

CleanSea



Towards a Clean Litter-Free European
Marine Environment through Scientific Evidence
Innovative Tools and Good Governance

Policy brief

Best practice examples of existing economic policy instruments and potential new economic policy instruments to reduce marine litter and eliminate barriers to GES

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Authors

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Ecologic Institute
Benjamin Boteler, Katrina Abhold, Frans Oosterhuis, Pedro
Fernandez, Dariya Hadzhiyska, Denitza Pavlova and Joana
Mira Veiga

Revised by

Benjamin Boteler, Katrina Abhold, Frans Oosterhuis, Pedro
Fernandez, Dariya Hadzhiyska, Denitza Pavlova and Joana
Mira Veiga

Approved by
Dissemination level

H. Leslie (Coordinator)
PP



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Key Messages

- ☰ Applying economic instruments is a matter of using the price mechanism smartly to achieve social objectives, with due attention to impacts, costs and benefits throughout the product chain. This can be done at all levels of government, but also by private actors who may apply market incentives to steer the behaviour of their suppliers, employees and customers in a direction that is better aligned with the objective of a clean sea.
- ☰ By identifying, selecting and combining pre-determined success factors, policy makers can help to ensure the use of appropriate and therefore more effective economic instruments to prevent or reduce marine litter. These factors may include addressing most dominant types of marine litter in the area, targeting key stages of the product-to-waste cycle, and having legislative support.
- ☰ Economic instruments that are effective in one marine region may not be adequate in another and may need to be adapted to regional contexts. For example, drink bottles are among the most frequently found marine litter types in all regional seas except the Baltic Sea, highlighting the need for alternative instruments to address different marine litter types in the region.
- ☰ Economic instruments that specifically target regional marine litter issues (e.g. key drivers of marine litter such as cultural drivers or tourism and recreation) will be more appropriate to address regional challenges and therefore more effective at reducing marine litter.
- ☰ There are opportunities to widen and improve the scope of existing economic instruments (e.g. subsidies for innovation and fines for littering to further reduce marine litter) by expanding their geographic scope, increasing the amounts and directing subsidies for innovation to encourage specific types of products and services, or increasing monitoring and enforcement of littering fines.
- ☰ There is the potential to broaden and adapt the application of economic instruments to reduce marine litter in the EU, as not all of the key marine litter types (e.g. cigarette butts and cotton bud sticks) are addressed by economic instruments. For instance, applying economic instruments that are known to be effective in reducing consumption or increasing rates of collection (e.g. tax on plastic bags and deposit refund schemes for drink bottles) to other types of frequent marine litter items could be considered. Over time, these instruments should reduce the occurrence of these marine litter types, eventually eliminating them from the 'top litter item' lists.
- ☰ As most economic instruments are implemented at a national level, there is the potential to expand the geographic scope of economic instruments to the regional level to address shared regional drivers or sources of marine litter and combine

efforts to meet Marine Strategy Framework Directive (MSFD) Good Environmental Status (GES) for a region.

- The complexity of the marine litter problem means that measures, including economic instruments, should address the issue at different stages, from design and production to clean-up. This would help to ensure that addressing marine litter is not just a matter of cleaning-up. Well designed economic instruments can provide incentives that are transmitted through the product chain, ultimately stimulating innovation in 'zero waste' design and production.

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1 Introduction

Marine litter is a complex problem and recognised as a major and growing environmental concern (UNEP, 2009). It threatens marine ecosystems and biodiversity (e.g. through ingestion or entanglement by marine species) and ultimately risks human well-being by damaging socioeconomic activities (e.g. losses to fishing or clean up costs) and posing health risks (e.g. ingestion of plastics through the food chain) (EEA, 2015). Marine litter originates from diverse and various, sources both land and sea-based, and the types of items which end up in the world's seas and oceans are both varying and numerous (UNEP, 2009). Those often identified include plastic caps and lids, bottles, plastic bags, hygiene products, food containers, fishing nets, and cigarette butts (Interwies et al. 2013). These items can be found in great quantities on the ocean floor, in the water column, floating at sea, and along shorelines and coasts (UNEP, 2009). Exasperating the issue of marine litter is the significant lack of knowledge and missing information about how and why this momentous problem persists (EEA, 2015).

While scientists continue to work to understand how marine litter impacts marine ecosystems and biodiversity, as well as its subsequent effects on human health, current understanding and growing concerns mean that both society and policy makers alike recognise that increased efforts are needed to properly address the problem (EEA, 2015). Along these lines, European policy makers established the EU Marine Strategy Framework Directive (MSFD) to protect, preserve and where possible restore the European marine environment to ensure clean and healthy seas by 2020 (EC, 2008). It identifies marine litter as a key threat requiring increased action from policy and selects its presence as one of eleven descriptors of Good Environmental Status (GES). Regulations (e.g. laws), economic instruments (e.g. taxes and deposit schemes) and soft measures (e.g. voluntary actions such as organised beach clean ups) will all be required to meet this policy demand (EC, 2008). Moreover, given the complexity of the problem combined with resource constraints, policy makers must seek to design and implement policies which are both cost effective as well as maximise benefits to society.

The main objective of this policy brief is to provide a critical review and assessment of potential measures to reduce marine litter. The focus of this brief is on existing economic instruments implemented in Europe. It aims to point to critical factors which influence the appropriateness and effectiveness of economic instruments. It also seeks to show where the scope of current economic instruments could be expanded to explore their capacity to reduce marine litter. Such an evaluation of existing economic instruments to reduce marine litter is essential to furthering the necessary steps to achieve GES and sustainable marine ecosystem management.

This policy brief is a result of research conducted with the project Towards a Clean, Litter-Free European Marine Environment through Scientific Evidence, Innovative Tools and Good Governance (CleanSea) funded through the EU's Seventh Framework Programme (FP7).

2 Economic instruments

Economic instruments generally provide incentives or disincentives to encourage or discourage behavioural changes (Oosterhuis et al. 2014). With respect to marine litter, economic instruments are used to stimulate a gradual shift in behaviour through the internalisation of environmental costs (or benefits) into the prices of products or activities. As such, economic instruments are not prescriptive, e.g. dictating the use of certain technologies, the adoption of specific standards, or the reduction of marine litter by a target amount. Instead, they allow for greater flexibility in the approach to management and can stimulate transitions to new

innovative ways of production or consumption patterns that reduce litter (Oosterhuis et al., 2014).

Incentives aim to stimulate behaviour that alleviates the marine litter problem, e.g. in the form of encouraging recycling and reuse of materials and proper waste disposal. *Subsidies and fiscal incentives* are remunerations for any type of activities that prevent or reduce marine litter. These include economic or fiscal incentives; eco-design awards; subsidies for clean ups and waste management improvements; and fiscal incentives for firms investing in environmentally friendly techniques, equipment, and capital goods. *Deposit-refund schemes (DRS)* reward consumers who return packaging material and residues to manufacturers (and hence encourage recycling and reuse of high quality materials) by refunding a deposit that was charged upon the purchase of the potentially polluting product. *Price differentiation* can be used to encourage consumers to choose products and services that lead to less environmental damage (in this case marine litter), such as discounts related to a tax for treatment and disposal of municipal waste, or reduction of harbour dues.

Disincentives aim to discourage behaviour associated with the problem of marine litter through various charging or accountability schemes. These types of economic instruments can include: *'No Special Fee'* or *'One Fee'* for ships in ports, which charge for the reception, handling and disposal of ship-generated wastes as well as of marine litter caught in fishing nets, as part of the harbour fee. It is charged to the ship irrespective of whether waste is delivered in the port. On land, *Pay-As-You-Throw (PAYT)* schemes charge users based on the amount of waste they dispose for collection to a municipality; while *landfill taxes* (a type of weight-based charge) and *gate fees* charge users for the amount of waste they bring to a landfill, providing not only revenues that may be used to cover operating costs but also an incentive to reduce the amount of waste sent to landfill. Consumers can be targeted through instruments such as *plastic bag fees*, which discourage users from buying single-use plastic bags, *finer*, which charge firms or individuals who do not comply with set rules or standards (e.g. fines for littering), and *ecotaxes* or *tourist taxes*, which charge a set amount to individuals to help fund the maintenance of local facilities. Producers can be held liable through instruments such as *packaging taxes*, which charge producers for the use of certain polluting materials in their products, and *Producer Responsibility Schemes (PRS)*, which require producers to see to the end-of-life stage of their products and their collection, recycling and proper disposal.

3 Methodology and approach

This study considered economic instruments aimed at preventing or influencing the generation of marine litter, implemented and applied within the EU. The instruments were identified through literature reviews focusing on each marine region, as well as through existing expert knowledge. The four marine regions, as used by the MSFD, were selected to delineate the instruments. These are the Baltic Sea, the Black Sea, the Mediterranean Sea, and the North Sea.

The evaluation aimed to:

- Identify effective economic instruments in the four marine regions.
- Identify litter items, sources and drivers that are not sufficiently addressed by economic instruments.
- Explore the possibility to enhance, extend or upscale selected economic instruments.

- Provide options for improving existing economic instruments and new options that could be explored.
- Propose new economic instruments to address marine litter at different stages of its generation.

The evaluation of the selected economic instruments was carried out using multicriteria analysis (MCA) and based on a review of academic and grey literature, and cross-checked together with stakeholders. The MCA was based on the methodology developed by Volckaert et al. (2015) and has been adapted to fit the CleanSea context. The criteria were developed to evaluate the appropriateness and effectiveness of economic instruments to reduce marine litter. The criteria are formulated as:

- Relevance for addressing **key marine litter items** - based on top 10 marine litter items most frequently found on beaches for each region (see Table 1). Economic instruments that addressed more of these litter items were scored higher than those that addressed fewer of them.

Table 1: Key marine litter items¹

Rank	Baltic Sea	Black Sea	Mediterranean Sea	North Sea
Top 5	Cigarette butts	Cigarette butts	Smoking related products (Butts, tips, package and lighters)	String and cord (diameter less than 1 cm)
	Caps/lids (total)	Crisp/sweet packets and lolly sticks (total)	Plastic bottles	Caps/lids (total)
	Foam sponge (total)	Drink bottles (total)	Plastic bags	Cotton bud sticks
	Other ceramic/pottery items	Caps/lids (total)	Aluminium beverage cans	Crisp/sweet packets and lolly sticks (total)
	Bags (e.g. shopping)	Drink cans	Packaging, food wrappers and containers	Rope (diameter more than 1 cm)
Top 10	Food incl. fast food containers	Small plastic bags, e.g., freezer bags	Cups/plates/forks/knives/spoons	Nets and pieces of net < 50 cm
	Bottle caps	Food incl. fast food containers	Straws	Food incl. fast food containers
	Cutlery/trays/straws (total)	Cups	Plastic pieces	Drink bottles (total)
	Wood Crates	Clothing	Sanitary waste (cotton bud sticks, tampon applicators etc.)	Small plastic bags, e.g., freezer bags
	Crisp/sweet packets and lolly sticks (total)	Bottle caps	Fishing nets and fishing traps	Cigarette butts

- Relevance for addressing main regional **economic drivers of marine litter and barriers to GES (e.g. institutional or cultural aspects)** - based on previous CleanSea research

¹ Arcadis & EUCC (2013b): for the top 10 marine litter items of the Baltic, Black and North Seas; In the Mediterranean region, the list was agreed by Member States in the project *Technical and administrative support for the joint implementation of the Marine Strategy Framework Directive (MSFD) by the EU Mediterranean Member States (Phase II)* based on Interwies et al., 2013; UNEP/MAP MEDPOL, 2011; Arcadis, EUCC & Milieu, 2013a; and Öko-Institut, 2012.

which identified and assessed economic drivers of marine litter and barriers to reach GES per regional sea.² Economic instruments that addressed more of these economic drivers and barriers per region were scored higher than those that addressed fewer.

- **Relative impact on the source or activity** producing marine litter - considers the impact of an instrument on economic sectors or activities that can generate marine litter. Economic instruments that addressed an important regional sector or activity previously identified as producing marine litter were scored higher than those that addressed less important sources.
- **Type of economic instrument** - considers the impact and compliance of the instruments by differentiating between: economic incentives with legal backing (e.g. taxes), economic incentives (e.g. deposit refund schemes), economic incentives with communication engagement (e.g. subsidies for cleanup campaigns), and communication and stakeholder engagement (e.g. awards). Economic instruments that incorporated legal backing were scored higher than those without, as their implementation and uptake is not voluntarily based, while instruments based on communication and stakeholder engagement were scored the least, as this is a passive form of an economic instrument without financial implications.
- **Geographical scale** at which the instrument is implemented, from regional, national, sub-national to local level; economic instruments which covered a larger geographical scale were scored higher than those covering smaller scales.
- **Evidence of effectiveness** of the implemented instrument in reducing litter, considers whether the reviewed literature suggests significant quantitative reduction of litter, moderate reduction of litter (or little evidence), or no (evidence of) reduction of litter. Economic instruments supported by quantitative evidence of effectiveness were scored higher than those which have little or no evidence of effectiveness.
- **Stage in the 'product-to-waste' cycle** the instrument targets, ranging from design and production/packaging; use and consumption; collection/waste transfer; disposal, recovery, recycling; or clean up. Economic instruments which targeted earlier stages of the cycle were scored higher, as it is assumed these instruments have a trickledown effect reducing litter on all other stages, while being in line with the waste management hierarchy (Waste Framework Directive 2008/98/EC).

A scoring system from 1 (minimum) to 5 (maximum) was developed for each criterion and various weighting options were established and tested to identify and evaluate the importance and influence of the specific criteria on the overall score of an instrument. A number of outcomes were then used to identify the overall or general results of how the instruments compared against one another.

It must be noted that this approach has limitations, mainly in terms of the inherent subjectiveness of the assessment. In order to address this, an additional step was included, whereby multiple researchers reviewed the scored instruments to harmonise the assessment, ensuring consistency in scoring related to all criteria both within and between marine regions. Finally, a participatory workshop was held in the Mediterranean region³ and a questionnaire was sent out to key stakeholders in the Black Sea region, both of which focused on validating

² The executive summary of deliverable *Driving forces behind marine litter generation in European regional seas* can be found at <http://www.cleanease-project.eu/drupal/sites/default/files/project%20results/D4.1.factsheet.pdf>

³ Workshop held in Venice, Italy on 13 October 2015; EUCC Mediterranean Centre, 2015, in preparation.

the results of the MCA by assessing the effectiveness and feasibility of instruments with stakeholders.

4 Regional use of economic policy instruments

The following sections provide the regional results of the MCA and highlight those instruments which ranked highly in the various weighting options with respect to the criteria outlined above. In addition, an overall assessment for each region is included.

4.1 Baltic Sea

Twenty-two specific implemented economic instruments were identified in the Baltic Sea region. Of these, the particular types of instruments highlighted in the results of the assessment are a 'No Special Fee' for ships in ports, Pay-As-You-Throw (PAYT), packaging taxes and eco charges.

The results of the assessment suggest that the instrument 'No Special Fee' for the Baltic Sea region is a highly effective economic instrument. This instrument has a direct impact on marine litter and ranked high in the tested weighting options. This is because it is an economic instrument which is underpinned by legal backing and reaches a broad geographic scope, the overall Baltic Sea region. Moreover, the instrument addresses key drivers of litter identified in the region including maritime transport and insufficient financial incentives for prevention of marine litter as well as industrial activities and fisheries. Moreover, a review of academic literature underpins the result showing that there is a quantitative reduction in marine litter, though evidence is limited.

Another result of the assessment highlighted PAYT as a potentially successful and effective economic instrument. It scored high across the tested weighting options, as it is a legally backed economic instrument which addresses key drivers in the region such as cultural drivers and insufficient incentives for collection. A local instrument in Germany had one of the highest scores for evidence of effectiveness, supported by statistics regarding its success in the County of Aschaffenburg: reduction in household waste generation from 22,000 tonnes to 12,000 tonnes in its first year, and stabilising around 8,000 tonnes since with no observed increase in illegal dumping. A similar PAYT scheme in the Baltic Sea region also scored relatively well across the options, though lacked the concrete evidence of effectiveness included in the German example.

Estonia's packaging tax also ranked well as a potentially effective economic instrument. This is based on the assumption that a packaging tax imposed on producers (importers of goods in Estonia) impacts the *design and production* stage of the 'product-to-waste' cycle. However, there is little evidence of its effectiveness, reflecting its low performance when this criterion was considered. Similar packaging taxes in Finland and Denmark did not perform as well, due to the limitation of the tax in Finland to non-refillable beverage containers and in Denmark to bottles and jars, sales packaging and multi-packs (not considered top marine litter types for the Baltic Sea region).

Finland's EcoCharge (Ekoavgift) was identified as being a potentially ineffective instrument. The purpose of the charge is to promote waste sorting by covering costs associated with a recycling and collection station network, where households can freely deliver untreated wood, glass, electronic waste and batteries, card and paper, and metal. The reason for its expected poor performance is due to its failure to address key marine litter types in the Baltic (see Table 1), with little to no evidence of its effectiveness. Other instruments in the Baltic Sea region

receiving intermediate results in regard to effectiveness include plastic bag fees, landfill taxes / gate fees, DRS, PRS, and weight-based waste charges at landfills.

4.2 Black Sea

Eleven implemented economic instruments were identified in the Black Sea region. The assessment revealed that several instruments are potentially effective at reducing marine litter in the region. These include port reception fees, non-compliance fines (e.g. fines for littering), and packaging taxes.

The Bulgarian port reception fee (called 'No Special Fee' in the Baltic Sea region) is a potentially effective instrument according to the outcome of the MCA. As in the Baltic, this economic instrument is underpinned by legal backing, addresses key drivers identified for the region (including, insufficient incentives for collection, reusing and recycling of plastics and packaging; and insufficient incentives to prevent and clean up marine litter), and is supported by evidence from academic literature. The implementation of the instrument on a national scale in Bulgaria, indicates that it has the potential to be more effective when up-scaled to the whole Black Sea region.

Non-compliance fines were also identified amongst the most appropriate instruments to prevent marine litter. These instruments are legally backed and used in cases where specific waste management rules are not adhered to. They were assessed relatively positively because they successfully address economic drivers of marine litter (e.g. recreation and tourism) and barriers to GES in the region, as well as impacting sources and activities of marine litter, such as land-based sources of litter associated with municipal waste management. However, stakeholder responses from the Black Sea questionnaire debated the effectiveness of these fines, suggesting that the enforcement of littering fines should be improved and the level of these fines increased for violators.

Packaging taxes in both Bulgaria and Romania obtained mixed results. They scored high in relation to the life cycle stage they target, as they tackle litter at an early stage in the 'product-to-waste' cycle and there was significant evidence from academic literature regarding their effectiveness. However, they do not address as many key economic drivers of marine litter and barriers to GES (e.g. sufficient waste management infrastructure) identified in the Black Sea region, in comparison to other applied instruments in the region, and therefore have little relative impact on key litter sources and activities. The implications of these results may indicate that, despite its relative success, a packaging tax may not be the best instrument to address marine litter in the Black Sea.

Interestingly, the lowest performing instrument in the Black Sea also comes from Bulgaria in the form of a DRS. Though generally considered a successful instrument, because DRS in Bulgaria is only applied to glass bottles limits its overall potential to prevent marine litter. However, if it is extended to other frequently found items deposited on beaches, such as plastic and aluminium drink containers, it could become a more effective instrument to prevent these items from ending up in marine environments. Other instruments in the Black Sea region with intermediate scores include plastic bag taxes, landfill taxes, subsidies for waste management improvement, tourist taxes, and fines for campers. Responses to the Black Sea questionnaire validated these findings, indicating positive perceptions towards port and ship waste management, subsidies for waste management improvements, plastic bag taxes and fees, as well as fines for littering. In addition, participants urged for improved public awareness campaigns in the region.

4.3 Mediterranean Sea

For the Mediterranean, a total of ten instruments implemented across the region were identified. The results highlighted several instruments as potentially effective: One Fee system at ports, DRS for beverage packaging, plastic bag fees, and PAYT.

Similar to the 'No Special Fee' in the Baltic Sea and the port reception fee in the Black Sea, the One Fee implemented in Spanish ports incentivises ship owners to collect and properly dispose of their ship-generated wastes. In the Spanish example, discounts are given in the event that a ship meets certain requirements (e.g. on board waste management systems). As in the Baltic Sea and Black Sea cases, the Mediterranean example is suggested to be effective because it is backed by legislation and addresses key drivers of marine litter identified in the region. It also has the potential to be more effective when up-scaled to a regional level in the Mediterranean Sea.

Another highly effective instrument was the DRS pilot project in Cadaqués, Spain. It scored high in the assessment because it addressed key drivers in the region such as cultural drivers, insufficient incentives for collection, insufficient awareness, and insufficient financial incentives for prevention of marine litter. It is therefore expected to have a meaningful impact on sources of litter. It also is expected to be effective as it addresses the collection/waste transfer stage of the 'product-to-waste' cycle, meaning it addresses waste close to the source as opposed to once it reaches the marine environment. However, since it was implemented only at a local level, it has limited geographical impact. Overall, DRS for beverage packaging has a high potential to impact marine litter levels in the Mediterranean, if implemented and up-scaled throughout the region. These results are in line with the outcomes from the Mediterranean stakeholder workshop,⁴ in which participants rated DRS as the fifth most effective type of measures among twenty-three identified.

Additionally, single-use plastic bag fee and PAYT in Elefsina, in Greece, also scored relatively high, both showing evidence of effectiveness and the potential to be up-scaled across the Mediterranean. Both instruments scored high across the tested weighting options, as they are enforced by legislation and are expected to have broad impact on waste prevention, according to available evidence. In addition, potential adaptations of these instruments could create synergies with environmental protection. For example, in the case of supermarkets charging for plastic bags, this revenue could be devoted to an environmental fund and used to finance and support environmental activities, as done in Ireland (Convery et al., 2007).

An instrument identified as potentially ineffective in the Mediterranean region was the Eco-tax in the Balearic Islands, collected by accommodation facilities. The instrument is used to fund projects on nature restoration and tourism promotion, and lacks specification of addressing marine litter. Hence, despite being an economic instrument with legal backing, the general broadness of the tax hinders it from performing well in comparison to more targeted instruments. Those instruments with mid ranking results include discounts related to the Metropolitan tax for treatment and disposal of municipal waste, charges on single-use plastic bags at supermarkets, taxes on disposal of industrial waste, and eco-design awards.

Regarding economic drivers of marine litter and barriers to GES, both fisheries and aquaculture and maritime transport are important drivers in the Mediterranean, but not many economic instruments address these sectors. For example in the case of fisheries and aquaculture, implementing DRS schemes for fishing nets or fish boxes could considerably prevent its improper disposal.

⁴ EUCC Mediterranean Centre, 2015, in preparation.

4.4 North Sea

For the nine economic instruments identified in the North Sea region, the assessment resulted in positive results for the following instruments: fines for littering, packaging taxes, and DRS while “Fiscal Incentives for Enterprises Investing in Environmentally Friendly Techniques”, and subsidies for cleanups showed interesting results.

Fines for littering are identified as highly effective instruments in the North Sea region. This is due to the ability of the fines to address multiple top marine litter types, litter-generating sources and activities, as well as key economic drivers of marine litter and barriers to GES in the North Sea. This instrument also has the potential to be explored and widened (see section 5).

Similar to the packaging tax in the Black Sea, Belgium’s drink packaging tax also showed mixed results. Though generally scoring high across the criteria and thus indicating its effectiveness, this instrument scored very low with respect to evidence of effectiveness. This is generally due to a lack of information regarding the impact this tax has on producers of drink packaging. Should there be an indication that this instrument has demonstrated changes in drink packaging design or production in Belgium, it has the potential to be a highly effective instrument in the North Sea region.

DRS in the Netherlands is another interesting example, providing the counterpart to Belgium’s packaging tax. Despite receiving relatively high scores for both evidence of effectiveness and ‘product-to-waste’ cycle stage (at the collection/waste transfer stage), the DRS scheme scored comparatively low with respect to addressing key drivers of marine litter and barriers to GES in the North Sea.

“Fiscal Incentives for Enterprises Investing in Environmentally Friendly Techniques” obtained a relatively low score in the effectiveness ranking for the North Sea region. This result is mainly because this type of instrument addresses a sector and types of economic drivers of marine litter and barriers to GES that are considered relatively less important for marine litter in the North Sea region. Furthermore, there is little evidence on its effectiveness.

Subsidies for beach and riverbank cleanups are considered to have low level of effectiveness when the criteria relating to geographical scale, evidence on effectiveness and stage in product-to-waste cycle are considered. The other instruments considered for the North Sea region including reduction of harbour dues, plastic bag fees/charges, and PRS, obtain intermediate results regarding their effectiveness.

5 Widening the scope of economic instruments

The preceding section has presented a rich sample of economic instruments used to prevent and reduce (marine) litter in the four European marine regions. The analysis above indicates that an economic instrument’s usefulness and potential impact in terms of addressing marine litter in a cost-effective way differs depending on the criteria used and the importance given to them. In general, however, some trends in the analysis can be extracted.

For example, instruments tend to get a relatively low score if they address a type of waste that does not correspond to key regional items of marine litter or if there is limited evidence on their performance. This lack of evidence may be due to the limited extent to which the instrument is applied, and/or because its effectiveness has not been (publicly) evaluated. Insufficient information regarding instrument implementation in non-EU countries must also be considered a limitation of the current analysis. For example, an environmental tax in Turkey

with a particular focus on financing certain services, such as garbage collection, received a low score due to the limited evidence for effectiveness in literature and to a low 'product-to-waste' cycle score. Rather than discarding such instruments right away, it is recommended to broaden the evidence base: by evaluating them more systematically and by extending their (experimental) application to attain more information.

This section briefly looks at two examples of such relatively neglected economic instruments: subsidies to early adopters of clean technology and fines for littering. The first instrument impacts the start of the 'product-to-waste' cycle, whereas the second aims to impact the end.

5.1 Subsidies for clean technology

In economic terms, the insufficient provision of environmental innovation such as clean technologies is an example of a 'double market failure' (Jaffe et al., 2005). Environmental pollution, as a negative externality, calls for internalisation by means of e.g. taxation, hence the Polluter Pays Principle (PPP). Innovation, on the other hand, tends to be undersupplied in competitive markets and its positive externalities call for internalisation by e.g. subsidies. Environmental innovation, thus, justifies an exemption from the PPP and from the EU principle that state aid is prohibited (European Commission, 2014). Especially with respect to preventing or addressing sources of marine litter, incentives for innovation have the potential to affect the entire 'product-to-waste' cycle (if they lead to changes in products or production processes that prevent waste).

The EU provides financial support to the development and diffusion of new, cleaner technology in various ways, e.g. by means of its Research and Technological Development framework programmes and the European Structural and Investment Funds. Member States also apply a variety of financial support instruments to stimulate innovation, including eco-innovation. The Netherlands, for example, has a fiscal incentive scheme for the accelerated or free depreciation of investments in innovative, environmentally-benign equipment and capital goods (MIA/Vamil). In the period 2005 to 2010, the top ten supported equipment did not include any category that is relevant for marine litter (Van Heekeren and Frima, 2012). Updated annually, the 2015 list (RVO, 2015) contains several waste-related types of equipment, e.g. for the production of products containing bioplastics. The 2016 list will investigate the option of extending the scope to the area of marine litter.

The effectiveness of subsidy schemes is often not evaluated. For example, in the period 2005 to 2009 there were 633 national subsidy schemes in the Netherlands, of which only 81 were evaluated, and most of them not on effectiveness (Algemene Rekenkamer, 2011). Evidence on effectiveness, however, is a prerequisite for a proper design of possible new subsidy schemes and improvement of existing ones, as well as for their political acceptance. A systematic review of experiences with various kinds of financial support to eco-innovation is recommended to better assess their potential in stimulating the market for products and processes that can contribute to cleaner seas.

5.2 Fines for littering

Fines are, in principle, an adequate instrument to apply the PPP to littering behaviour. In practice, however, fines are difficult to enforce, as the polluter or litterer must be caught violating the established law by a competent authority. In general, littering occurs at an individual level, making enforcement challenging. Given the high cost of enforcing such regulations, 'second best' instruments (e.g. taxes on disposable containers or DRS) are often employed on grounds of economic efficiency (Kohn and Pines, 1990; Lee et al., 1988). Nevertheless, penalties do play a role in litter prevention policies, albeit to varying extents in

different countries. The experience with ‘Fixed Penalty Notes’ in the UK shows that “although they themselves are not a shortcut to improving the quality of local environments, they are powerful tools when they are underpinned by the education and engagement stages of a strategy” (Keep Britain Tidy, 2011). However, fines can also have a counterintuitive impact, if they are perceived as a ‘price’ giving legitimacy to the offence (Gneezy and Rustichini, 2000). This highlights the importance of appropriate ‘framing’ of the instrument: it is more effective if it is clear that the punishable act (e.g. littering) remains improper even if the fine is paid (Kurz et al., 2014).

Standard fine levels for littering differ between and within EU Member States, as exemplified in the North Sea region (see Table 2). Future studies could analyse the impact of fine levels, in combination with enforcement intensity, on the actual size of the litter problem, taking due account of various other factors (e.g. social, cultural and educational) that play a role. This might lead to better insights in what is ‘best practice’ with respect to this specific economic instrument.

Table 2: Default fine levels for first offenders littering small item of non-hazardous waste in different EU countries in the North Sea region

EU Member State	Fine level in €	Remarks
Belgium (Flanders) ⁵	up to 350	differs between municipalities
Germany ⁶	5–100	differs between Länder
Ireland ⁷	150	
The Netherlands ⁸	140	
UK ⁹	100	default penalty (75 GBP)

6 Discussion

This policy brief aims to identify and highlight economic instruments which are potentially effective to reduce marine litter in EU marine regions. The results of the assessment provide valuable insights into economic instruments, how they are applied and how they could potentially be improved to better target this challenging issue. The results show that certain individual factors can significantly impact the effectiveness of instruments. According to the selected criteria, those instruments which are backed by law, target specific marine litter types, address key economic drivers of marine litter or barriers to GES, have a broad geographic scope, or target the reduction of waste in the design and production stage are expected to have a greater impact and more effectively reduce litter. This also means that when these factors are used in combination, economic instruments are expected to have an even greater impact and effectiveness on reducing marine litter.

A good example of this is that instruments addressing a broad range of marine litter types perform better with the selected criteria. According to the assessment, the reduced port reception fees on waste from ships was deemed a successful instrument in all sea regions, both at the regional scale (e.g. Baltic) and at the national scale (e.g. the Netherlands, Spain,

⁵ https://www.besafe.be/sites/besafe.localhost/files/wetgeving/omzendbrief_gas_nl.pdf (visited 14 October 2015)

⁶ www.bussgeldkatalog.net/umweltschutzordnungswidrigkeiten/krw-abfg/ (visited 14 October 2015)

⁷ http://www.citizensinformation.ie/en/environment/environmental_protection/litter_law.html (visited 14 October 2015)

⁸ <https://www.om.nl/onderwerpen/feiten-tarieven/> (visited 14 October 2015)

⁹ <https://www.gov.uk/guidance/fixing-penalty-notices-issuing-and-enforcement-by-councils> (visited 14 October 2015)

Bulgaria), despite the lack of evidence of effectiveness of this instrument in the North Sea. Conversely, economic instruments that focus on one marine litter type offer a targeted approach (e.g. plastic bag fees) to tackle a marine litter item but limit their overall scope to reduce multiple marine litter types. However, depending on the characteristics and considerations of plastic bags as a litter type, policy makers may choose to select this strategy.

At the same time, it cannot be said that economic instruments which are considered effective in one marine region will be effective in another region. For example, DRS instruments were identified as effective instruments in the Mediterranean region, while being considered less effective in other regions. This is due to regional differences such as drivers of marine litter and main marine litter types and the design of the regional DRS to target these.

Nevertheless, the assessment showed that in only one instance is an economic instrument implemented at a regional level. The 'No Special Fee' system focuses on the entire region, potentially to discourage ships from selecting ports with lesser fees. In most cases, economic instruments are implemented at a national level, while in much less cases they are implemented at a sub-national or local level. Given the multi-scaled level of the problem, it could be expected that instruments would be utilised more evenly across the geographic scales.

Another identified trend is that instruments targeting the *design and production/packaging* stage of the product-to-waste cycle generally failed to score well overall in the scheme developed for this assessment. For these types of instruments it is often difficult to establish a clear connection with a reduction of marine litter. Furthermore, these instruments tend to rely on incentives and voluntary schemes and may therefore be less immediately as effective as legally binding economic instruments (i.e. taxes, restrictions, bans, mandatory fees, etc.). Regardless, participants of the Mediterranean stakeholder workshop favoured instruments that target upstream stages of production and use, which lead to a reduction in the final consumption of items, i.e. waste prevention vs. clean-up. Even with these shortcomings, the importance of this cycle stage in preventing top marine litter types (e.g. unnecessary packaging and single-use products) warrants support and expansion of implementation of these economic instruments, especially with consumer backing.

Stakeholder responses to the Black Sea questionnaire also discussed the effectiveness of some of the instruments mentioned above, providing some insight into public perception. Plastic bag fees and taxes were considered highly effective among the participants, together with subsidies for waste management improvements and port and ship waste management. Fines were perceived as relatively good instruments to address littering, though stakeholders suggested improvements in the enforcement of littering fines as well as an increase in fines for violators. Lastly, participants of the workshop strongly supported awareness campaigns of marine litter, reflecting their perceived need for more information. In addition to discussing the effectiveness of particular instruments, participants also commented on the stages of the product-to-waste cycle which should be addressed, highlighting *disposal, recovery, and recycling* as top priority, followed by *collection/waste transfer* and *design and production/packaging*.

In terms of gaps found in the analysis, two of the most important litter categories in all marine regions were not appropriately addressed: smoking-related products and sanitary waste. Though taxes on cigarettes to discourage smoking and awareness campaigns are somewhat effective in preventing smoking, these instruments do not contain an incentive for smokers to dispose of cigarette butts properly. Fines and penalties or non market-based measures may be able to address this gap. While a similar situation occurs with cotton bud sticks, which end up

in the sea due to land-based sources, a more effective measure may be an awareness campaign highlighting eco-alternatives or perhaps a ban on plastics in their production. In both cases economic instruments encouraging eco-design in the *design and production/packaging* stage should be explored, e.g. through awards or requirements on alternative materials.

In regard to evidence of effectiveness for economic instruments, the assessment showed that there are very few economic instruments with strong evidence from the literature suggesting they lead to a significant quantitative reduction. These are the PAYT in Germany, the PRS in Sweden, the plastic bag taxes in Ireland, and the DRS scheme on bottles in the Netherlands. For the majority of instruments, evidence from the literature shows moderate or little quantitative reduction in marine litter. This is mostly because there is limited research into the effectiveness of economic instrument to quantitatively reduce marine litter and, therefore, the instruments should not be disregarded based on lack of concrete evidence.

Two types of economic instruments, subsidies for innovation and fines for littering, were explored here to demonstrate examples of how policy-makers could widen the scope of economic instruments to explore their effectiveness to address marine litter. Subsidies offer a method to support innovation and boost market presence of products and processes which reduce marine litter. Fines for littering require more knowledge to obtain an in-depth understanding into the marginal differences stemming from fine levels and enforcement intensity. Other economic instruments may also offer new opportunities with a broadened scope.

Overall, both the evaluation of existing instruments and the experimental introduction or broader application of carefully designed new ones should be a priority for policy-makers. It is quite likely that not all of these instruments will turn out to be cost-effective in terms of the overall MSFD objective, but the value of a broader evidence base and mutual learning would justify this investment.

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