

# CleanAtlantic

## Tackling Marine Litter in the Atlantic Area

DELIVERABLE 4.3.2, 4.3.3 and 4.3.4 - Review of economic sectors impacted by marine litter in the Atlantic Area: Cost-benefit analysis; General overview of economic impacts and policy recommendations; Guidelines.

WP 4: Marine litter in the Atlantic Area

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# Policy, strategy and operational instruments to tackle marine litter in the Atlantic Area

## 1. INTRODUCTION

The marine litter problem is affecting many marine economic sectors, like tourism, fisheries, and aquaculture, for example, which we have analysed in detail in Task 4.3 of Clean Atlantic. To tackle the marine litter issue, effective marine litter policies able to address these impacts, either temporarily like beach clean-up or more long-term like a single use plastic ban, have to be designed and implemented. Our work in Task 4.3 was aimed to identify the costs and the benefits of different potential marine litter policies in the tourism, fisheries, and aquaculture sectors. In this document we present some cost-benefit analyses building on the results of the case study area investigations undertaken in Task 4.3.2 (see Grilli et al., Loureiro et al., and Parretti et al.) in order to provide some recommendations on how to design the needed marine litter policies for these three sectors in the light of the results of the whole work undertaken in WP4.

## 2. Policy evaluation

One way to study the performance of a policy before or after its implementation is through a policy evaluation. To inform the design of a new policy, as it may be the case here with marine litter policies, an evaluation before the policy is implemented can be very useful. The evaluation process can be done on a qualitative or a quantitative basis. As reported in the Magenta Book (HMT, 2020), there are different types of evaluation, each of which tries to answer a different question:

- Process evaluation: what can be learned from how the intervention was delivered?
- Impact evaluation: what difference has the intervention made?
- Value-for-Money evaluation: is this intervention a good use of resources?

A cost-benefit analysis (CBA) tool, using a common monetary metric, can help to identify the 'value for money' of a specific policy because it compares the societal benefits the policy may bring with the costs of designing and implementing the policy. It provides a holistic view because it usually includes the financial, environmental and social impacts of an intervention (HMT, 2020). In Task 4.3.2 we have estimated the potential economic benefits of implementing marine litter policies. That information is useful not only to understand the preferences and willingness to pay of the respondents (e.g. those potentially positively and negatively affected by the policy) and therefore to understand what are the characteristics of a policy that may be implemented, but also to be used as an expression of the potential benefits of the new policy, and therefore used in cost-benefit analyses. Our results in Task 4.3.2 provide information to make assumptions on how the policies considered might work. In this report, we present initial value-for-money evaluations to provide an indication and initial guidelines on how the process could be developed for marine litter policies

implementation around Europe and to benefit different economic sectors. Therefore, any country that wanted to implement a similar process could undertake the policy evaluation in a more or less complex manner, bearing in mind what in the Magenta Book is defined as the principle of ‘proportionality’ (HMT, 2020); in other words, as not all interventions require the same level of scrutiny, the policy evaluation has to be proportional to the level of scrutiny required for that intervention. Also, the evaluation results will provide information to check if the potential benefits will outweigh the potential costs of a new marine litter policy implementation and to compare this to other alternative interventions the policy maker may be interested to. However, it is not always possible to collect information on all the societal costs and benefits needed for a full evaluation; this may be because of ‘proportionality’ or simply because for different reasons data are not available.

### 3. Marine litter policies and economic activities: tourism, fisheries and aquaculture

Initial international regulation on marine litter dates back to the seventies with the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters (1972) and the Convention for the Prevention of Pollution from Ships (known as MARPOL 73/78).

At the level of the EU, the EU Water Framework Directive (WFD)<sup>1</sup> and EU Marine Strategy Framework Directive (MSFD)<sup>2</sup> include provisions on reducing pollution and marine litter respectively. The MSFD requires member states to undergo monitoring programmes to measure the trend in levels of pollution as well as to distinguish pathways and sources (Nems et al., 2017) in order to achieve Good Environmental Status (GES) of EU marine waters by 2020. The directive defines GES in terms of 11 descriptors and descriptor 10 is specific to marine litter stating it requires litter to be at levels where ‘properties and quantities of marine litter do not cause harm to the coastal and marine environments’. Moreover, with the launch of the Circular Economy Action Plan, the European Commission committed to “adopt a strategy on plastics in the circular economy, addressing issues such as recyclability, biodegradability, the presence of hazardous substances of concern in certain plastics, and marine litter” (European Commission, 2015). Other European directives that also affect marine litter are:

- the EU Bathing Water Directive<sup>3</sup>
- the EC Urban Waste Water Treatment Directive<sup>4</sup>
- the EU Environmental Liability Directive<sup>5</sup>
- the EU Directive on Packaging and Packaging waste<sup>6</sup>

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<sup>1</sup> Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for community action in the field of water policy.

<sup>2</sup> Directive 2008/56/EC of the European Parliament and of the Council from 17 June 2008 establishing a framework for community action in the field of marine environmental policy.

<sup>3</sup> DIRECTIVE 2006/7/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC.

<sup>4</sup> Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment.

<sup>5</sup> Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage.

<sup>6</sup> The European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste.

- the EU Waste Framework Directive<sup>7</sup>
- the EU Single Use Plastics and Fishing Gear Directive (SUP)<sup>8</sup>
- the EU Port Reception Facilities Directive (PRF)<sup>9</sup>

Although not always addressed directly, the economic sectors of tourism, fisheries, and aquaculture, considered in Task 4.3 of CleanAtlantic, benefit from the implementation of these policies. Our case studies aimed at providing information to design and implement policies specifically for each of those economic sectors by the appropriate municipality.

### **3.1. UK and Irish Case study summary**

The CleanAtlantic case studies in England and Ireland aimed at assessing the preferences and willingness to pay of respondents for a cleaner beach (Grilli et al.). A choice experiment was conducted in two different regions in England and one region in Ireland with over 1,500 respondents. The results show a positive willingness to pay and can be used to inform a cost-benefit analysis to verify the value-for-money of designing and implementing such potential marine litter policies (see Section 5.1).

#### *3.1.1. UK marine litter related policies*

At present, in the UK, the Prime minister is leader of Her Majesty's Government and is ultimately responsible for all policy and decisions. A number of government departments and agencies are responsible for putting marine litter policy into practise and in Scotland, Wales and Northern Ireland, the devolved administrations, are responsible for domestic policy. Local government is responsible for making and carrying out decisions regarding local services at county council or district, borough, or city council level. In 2018 England launched the 25 Year Environment Plan, and 'Our waste, our resources: A strategy for England'. Both ambitious plans that include aims to eliminate avoidable waste by 2050, move towards a circular economy and put greater responsibilities on businesses to address waste challenges (polluter pays principle). Scotland and Northern Ireland have specific marine litter strategies.

UK policies and measures relating to marine litter include (but are not limited to): Single Use Carrier Bag Charge Order (2015), Environment Protection (Microbeads) Regulations (2017), Environment Protection (Plastic Straws, Cotton Buds and Stirrers) Regulations (2020), waste prevention programmes (inc. Scotland's zero waste plan and Keep Britain Tidy) and the Fishing for Litter (FFL) scheme. Both sea-based and land-based sources are considered, many of the policies are relating to waste management so they have a bearing on marine litter, however, are not addressing it directly.

The cost of 40% of local authorities removing beach litter in 2010 through beach cleaning and annual costs was estimated to be £15.5 million (Mouat et al. 2010). The main economic cost to municipalities is the cost of keeping beaches clean, including: the collection, transportation and removal of litter as well as costs involving administration and contract management, and indirectly volunteering time. Moaut et al. (2010) distributed a survey to local government authorities in the UK to gain a better understanding of their role in

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<sup>7</sup> Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

<sup>8</sup> Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment.

<sup>9</sup> Directive (EU) 2019/883 of the European Parliament and of the Council of 17 April 2019 on port reception facilities for the delivery of waste from ships, amending Directive 2010/65/EU and repealing Directive 2000/59/EC

the removal of marine litter from UK beaches. When asked why they undergo beach cleans, 89% of municipalities noted this was due to the fact that the beaches were a “popular tourist area.” Mouat et al. (2010) concluded that protecting the local economy and tourism seemed to be a larger incentive for beach cleaning rather than the statutory or regulatory requirements. Furthermore, over 95% of municipalities recognised tourists as a key user group of the beaches that were in question, revealing the significance of tourism as an incentive for marine litter removal. Mouat et al (2010) noted also that 46.3% municipalities disposed of marine litter to warrant a Blue Flag award at that beach or beaches. Blue Flag Awards are considered “gold standard” awards to guarantee to tourists that the beach satisfies particular standards regarding water quality, safety etc. in the same survey, all but one municipality interviewed had implemented measures to prevent litter (e.g. litter bins and notices proved to be the most popular practices). Numerous municipalities were also implementing other measures such as fixed penalty notices and fines for littering, building awareness within the local community through newsletters and talks in schools etc, as well as offering specific recycling bins on beaches.

The Cornwall coasts, one of the areas of our UK case studies, featured frequently in local and national news articles highlighting the extent of the marine litter problem in this area, especially after “Storm Eleanor” hit the UK and dumped masses of litter along the Cornish coastline. The Cornwall Wildlife Trust has set up several initiatives to tackle and highlight the problem in the area such as voluntary beach clean ups, and local businesses are also partaking in strategies to reduce marine litter.

### *3.1.2. Ireland marine litter related policies*

In Ireland, the Department of Housing, Local Government and Heritage (DHLGH) is responsible for national marine environmental policy and is the competent authority for the implementation of the MSFD. Because of the cross-cutting nature of marine-related issues, other Departments and agencies are intrinsically linked to the process including the Department of Agriculture, Food and the Marine; the Department of Transport; the Department of Environment, Climate and Communications (DECC); the Marine Institute, the Environmental Protection Agency as well as a variety of other agencies and stakeholders.

The Department of Transport, for example, is responsible for the implementation and enforcement of legislation relating to MARPOL. It attends the Marine Environment Protection Committee (MEPC) at the International Maritime Organization, as well as a number of other working groups, to further enhance and develop policies at an international level in relation to ship source pollution. In 2018 MEPC adopted an action plan aimed at preventing marine plastic litter entering the ocean through ship-based activities. It is also responsible for the transposition of EU Directives in relation to reception facilities at ports for the delivery of waste. The PRF Directive, which was transposed in June 2021<sup>10</sup>, provides for an indirect fee for all ships which then allows them to discharge Annex I (Oil and Oily Water) and Annex V (Garbage) waste with no additional costs which further incentivises ships to offload their waste at ports. The Department of Transport is responsible for the approval of individual port waste plans to ensure that adequate facilities are available at Irish ports.

The DHLGH works closely with Bord Iascaigh Mhara (BIM), Ireland’s Seafood Development Agency, to encourage programmes such as the Fishing for Litter (FFL) scheme, which was launched in 2015. Currently,

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<sup>10</sup> PRF Directive transposed by S.I. 296 of 2021 the European Union (Port Reception Facilities for the Delivery of Waste from Ships) Regulations 2021.

there are 244 vessels registered, totalling 1,169 crew members across a national network of 12 major ports. Part of BIM's remit is to support the sector to improve and demonstrate environmental performance and best practice. BIM, in partnership with its stakeholders, has ambitious plans under the strategic umbrella of Clean Oceans to proactively support the industry in their future obligations of the SUP and PRF Directives. Clean Oceans is the inclusive umbrella which allowed BIM to explore and foster growth with multiple stakeholders. New stakeholders arose from within the sector but also wider non-traditional sectors such as plastic recyclers and entrepreneurs and also from EU projects and initiatives that had an interest in marine plastics. Clean Oceans became an umbrella term for all the various actions and initiatives in the seafood sector that contribute to having a Clean Ocean.

DHLGH engages with DECC to harmonise marine litter, general waste management and anti-litter policy. Measures such as the plastic bag levy, the Waste Framework Directive, the Circular economy package and the Plastics Strategy are also considered key marine litter measures in Ireland's MSFD Programme of Measures.

DECC's Waste Action Plan for a Circular Economy<sup>11</sup>, contains a range of measures which will impact directly on marine litter including:

- Banning certain SUP items
- Reducing the amount of SUP cups and food containers, with a view to ultimately banning SUP coffee cups
- Introducing a Deposit and Return Scheme for aluminium beverage cans and plastic beverage bottles
- Establishing an Extended Producer Responsibility Scheme for fishing and aquaculture gear that contain plastic
- Measures to increase packaging recyclability and encourage reuse
- Promotion of citizen engagement through raising awareness, education and effecting behavioural change

The MSFD requires that our seas achieve GES according to defined criteria, including marine litter. The achievement of GES supports the objectives of national policies such as Marine Spatial Planning and the National Marine Planning Framework. Ireland supports other international agreements and structures which include the UN Environment Programme on Marine Litter, the UN Convention on Biological Diversity and the UN Sustainable Development Goals (SDG) especially Goal 14 – "life below water", and the London Protocol on dumping at sea.

Ireland, in co-operation with the EU and other North Eastern (NE) Atlantic States, is actively involved on the international stage in developing measures to address plastic marine litter, based on the precautionary principle. The OSPAR Regional Sea Convention for the NE Atlantic to which Ireland is a signatory, also seeks to address the problem of marine litter.

The DHLGH is responsible for the following national marine environmental legislation:

- S.I. 249 of 2011 EUROPEAN COMMUNITIES (MARINE STRATEGY FRAMEWORK) REGULATIONS 2011
- S.I. No. 265 of 2017 - European Communities (Marine Strategy Framework) (Amendment) Regulations 2017.

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<sup>11</sup> <https://www.gov.ie/en/publication/4221c-waste-action-plan-for-a-circular-economy/>

- S.I. No. 648 of 2018 - European Communities (Marine Strategy Framework) (Amendment) Regulations 2018
- S.I. No. 293 of 2015 - European Communities (Environmental Liability) (Amendment) Regulations 2015
- Microbeads (Prohibition) Act 2019
- The Dumping at Sea Act, 1996 (as amended)

The DHLGH provides funding and support for a range of citizen activation, marine environmental education and awareness raising programmes.

For example, the Clean Coasts programme, managed by An Taisce, Ireland's national trust with funding and support from the DHLGH, engages communities in the protection of Ireland's beaches, seas and marine life. It works with local authorities and state agencies to promote best practice in coastal management and to implement the Clean Coasts range of programmes, which includes:

- Clean Coasts Volunteering which provides support to over 1,480 Clean Coast community groups with over 28,000 volunteers participating;
- Administering the Blue Flag and Green Coast Awards;
- Other community engagement initiatives to include marine litter clean-ups, hosting Roadshows, educational events and Clean Coasts campaigns, biodiversity and habitat awareness initiatives, the Love Your Coast photography competition, the #2MinuteBeachClean initiative and the Ocean Hero Awards.

Ireland's Green Schools: Global Citizenship Marine Environment Module<sup>12</sup>, managed by An Taisce and funded by the DHLGH, is frequently held up as an example of best practice on an international level. This is a bespoke marine environmental module within Ireland's overall Green Schools (Eco Schools) programme which focusses on raising awareness of threats to the marine environment as well as improving students' knowledge, understanding and appreciation for the ocean and marine biodiversity. The Green Schools Programme operates in 94% of Ireland's primary and Secondary Schools.

### **3.2. Fisheries: Spanish case study**

The Spanish case study (see Loureiro et al.) assessed the situation of marine litter on Galician coasts by conducting a survey with 199 Galician fishermen. Although some initiatives to clean marine litter are being applied in Galicia, the main objective of the Clean Atlantic study is to develop a fishing for litter (FFL) programme adapted to fishermen's needs with the help of a choice experiment. Once the best model has been chosen and results analysed, a cost-benefit analysis of its application in Galicia is made (see Section 5.2).

### **3.3. Aquaculture: Madeira Island case study**

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<sup>12</sup> Global Citizenship – Marine Environment – Green-Schools ([greenschoolsireland.org](http://greenschoolsireland.org))

The Madeira Island case-study aimed at providing an initial assessment and baseline information on the interactions and impacts of marine litter on offshore aquaculture facilities and activities. In order to do this, we investigated how marine litter may interfere with stakeholders' activities developing and administering a survey questionnaire addressed to open-ocean marine aquaculture companies. The survey was distributed to aquaculture facilities' staff and had a response rate approximately of 70% (n=27). Overall, the age range of interviewees varied between 28 and 46 years. The results show that the current knowledge on the interactions between marine litter and offshore aquaculture facilities and activities is still limited. Nevertheless, our case-study results provide key relevant information on the concerns related to marine litter towards aquaculture. A limitation of this study is that it was not able to provide a clear insight into the financial losses and/or economic costs promoted by marine litter to the sectors' activity. However, and despite respondents considering that current levels of marine litter pollution do not have major impacts on the sector, average time spent daily dealing with litter (approximately 50 minutes) suggests that marine litter pollution does have an impact on daily activities and, consequently, an associated cost. In addition, this study also revealed that even though respondents considered that their activities are not a major contributor to marine litter pollution, there is actually a clear lack of data and knowledge on how much litter is produced and possible leaks of the waste management practices. Despite providing valuable data on current information gaps, limitations have affected the possibility to have a cost-benefit analysis for this case study.

## Cost-benefit analyses

### 4. INTRODUCTION TO COST-BENEFIT ANALYSIS

Following from Sections 1 and 2, here we introduce a step-by-step methodology for cost-benefit analysis (CBA) following the one in Hanley and Barbier (2009). A social cost-benefit analysis aims to compare all relevant economic costs and benefits, expressed in monetary terms, of an intervention (e.g. an environmental policy or project) with the aim of assessing the impact of the intervention on social welfare (HMT, 2020). Social means 'with reference to society as a whole' (Hanley and Barbier, 2009). The basic assumption is that, if the benefits are higher than the costs, then the policy or project makes society better off (Hanley and Barbier, 2009). The fundamental steps involved in a CBA, as set out by Hanley and Barbier (2009), are:

1. Define the policy or project under investigation;
2. Identify the impacts of the policy or project in a physical manner (e.g. man-hours of labour, kilometres of cleaned beach etc);
3. Value the impacts (both costs and benefits) in monetary terms (e.g. using market prices). Most natural resources do not have a market though; therefore, non-market valuation methods like those used in Task 4.3.2 of CleanAtlantic can be employed;
4. Check if the costs and benefits involved extend into the future (for a set time horizon). If so, there is the need to bring all relevant costs and benefits flows to the present time calculating its Present Value (PV) by means of a discount rate so to make them all comparable;

5. Apply the Net Present Value (NPV) Test in which all costs and benefits at their present value are compared. This test aims to determine if the policy/project is efficient in its use of the resources. The test is passed when the benefits (gains) outweigh the costs (losses);
6. Take into account the uncertainty around key assumptions and parameter estimates used in the CBA (e.g. the discount rate, the time horizon, etc) and perform a sensitivity analysis (i.e. different CBAs using different key parameters).

## 5. The cost benefit analyses undertaken in CleanAtlantic

We wished to present in this report a cost-benefit analysis for each economic sector analysed: tourism, fisheries, and aquaculture. However, the aquaculture case-study did not provide any economic information to make any meaningful cost-benefit analysis possible. Therefore, only tourism, based on the results of the UK and Irish case studies, and fisheries, based on the results of the Spanish case study, are considered.

### 5.1. CBA UK and Ireland

For the tourism sector, we present, as an example, a potential cost-benefit analysis for England. Our case study in Grilli et al. presents the individual willingness to pay (WTP) of the respondents for a cleaner beach. This WTP represents how much the respondents are prepared to pay, for example, for removing X% of litter from the beach. Therefore, this WTP also represent the perceived benefits of implementing the policy. In other words, how much having a clean beach is worth. In fact, the results obtained in our case study provide information on what is an acceptable cost to respondents for a marine litter policy (i.e. beach clean-up). This information is important for the policy maker as it gives them an indication of what is an acceptable societal cost for that policy. A CBA in this case would consider the costs involved in the design and implementation of the policy and compare it to the estimated benefits of implementing that policy. However, we do not have the costs of such hypothetical policies for specific areas in the UK or Ireland. Also, a major issue to run these analyses is selecting the appropriate level of benefit aggregation from individual to population level to be used. So, for example, in the case of the beach clean-up, its cost in a specific municipality should be selected and the people in that municipality asked to pay the related tax to clean the beach would be the relevant population to be considered for the aggregation. However, if a marine litter related policy is designed and implemented at the UK level, then that would be the relevant population to be considered for aggregation. The same reasoning applies to the Irish case study example.

Although we cannot present specific figures for this case study, we have reported how the information gathered in the CleanAtlantic case study for the UK and Ireland would be of use to the policy maker to inform a CBA aimed at assessing the value-for-money of designing and implementing a new marine litter policy, as explained in Section 2 and 4.

### 5.2. CBA Spain

In order to obtain accurate information on the impact of marine litter on the Galician fishing sector, a survey was designed and carried out with 199 fishermen. The responses were analysed to obtain a cost-benefit analysis of the implementation of a 'fishing for litter' (FFL) programme in Galicia. According to elicited preferences, it was found that the programme chosen by Galician fishermen would have the following characteristics:

- Passive fishing: the fishermen who responded preferred this type of fishing for litter, in which litter collection would be included within their fishing tasks, rather than an active fishing in which they would go out directly to collect litter at sea.
- They would like to have someone in control of the litter collected at sea, rather than having to supervise it themselves.
- Their job would be to collect litter, not to separate it. They prefer to keep the rubbish they collect in one bag, rather than separate it according to type into different containers.
- Finally, more than half of the fishermen (58.67%) stated that they should not be rewarded for litter picking, although the rest of the respondents preferred to be rewarded for the work done.

The cost-benefit analysis performed is based on multiple assumptions for both costs and benefits obtained from litter fishing.

On the cost side, we have assumed that each vessel would carry only one bag on board to collect waste. There are two types of bags depending on the vessel: large bags (90x90x90 cm) for trawl, seine and gill vessels, costing €5 per bag (Amazon, 2019b); and small bags (53x89 cm) for minor arts and longline vessels, costing €2 per bag (Amazon, 2019a). To estimate the cost of cleaning the beaches, we use the cost of cleaning the beaches of A Coruña provided by the Consellería de Medio Ambiente (Consellería de Medio Ambiente, 2018). The annual total expenditures for cleaning was 900,000€, which implies an average cost per tonne of litter around 3,853.73€. Given the impossibility of obtaining information on the costs of cleaning the rest of the important coasts of Lugo and Pontevedra in Galicia, the cost was extrapolated using the estimate of A Coruña and adapting it to the coastal kilometres of each region.

To estimate the amounts of litter that could be collected by Galician fishermen, we used as a basis the average amount collected by the trawlers enrolled in the voluntary program Upcycling the Oceans between 2016 and 2018. To adjust the results, the amounts collected were adapted to each type of vessel along the Galician coast, with the amount collected from each vessel being a percentage of the capacity of a trawler.

The average number of sailors per vessels was taken from the division of the number of fishing vessels in Galicia on January 1<sup>st</sup> 2018, and the total number of Galician sailors on this date (Xunta de Galicia, 2017). The average result is 2,57 sailors per fishing vessel.

When calculating the benefits of marine litter collection by fishermen, we refer to the costs that are reduced by not having to clean the litter directly on the beaches. For this, we generated three different scenarios: that fishing for marine litter reduces the occurrence of litter on beaches by 20% (first scenario); that this litter is reduced by 50% (second scenario); or that a reduction of 70% is achieved (third scenario).

Due to the divergence of opinions in the survey in terms of the compensation required, two different scenarios were considered.

**The first scenario** is the most optimistic because it supposes that fishermen will participate with no reward. However, fishermen will be paid to make up for the opportunity cost of collecting the litter. Taken as basis the average loss per day of 67€, we estimated a payment of the 30% of this amount, due to the fact that even if they do not collect the litter, they also have to lose time cleaning riggings. The average estimated litter that could be collected was the following:

- Minor arts and longline vessels: 25% of the base quantity (68.87 kg per year).

- Gill vessels: 50% of the base quantity (137.53 kg per year).
- Trawl and siege vessels: 80% of the base quantity (220.38 kg per year).

With these assumptions it was estimated that the Galician fishing sector could clean 323.62 tons of marine litter per year with an associated cost of 226,028.74 € derived from the purchasing of bags. The benefit was calculated discounting the cost of the programme from the estimated spend on beach cleaning and amounts to 104,258.70 € per year if it reduces 50% of marine litter.

**The second scenario** considers a reward for the participants depending on the average requested rewards taken from the survey per type of vessel. The average reward was 25 € per worker a day for trawl, 20 € for siege, 32.67 € for minor arts and 34.1 € for longline and gill. The average estimated litter collected changes by:

- Minor arts and longline: 25% of the base quantity (137.73 kg per year).
- Gill: 80% of the base quantity (220.40 kg per year).
- Trawl and siege: 100% of the base quantity (275.47 kg per year).

In this scenario the estimated marine litter collected was 610.16 tons per year with an associated cost of 355,850.11€ deriving from the purchasing of bags and the mean reward required. This scenario only provides positive benefits if it reduces 70% of marine litter on Galician beaches. In this case, there will be a positive benefit of 106,552.31€, quite smaller than in the first scenario due to requirement of rewards to fishermen.

Table 1. Estimated benefits of a fishing for litter programme in Galicia

	Scenario 1	Scenario 2
<b>Estimated litter collected (t)</b>	323.62	610.16
<b>Estimated cost (€)</b>	226,028.74	355,850.11
<b>Estimated benefit 1 (€)</b>	-93,913.77	-223,735.13
<b>Estimated benefit 2 (€)</b>	104,258.70	-25,562.67
<b>Estimated benefit 3 (€)</b>	263,373.67	106,552.31

Table 1 above shows the benefits of the different percentages of reduction on marine litter that comes from Galician beaches. It is important to remark that if fishermen are going to be rewarded (Scenario 2) it would be necessary to demand them a minimum reduction of 70% of marine litter so the programme could be economically viable. If the programme is based on scenario 1, it would be economically viable with a minimum reduction of 50% of marine litter that arrives at the beaches.

### 5.3. CBA Portugal

As reported in Section 1.1.3, it was not possible to collect the necessary data to conduct a cost-benefit analysis for this case-study. However, it is possible to ascertain that, on top of potential damages, marine litter affects some daily activities in offshore aquaculture farms by using an average of 50 minutes of staff daily routines, summing up to more than 200 hours a year of time spent dealing with marine waste.

# General overview of economic impacts in the case study areas and policy recommendations

## 6. Introduction

Work package 4 in the CleanAtlantic project has gathered and assessed data and knowledge gaps, identified and mapped stakeholders and associated initiatives, and assessed the economic impact of marine litter in the Atlantic Area. Task 4.1 produced seafloor, beach and floating litter assessments showing marine litter is widespread in the Atlantic Area. The project identified gaps in data for floating litter, and lack of harmonisation of methodologies used. Task 4.2 characterised key stakeholders and actions to reduce marine litter including those on clean-up/ recovery, awareness raising and circular economy. Task 4.3 looked at the impacts of marine litter on economic sectors. The analyses conducted under Task 4.3.2 confirm the impacts of marine litter as reviewed in Task 4.3.1, especially plastic, in the Atlantic Area for all the sectors analysed: tourism (UK and IR), fisheries (SP), and aquaculture (PT). We ran five different case studies (two in England, one in Ireland, one in Spain, and one in Madeira Island) to assess the monetary costs and benefits these different sectors could incur because of marine litter. Task 4.3.3 is highlighting what cost and benefit data are needed to investigate the value-for-money of designing and implementing marine litter policies to benefit different economic sectors. This Task has reported on best practice for policy evaluation and, in particular, to conduct a cost-benefit analysis.

## 7. Policy Recommendations

### 7.1. Task 4.1

Data used to make regional assessments for beach and seafloor litter assessments is already harmonised and part of the OSPAR Coordinated Environmental Monitoring Programme (CEMP), however there are still improvements which can be made, and continued work is needed to strengthen the assessments. Methods for monitoring and recording marine litter and microplastics need to be standardised. For seafloor litter, efforts need to be made to ensure count and weight data can be included to make the assessments easier to understand and able to show seafloor litter abundance trends. With floating litter, the current indicator at OSPAR level (plastic particles in Fulmars) does not have sufficient data to support an assessment of the Atlantic Area due to the geographical range of the indicator species. For Clean Atlantic an alternative method of using observers onboard research vessels was developed, but further work is needed both from harmonisation of the methods and also the use across the area before it could be used as a regional indicator. Further work to progress this should be a priority to have a better understanding of transport and pathways of marine litter. There is also potential for assessments to be made at different spatial scales (local, national, regional) and for source identification to be improved.

### 7.2. Task 4.2

An online database was created to share initiatives and best practices to tackle marine litter in the Atlantic Area, this information and database needs support from countries to keep up to date and active beyond the

Clean Atlantic project. Other projects also have looked at collating information, but this needs regional or global cooperation beyond individual projects to maintain. Feeding into the Global Partnership on Marine Litter digital platform or being maintained as part of regional actions for regional seas conventions is recommended.

### **7.3. Task 4.3**

To decide if and how to design and implement a new policy, a policy evaluation is recommended. The evaluation should be proportionate to the need of the policy. There are several tools that could be employed to this end. In CleanAtlantic we have collected new data to inform on the benefits provided by a hypothetical new marine litter policy for different economic sectors in order to perform a cost-benefit analysis (CBA). However, CBAs are demanding on the data side, and it was difficult in this project to get hold of the cost data that will be involved in the design and implementation of a new marine litter policy. The usefulness of a CBA is that it can provide information on the actual costs and the foreseen benefits a policy may bring. Thanks to this project, policy makers in the UK and Ireland now have details of the benefits needed for a CBA, which we recommend for verifying the efficiency of both already implemented marine litter policies and new potential policies with reference to a cleaner beach. Policy makers in Spain now have information on how to relate to fishermen and the fishing industry in relation to a fishing for litter policy. For the aquaculture sector in Madeira, we were not able to collect any economic data. In this case, a follow up assessment of what kind of alternative policy evaluation methodology could be employed, also considering the proportionate cost of the analysis, is recommended (see Section 2 and HMT, 2020). That study highlighted that: i) there is already an impact of marine litter on the aquaculture sector and there is concern of greater impacts in a future scenario with increasing marine litter contamination; ii) despite considering that the sector does not significantly contribute to local marine litter pollution, there is a clear gap in data and information on how much and what kind of litter is produced; and with regard to iii) waste management practices, there is room for further improvement. As such, recommendations include a follow up study to detail economic losses and taking action to enable monitoring of aquaculture waste production and management.

## **High level guidelines to improved policies and strategies to tackle marine litter in the Atlantic Area**

To design a new policy, or to improve a policy or a set of policies, to tackle marine litter, based on our Work Package 4 analysis and results we suggest the following high-level guidelines:

1. Monitor macro litter and identify hot spots and transport and pathways of marine litter at different spatial scales (local, national, regional).
2. Identify the policy needed: e.g. marine litter reduction; fishing for litter.
3. Identify the economic sectors that would benefit or receive an impact because of the policy implementation: e.g. tourism, fisheries, aquaculture.

4. Identify how the stakeholders affected, positively or negatively, could and/or would contribute to the policy implementation.
5. Decide on the policy evaluation to undertake: e.g. on the policy process? On the impact of the policy? On the value-for-money of the policy implementation?
6. If undertaking a value-for-money analysis, identify, and where possible quantify, all costs and benefits involved, present and future.
7. Perform the policy evaluation analysis chosen and use the results to inform policy and decision making for either designing and implementing the new policy or revise an already implemented policy.

CleanAtlantic Tasks 4.3.2, 4.3.3 and 4.3.4, aimed to evaluate the implementation of a marine litter policy on the tourism, fisheries, and aquaculture sectors. We have performed an initial value-for-money evaluation for tourism and fisheries based on the results of the case studies undertaken in Task 4.3.2. Although at a high level, the recommendations and guidelines presented in this report should provide an indication on how policy evaluation analysis for marine litter policy implementation could be performed in different sectors and different countries as needed.

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