, shellfish, turtles; cultural services: aesthetic and recreational services and non-use value) Saving of resources (mainly hydrocarbons, water and energy needed in the manufacturing process of plastic bags)	+ + +
Fishing sector					Additional earnings in the fishing sector due to improved health and biodiversity of marine species; Savings in the fishing sector due to less cleaning /repair – estimated to be about EUR 1 million per year.	+
Tourism sector				Avoided impact on the tourism sector: 591 million EUR/year.	Increased recreational value of Mediterranean coasts: 19 million EUR/year.	+ + +
Shipping sector					Less blocked intakes, less disruptions of operations as well as less required clean-up and repair.	+
Aquaculture industry					Less clean-up operations from less marine plastic bag waste. No quantification possible.	+
Coastal power stations					Less blockage of cleaning water intake screens, decreased removal of debris from screens and less maintenance costs. No quantification possible.	+
Overall balance (+/0/-)	+		+ +		+ + + +	

In conclusion...

Advantages and challenges to implementation

Implementing a tax on single-use plastic bags is linked to quite limited administrative and initial financial efforts. At the same time, the measure is very effective (about 95% reduction of the use of plastic bags) and creates significant revenues which cover expenses and provide funds for further environmental action and/or for example for accompanying awareness raising campaigns.

Want to know more?

Plan Bleu (2017). Socio-economic tools for supporting the achievement of Good Environmental Status of Mediterranean marine waters. http://planbleu.org/sites/default/files/publications/technical_report_good_environmental_status.pdf

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Voluntary agreements

Voluntary agreements can be made with retailers, supermarkets or producers to reduce the consumption of SUPBs

Why this measure?

Lightweight plastic bags are often only used once, for a few minutes, whereas they remain about 20 years in the marine environment (Alessi et al., 2018). On average, a European uses 175 single-use plastic bags (SUPBs) per year, although they could easily be replaced by long life alternatives (Surfrider Foundation Europe, 2018). Although the proportion of marine litter attributed to plastic bags varies depending on the location and the sampling methodology applied, there is a "consensus that plastic bag litter is amongst the most visible and persistent components of litter pollution" (Plan Bleu, 2017). According to UNEP (2009), plastic bags account for 8.5% of the marine litter items found in the Mediterranean (40% of the items found are linked to cigarettes or cigars). They can be ingested by marine animals either as a whole, or when they disaggregated into fragments; this way they enter the food chain (Alessi et al., 2018).

Together with bans and taxes, VAs are reduction strategies driven by the supply side. The value of VAs is that they do not attempt to force sudden changes in consumers and producers behavior, but they often leave the choice up to the consumers and give them time to change their consumption (UN Environment 2018). VA between the government and producers/retailers can act as an alternative to bans and be an effective instrument demonstrating public-private collaboration (UNEP 2018). VA can also be combined with other policies, such as regulations or economic instruments. They can also be put in place more quickly than other alternatives (Miller 2012).

The measure in the Mediterranean and beyond

Voluntary initiatives, often at the initiative of the government and retail sector, exist in many countries (UNEP/MAP 2018). Indeed, recently countries like in Belgium (in place since 2011), UK (2009), Finland (2016) and Germany (2016) and Austria (2017) have opted for a VA (Surfrider 2018). In the Mediterranean region, in contrast, few countries have VA in place except Tunisia, Greece and Spain. In Tunisia, two conventions were signed in 2017 between the Tunisian government and the Union Chamber of large retailers (UTICA) and The Union of Tunisia Pharmaceutics (SPOT), and SUPBs are no longer distributed since March 2017 in supermarkets and since March 2018 in pharmacies (UNEP/MAP 2018). In Greece, a VA is implemented on Syros island through a European project (LIFE Debag project). VA have also been established in Catalonia (Spain), since at least 2008. The main retail sector signed up to VA with the regional public authorities to promote prevention and reduce the consumption of plastic carrier bags. Some large supermarket chains now charge either for plastic carrier bags (Día) or pay a small amount back (around €0.10) if the customer does not take any plastic carrier bags (Eroski Group). « Pacto por la Bolsa in Catalonia » was signed in 2009 and by 2010, a reduction of 40% had been achieved (European Commission 2013). Outside Europe and the Mediterranean region, VAs have been put in place, for example, in Australia.

Implementing the measures

As defined in the EU Packaging Waste Directive, VAs entail a "formal agreement concluded between the competent public authorities of the Member State and the economic sectors concerned, which has to be open to all partners who wish to meet the conditions of the agreement" (EC DG ENV 2012). The VA takes place either between private actors and/or between the state. VA are based on the idea that participants can decide to commit themselves to go beyond regulation (Croci 2005), and it require parties to create specific rules applicable to the participants who commit to voluntary reduction or environmental improvements. Voluntary does not mean without obligations- there must be realistic targets, mutual trust, communication, and transparent monitoring (Miller 2012). Under VAs, for example, SUPBs can be charged, as it is already the case in some countries; if such an agreement encompassed all the largest retailers in the EU, it would correspond to a 55% (European Commission 2013; UNEP/MAP 2018). VA to waste prevention targets are generally sector specific, highly effective in achieving agreed goals and increase public awareness of the issue, as voluntary environmental actions undertaken by businesses are frequently well-publicized (EC DG ENV 2012).

The VA can be classified two main types: individual and independent or collective (through collective agreements) (Croci 2005; Miller 2012).

The process can come from the government or from public pressure. For example, in New Zealand in 2017, given the considerable public pressure from various groups to act on single-use plastic bags, the Ministry of Environment decided to pursue a VA. The negotiations was engaged with the two largest supermarket chains to encourage them to either charge for, or voluntarily ban, single-use carrier bags. Soon after the meetings, both chains announced the complete phase-out of such bags by the end of 2018 (UNEP 2018). Thus, there two main options within the VA with retailers, to stop free distribution of bags and to stop distributing single use of plastic bags. The cases in Tunisia and Catalonia show good results in tackling SUPB at supermarkets. However, in countries where the vast majority of the groceries sector is concentrated in small shops, additional measures are advised to reach that consumption, like tax or awareness campaign (UNEP/MAP 2018). For example in Belgium a combination of tax on disposable plastic bags charged on producers (€3/kg of plastic bags) and a VA of the retailers has delivered a reduction of 85% in the use of such bags in 2010 (European Commission 2013).

There are also agreements with plastic bags and plastic bottles manufacturers. For example, the European PET Bottle Platform is a voluntary industry initiative that provides PET bottle design guidelines for recycling and valuates PET bottle packaging solutions.

Under a VA, it is unlikely that there would be a dedicated monitoring and enforcement body, nor sanctions to ensure participating retailers stick to the targets and commitments set out (UNEP/MAP 2018).

Key facts

VA between the government and producers/retailers can act as an alternative to bans and be an effective instrument demonstrating public-private collaboration with a quick implementation

The measure

This measure provides financial incentives for consumers to change behavior (e.g. to use reusable bags) and at the same time generates environmental benefits.

The agreements can have different objectives: to stop free distribution of bags or to stop distributing single use of plastic bags. For bottles, deposit refund system can be implemented through VA.

Feasibility and acceptability

- *Make a package of measures and including VA with economic instruments and awareness campaign among citizens and stakeholders*
- *Target some actors at the national level, such as industries*
- *Provide financial support for the promotion and logistics (administrative in particular)*

Pre-conditions for successful implementation

The following factors of successful implementation can be identified:

- **Make it a package of instruments and get support from flanking measures**. A package of instruments, including command and control, voluntary and economic instruments rather than a single economic instrument (Plan Bleu 2017)
- **Support through funding, promotion activity and logistical support** for VA is highly recommended (EC DG ENV 2012). In the case Courtauld Commitment in UK (VA launched in 2005), the agreement is government funded and involves major retailers, brands, producers and suppliers (representing 92% of the UK grocery market) who commit to help deliver the targets (WRAP 2015; EC DG ENV 2012).
- **The VA should be undertaken at a national level**, in order to guarantee full coverage and result in lower plastic consumption (Miller 2012). Support for VA in specific industries is best achieved at national level, key examples including the EPA WasteWise programme, the Courtauld Commitment and the National Industrial Symbiosis Programme (EC DG ENV 2012). VA may also be appropriate where there are a limited number of polluters, as the costs of setting up a scheme based on an economic instrument may outweigh the benefits (UNEP et MAP 2015).
- For the reduction strategies to be successful and VA, **adequate social awareness** is necessary to engage citizens and stakeholders (Miller 2012) and should be regarded as a component of VA (UNEP/MAP 2018) – including for example promotion of alternatives to SUPBs. In Scotland, for example, with the slogan "Remember to re-use your carrier bags", the Scottish government and Scottish retailers ran the biggest street campaign ever. Based on the premise that an elephant never forgets, the campaign ran on TV and radio as well as in supermarkets and shops across the country. Twelve major retailers and almost 500 independent shops were on board, potentially reaching millions of consumers. The £466,000 campaign formed part of VA to reduce carrier bag use. (UNEP/MAP 2018). Thus, adequate social awareness can be an important and necessary instrument accompanying other measures such as VA (European Commission 2013).

Main challenges to implementation

This measure is purely voluntary and is therefore not always adopted by the economic sector. This was the case, for example, during negotiations and discussions in 2011 initiated by the European Commission with retailers – within the framework of the EU Retail Forum – on a voluntary commitment for the reduction/phase out of single-use plastic bags. At the end, both European organisations representing retailers, Eurocommerce and ERRT did not further pursue the idea of a voluntary commitment. One of solution for this problem can be the threat of regulation. It Is an important determinant in VA participation and effectiveness. Signatories will determine if the threat of regulation is more costly and problematic, then (most) will agree to sign the agreement in order to avoid the regulation (Croci 2005). For example, if the objectives of the VA are not met (i.e. reduction of 50% within 2 years), then a ban will automatically be imposed. This 'threat' of regulation can be a motivator for achieving VA targets.

Moreover, agreeing on voluntary action would require collaboration between retailers, which can be difficult to achieve and may be seen as interfering with market pricing mechanisms. Also, in absence of legal enforcement and regulation, there is the possibility of free-riders and usually few penalties (Croci 2005).

Effectiveness of the measure and related benefits

Being a voluntary measure, which can take different forms, it is almost impossible to estimate the effectiveness of the measure, if it was implemented in the Mediterranean as a whole. However, without an estimate of its effectiveness, it would not be possible to estimate some of the benefits according to the harmonized methodology, which has been applied to all measures included in the study. Thus, the estimate of effectiveness used in this study is based on available data on the percentage reduction in the use of SUPBs in some existing VA schemes.

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). Based on these estimates, it was decided to use a conservative estimate of the potential for litter reduction, equal to 30% of current SUPB use – to account for Southern Mediterranean countries with a large informal sector, where effectiveness of the measure is expected to be lower than in EU countries. These data were combined with EU data on SUPBs consumption, and namely: non-biodegradable SUPB in the EU are currently 85.3 billions; 8% of these are littered; the average consumption in the EUis 171 non-biodegradable SUPB/person; non-biodegradable bags weigh on average 8.6 g. The resulting expected potential effectiveness of VAs – assuming that these are implemented in all Mediterranean countries – is 17 700 tonnes/year.

Direct benefits

Direct benefits could only be estimated in a qualitative way, as information is scarce. For regulators, VA tend to have lower administration and compliance costs as compared to other measures, because they usually require few costly monitoring and enforcement and governments are less involved than in other measures, like bans. In addition, being voluntary agreements negotiated with authorities, this measure minimize disruption for the plastic industry, retailers and consumers.

Depending on how the scheme is designed, retailers might experience a reduction in the costs incurred in providing (free) carrier bags to their customers. Costs for providing plastic carrier bags would be drastically reduced, as retailers would forego the costs of providing single-use plastic bags free of charge, while charging for multiple-use plastic bags (European Commission 2013).

Direct economic impacts

Both the **plastic industry and retailers** benefit from increased sales of bin liners and reusable bags. Retailers benefit in addition from savings linked to largely reduced purchase of single-use plastic bags as well as linked to smaller storage costs (Plan Bleu, 2017).

In addition, retailers could improve their public image with a 'responsible' reputation that impact sales. For example, signatories of the UK retailer VA saw their sales volumes increase by 8.0% between 2006 and 2010. This could be partially explained through increased sales of reusable bags or increased customers satisfaction (Miller 2012).

Benefits: key figures

- *Expected reduction of marine litter: 17 700 tonnes/year*
- *Avoided costs for the waste management sector: 26 million EUR/year*
- *Avoided impacts on the tourism sector: 490 million EUR/year*
- *Total value of improved ecosystem services: 289 million EUR/year*

The public **waste management sector** (including landfills) saves money as a significant part of the plastic bag-related waste would disappear. The **avoided costs of collecting and processing the plastic waste** not used as a consequence of the tax are approximated by the minimal and maximal cost of landfilling 1 tonne of waste generated; the indicator is built on World bank data[1] on waste generation and management, based the income level of the country. Based on the estimated decrease in yearly SUPBs use at the Mediterranean level, these additional costs were estimated at 26 million EUR/year (average value).

The presence of marine litter on beaches is expected to reduce tourism arrivals. It is assumed that the current value of tourism receipts (based on WTO data)2 is 3% less than what it would be in the absence of beach litter3. On this basis, it is estimated that the reduction of marine litter following clean-up actions at the Mediterranean level would correspond to an **avoided impact on the tourism sector** of 490 million EUR/year.

In terms of **societal benefits**, jobs are created in the manufacturing of reusable bags and bin liners and in the administration of the tax (Plan Bleu, 2017).

Indirect benefits

Indirect benefits of VAs include:

- Cleaning up of beaches through voluntary actions will correspond to savings for regulators, who will thus be able to **save on beach cleaning operations**. Van Acoleyen et al. (2014) estimate the average cost of litter removal at 8170 EUR per km per year. If the measure were applied to the whole length of the Mediterranean coastline, and based on the expected effectiveness of the measure, it was estimated that total cost savings for beach cleaning amount to about 13 million EUR/year (own estimations based on Van Acoleyen et al., 20144).
- This study estimated **the increased recreational value of coastal environment** consequent to marine litter reduction (based on Brower et al, 2017 – see final report for full methodology). According to these estimates, based on the expected marine litter reduction of 17 700 tonnes per year, the increased recreational value of Mediterranean coasts would amount to 16 million EUR/year.
- This study estimated the **total value of improved ecosystem** services following the implementation of the measure at the Mediterranean level, based on the expected marine litter reduction and on the economic costs of marine plastics as related to the natural capital estimated by Beaumont et al (2019 – see final report for full methodology). The improvement in marine ecosystem services following the introduction of a tax on SUPBs at the MED level would amount to 289 million EUR/year. provisioning services (fish, shellfish, turtles) are supposed to increase due to decreased ingestion of marine plastic bag waste by animals. A positive effect can also be expected for cultural services: aesthetic and recreational services and non-use value (Plan Bleu, 2017).
- Reduced littering leads also to benefits for the **fishing sector**, in terms of **avoided costs** of removing litter from fishing gear, avoided costs of reduced catch revenue, avoided costs of broken gear and fouled propellers as well as avoided costs of rescue services. According to own estimations (based on Van Acoleyen et al. 2014), total benefits in this regard for the Mediterranean Sea would amount to 1 million EUR per year.

[1] https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-334852610766/What_a_Waste2012_Final.pdf
[2] WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - please refer to the final report of this study for more detail on the estimation method
[3] Calculations based on UNEP, 2017, and WTO - International tourists 2017 https://www.e-unwto.org/doi/pdf/10.18111/9789284419876 - Please refer to the final report of the study for more detail on the methodology
[4] For the full methodology, please refer to the final report of the study

Negative impacts and related costs of the measures

Direct costs

Some VA with retailers and educational campaigns involve government participation. In Hong Kong, for example, the awareness campaign cost the government For example, according to the (GHK 2007), the Hong Kong government actively participates in the voluntary retailer agreement. These costs the government 363,000 EUR each year, including marketing, staffing, and education and awareness (European Commission 2013). ,

Public authorities are also likely to face additional some costs related to monitoring (in particular to ensure compliance by retailers with reporting obligations); in the EU, in particular, this would be a small part of the costs already borne by States in the context of packaging waste (European Commission 2013).

The retailers are affected by the cost of administering and compliance with the VA (Miller 2012). Indeed, because there may be no (or little) government intervention in the VA, participants are responsible for all transaction, start-up, administrative costs, etc. These costs can include: drafting the agreement, data gathering, data checking, distribution, monitoring, revisions, and sanctioning (Croci 2005). In Australia, for example, extending Australia's Code of Practice from 2006 until 2016 cost participating retailers around 300 000 EUR. It is expected that small retailers will have more difficulties in implementing the measure, therefore entailing a high administrative burden in relation to the results (European Commission 2013).

Consumers may face an initial increase of costs, although these would decrease as consumers switch to reusable alternatives – e.g. 0.03% of GDP/capita in the case of the tax.

- **Direct economic impacts**

It is necessary to distinguish impacts per stakeholder groups :

Small retailers involved in a VA scheme are more at risk of losing customers, as customers might easily switch to retailers no involved in VAs (Miller 2012). In addition, if the measure is not adopted by a large part of retailers (supermarket, smaller retail shops and parallel market), some competitiveness issues might occur, and customers might eventually recur to retailers not involved in the VAs.

As illustrated in the main report, an estimate of the economic impact on the plastic industry is out of the scope of this study, as several variables are involved including import-export of SUPBs and reconversion of the plastic industry. A study conducted by BIOis (2011) concludes that, considering reconversion efforts by the plastic industry, the final impact of these measures might even be slightly positive.

Costs: key figures

- *Regulators: costs of awareness campaigns accompanying VAs*
- *Retailers: administrative and compliance costs*
- *Plastic industry: potentially, negative impacted – but it depends on its ability to reconvert to other production types (e.g. multiple use bags)*

In synthesis…

Overview of costs, benefits and distributional impacts

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	Gains	Costs	Benefits		
Regulators	Some costs related to monitoring (in particular to ensure compliance by retailers with reporting obligations) and awareness campaign	Have lower administration and compliance costs and also less administrative burden			Avoided costs for beach cleaning: 13 million EUR/year Cleaner public spaces might lead to higher tourist numbers.	+ +
Plastic industry		Minimal disruption for manufacturers	Not possible to obtain a reliable estimate	increased sales of bin liners and reusable bags		?
Retailers	Because there may be no (or little) government intervention in the VA, participants are responsible for all administrative and compliance costs (start-up, administrative costs, training staff etc.).	Reduction in the costs incurred in providing (free) carrier bags to their customers Minimal disruption for retailers: allowing maximum flexibility in achieving agreed outcomes and avoiding stricter regulation options More 'buy-in' from retailers. Better image in the public opinion	Risk of losing some customers Costs can include: drafting the agreement, data gathering, additional staff training, distribution, advertising and promotion… Additional cost of management for collaboration between retailers at national level	Gain a 'responsible' reputation and new customers (increasing sales volume) increased sales of bin liners and reusable bags	Better image of the shop.	0/-
Consumers	Some additional costs for consumers for the purchase of alternative bags. However, as assessed for other measures (ban and tax on SUPBs), this negative impact is expected to be very negligible	Minimal disruption for consumers			The satisfaction of doing something useful for the environment when using reusable bags.	-

Overview of costs, benefits and distributional impacts (cont'd)

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	Gains	Costs	Benefits		
Waste management				Savings for waste management due to less waste to be managed: 26 million EUR/year		+ +
Society			Employment losses on the industries on **single use** plastic bags manufacturers	Employment gains on **multiple-use** plastic bags manufacturers	The improvement in marine ecosystem services following the introduction of a tax on SUPBs at the MED level would amount to 289 million EUR/year (provisioning services: decreased ingestion of marine plastic bag waste by animals, e.g. fish, shellfish, turtles; cultural services: aesthetic and recreational services and non-use value) Saving of resources: reduced use of resources embedded in the production of single-use plastic carrier bags, and corresponding greenhouse gas emissions Increased public awareness toward marine litter issues	+ + +
Tourism				Avoided impact on the tourism sector: 490 million EUR/year.	The increased recreational value of Mediterranean coasts would amount to 16 million EUR/year	+ + +
Fishing sector					Avoided costs linked to plastic litter in fish gear and equipment: 1 million EUR/year	+
Overall balance (+/0/-)	0		+ + +		+ + + +	

In conclusion...

Voluntary actions are are simple and inexpensive to implement for retailers and governments, and are low-cost to consumers. The VA result in less participation from retailers as compared to compulsory options such as ban or tax.

To improve general performance and success of VA, suggestions are as follows:

1. Establish sanctions for non-compliance by participants. Without sanctions, participants will "compare the benefits deriving from the non-compliance with the expected costs" (Croci 2005).

2. An active, legitimate threat of regulation might increase effectiveness of VAs.

3. Targets must go beyond 'business as usual'. Voluntary action can stimulate innovation and performances, but the established targets must be set in advance.

4. Education and awareness campaigns must be organized at the same time of the implementation of VA for consumers to understanding the measures.

Want to know more ?

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