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## Understanding the socio-economic implications of marine litter

IN THE ADRIATIC-IONIAN MACROREGION



The project is co-funded by the European Union,  
Instrument for the Pre-Accession Assistance

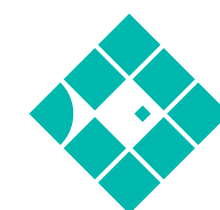


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**Author:**  
Thomas Vlachogianni (MIO-ECSDE)

**Contributors:**  
This report was possible thanks to the contributions made by the members of the DeFishGear team with regards to the design and/or implementation of the marine litter socio-economic implications surveys. The contributors are (in alphabetical order): Amplianiti Danaï <sup>a</sup>, Anastasopoulou Aikaterini <sup>b</sup>, Banicevic Gorana <sup>c</sup>, Bettoso Nicola <sup>d</sup>, Božanić Jakša <sup>e</sup>, Cepuš Sabina <sup>f</sup>, Chieruzzi Tiziana <sup>g</sup>, Domenichetti Filippo <sup>g</sup>, Fortibuoni Tomaso <sup>g</sup>, Fusco Marina <sup>h</sup>, Giovanardi Otello <sup>g</sup>, Kalampokis Vaggelis <sup>g</sup>, Kolitari Jerina <sup>h</sup>, Kroqi Gulielm <sup>h</sup>, Latella Aurelio <sup>i</sup>, Mandić Milica <sup>i</sup>, Marković Olivera <sup>i</sup>, Mazziotti Cristina <sup>g</sup>, Melli Valentina <sup>g</sup>, Nazlić Marija <sup>k</sup>, Papadopoulou Konstantia <sup>b</sup>, Pešić Ana <sup>l</sup>, Prevenios Michalis <sup>b</sup>, Prvan Mosor <sup>k</sup>, Renier Daria <sup>g</sup>, Riga Maria <sup>b</sup>, Robič Uroš <sup>f</sup>, Ronchi Francesca <sup>g</sup>, Roniotes Anastasia <sup>g</sup>, Škunca Ognjen <sup>c</sup>, Tarulli Enrico <sup>g</sup>, Tutman Pero <sup>g</sup>, Vlachogianni Thomas <sup>a</sup>.

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<sup>a</sup> Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSDE)

<sup>b</sup> Hellenic Centre for Marine Research (HCMR)

<sup>c</sup> Public Institution RERA SD for coordination and development of Split Dalmatia County (RERA)

<sup>d</sup> Regional Agency for Environmental Protection in the Emilia-Romagna region (ARPAE)

<sup>e</sup> Institute of Oceanography and Fisheries (IOF)

<sup>f</sup> Institute for Water of the Republic of Slovenia (IWRS)

<sup>g</sup> Italian National Institute for Environmental Protection and Research (ISPRA)

<sup>h</sup> Agricultural University of Tirana (AUT)

<sup>i</sup> Ca' Foscari University of Venice

<sup>j</sup> Institute of Marine Biology of Kotor (IBM)

<sup>k</sup> NGO SUNCE

<sup>l</sup> Hydro-Engineering Institute of the Faculty of Civil Engineering (HEIS)

**Editors-in-chief:**  
Michael Scoullas (MIO-ECSDE)  
Anastasia Roniotes (MIO-ECSDE)

**Text editing:**  
Anastasia Roniotes (MIO-ECSDE)

**Cover photo:**  
Thomas Vlachogianni

**Graphic design & page layout:**  
Pavlina Alexandropoulou

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# EXECUTIVE SUMMARY





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## EXECUTIVE SUMMARY

Marine litter related information in the Adriatic and Ionian Seas, as well as in the Mediterranean, remains limited, inconsistent and fragmented, even though it is widely considered that the Mediterranean is one of the most affected seas by marine litter worldwide. Effective measures to tackle marine litter in the region are seriously hampered by the lack of reliable scientific data. Within this context the need for accurate, coherent and comparable scientific data on marine litter in the Adriatic and Ionian Seas -including information on the socio-economic implications of marine litter- is evident in order to set priorities for action and address marine litter effectively, thus contributing to the sustainable management and use of the marine and coastal environment of the Adriatic-Ionian macroregion.

Within the framework of the 3-year long IPA-Adriatic funded DeFishGear project a survey-based assessment of the socio-economic implications of marine litter was carried out in the seven countries sharing the Adriatic and Ionian Seas, namely: Albania, Bosnia & Herzegovina, Croatia, Greece, Italy, Montenegro and Slovenia. This is the first-ever effort aiming to investigate in a coordinated, consistent and comprehensive way the socio-economic implications of marine litter in the Adriatic-Ionian macroregion. In fact it is the first of its kind marine litter related study in the Mediterranean.

The report is a direct and concrete contribution to the implementation of the main legislative marine litter related frameworks in the Adriatic-Ionian macroregion, the EU Marine Strategy Framework Directive and the UNEP/MAP Regional Plan for Marine litter Management in the Mediterranean. Furthermore, it provides valuable insights that could be of use to the EU Strategy for the Adriatic and Ionian Region that aims to address a number of pressing socio-economic and environmental challenges facing the region, among which marine litter.

The aim of this report is to deepen the understanding of the socio-economic implications of marine litter and facilitate the efforts of policy makers and stakeholders in effectively dealing with the issue in the Adriatic-Ionian macroregion, towards litter free coasts and sea. Moreover, it provides strategic input to regional efforts in successfully achieving good environmental status in the Mediterranean Sea.

The sector-based approach deployed for this socio-economic analysis of marine litter investigates the increased costs (e.g. cost of repairs of damaged nets or other equipment; cost of divers to cleanup aquaculture facilities, etc.) and potential losses of revenue associated with marine litter for vital economic sectors, such as tourism, fisheries, aquaculture and navigation. Efforts were made to also shed light on the associated costs and losses imposed on individuals and local communities. This report is the end result of 6-month-long surveys carried out in all countries of the Adriatic-Ionian macroregion. A total of 548 out of 1480 targeted respondents filled in the questionnaires representing an average response rate of 37%.

As indicated by the survey results, marine litter is acknowledged as a problem by all stakeholder groups, with 86% of the respondents considering marine litter as a serious or moderate problem. Interestingly though, more than half of the respondents working in the tourism sector (58%) and in harbours and marinas (31%) felt that marine litter is an insignificant problem.

The results related to the assessment of the direct and indirect costs on the studied economic sectors attributed to marine litter were revealing. For the fisheries sector the average annual cost of marine litter per vessel reaches € 5,378 (cost of repairs of damages, loss of revenue due to the smaller catch, loss of time spent on clearing and repairing nets, etc., reported by fishermen per fishing vessel per year), an amount much higher than the one reported for EU vessels. Given this, the total losses to the fisheries sector in the Adriatic-Ionian macroregion were calculated to be € 18.19 million per year, which represents one third of the marine litter costs to the EU fishing fleet (€ 61.7 million per annum). On average, the annual direct and indirect marine litter related costs for the aquaculture sector were assessed to be € 3,228 per aquaculture farm unit. The total annual cost of managing marine litter reported by 38 harbours and marinas in the Adriatic-Ionian macroregion was € 323,550 with an average annual cost of € 8,518 per harbour. The average annual amount per tourism related business of varying size and type was calculated to be € 5,685 per year, which can be considered as a substantial expense. The total cost of removing beach litter reported by the 32 municipalities was € 6,724,530 per year, with an average of € 216,920 per year per municipality. On average, the municipalities spent some 5% of their budget for marine litter cleanup operations.

When it comes to waste and marine litter management measures it is widely accepted by the different stakeholders that there is a lot of room for improvement. More specifically, the overwhelming majority of fishermen (89%) were of the view that there have not been any measures taken to support the sustainable management of used fishing gear nor for lost fishing gear. In the aquaculture sector, only a minority of aquaculture units (15%) recycle the solid waste produced in their farming operations and only one third of these companies regularly trains and informs their employees on issues related to marine litter. When it comes to harbours and marinas, a considerable percentage of almost one fifth of the interviewees reported that there are no waste reception facilities in ports and more than half of the respondents (58%) also reported that their harbours and marinas don't apply a certified Environmental Management System. Within the tourism sector, some 11% of the respondents felt that the existing waste collection infrastructure is not sufficient with the big majority of respondents claiming that such infrastructure exists only on the most popular beaches in the main urban centres and touristic resorts. Similar were the views of the NGO community too. In contrast, 82% of the respondents from municipalities reported that waste collecting infrastructure is in all beaches within their area. Only a small percentage of 2% said that such infrastructure isn't provided anywhere.

It was very encouraging to see that a significant number of the survey participants are willing to contribute to the implementation of wide ranging marine litter related measures. Close to half of the fishermen interviewed (45%) are willing to be pioneers and implement the 'fishing for litter' measure and an additional 25% will implement it if everybody does it. In the aquaculture sector, more than half of the respondents claim that they participate in marine litter removal actions and some 46% try to reduce the amount of packaging taken to sea. More than half of the interviewees (65%) from the tourism sector stated that there are joint efforts in their area to address the issue of marine litter, while 68% of them claimed that their enterprises participate actively in these actions. Regarding cleanup campaigns, the majority of the NGO respondents (72%) reported that they organize marine litter removal actions on beaches or at sea. Furthermore, a considerable number of NGOs (43%) are interested in data collection activities and they are planning to perform litter surveys in the near future, while 89% of the respondents would be willing to participate in marine litter monitoring activities, if provided with the necessary technical and financial support. Similarly, the majority of the municipalities (68%) reported that there are public campaigns organized to remove marine litter from the marine environment and almost all municipalities (except one) claimed that they are supporting them.





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# MARINE LITTER IN THE **ADRIATIC AND IONIAN MACROREGION**

1





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## 1.1 INTRODUCTION

Marine litter -any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment- is globally acknowledged as a major societal challenge of our times due to its significant environmental, economic, social, political and cultural implications (Galgani et al., 2010; Sutherland et al., 2010). Marine litter negatively impacts coastal and marine ecosystems and the services they provide, ultimately affecting people's livelihoods and well-being (Oosterhuis et al., 2014; Gall & Thompson, 2015; Veiga et al., 2016).

Growing scientific literature (Galgani et al., 2011; Gall & Thompson, 2015) documents the threats that marine litter poses to wildlife and ecosystems, with impacts varying from entanglement and ingestion, to bio-accumulation and bio-magnification of toxics either released from plastic items (e.g. PBDEs, phthalates, Bisphenol A) or adsorbed and accumulated on plastic particles (e.g. POPs, PAHs) (Teuten et al., 2009; Oehlmann et al., 2009; Rochman et al., 2013 & 2014;); facilitation of introduction of invasive alien species (Aliani & Molcard, 2003; Barnes & Milner, 2005); damages to benthic habitats and communities (e.g. through abrasion of coral reefs from fishing gear, disruption of colonies, reduced oxygenation or 'smothering' of communities) (Gregory, 2009; Richards & Beger, 2011).

Marine litter related information in the Adriatic and Ionian Seas and furthermore in the Mediterranean, is limited, inconsistent and fragmented, although it is widely accepted that the latter is one of the most affected seas by marine litter worldwide (Cozar et al., 2015; UNEP/MAP 2015). Effective measures to tackle marine litter in the region are seriously hampered by the lack of reliable scientific data. Within this context the need for accurate, coherent and comparable scientific data on marine litter in the Adriatic and Ionian Seas is evident in order to set priorities for action and address marine litter effectively, thus contributing to the sustainable management and use of the marine and coastal environment of the Adriatic-Ionian macroregion.

Understanding the full economic significance of the impacts of marine litter still remains relatively limited, however it is well known that every year, marine litter results in tremendous economic costs and significant losses for the economic sectors involved, such as tourism and recreation, fisheries and aquaculture, maritime transport and navigation, and infrastructure and services for individuals, local communities and enterprises (Mouat et al, 2010; Leggett et al, 2014).

The wide diversity of marine litter implications makes measuring the full economic cost resulting from marine litter extremely complex. Direct economic impacts such as increased litter cleansing costs are clearly easier to calculate than indirect economic and social costs such as ecosystem degradation or reduced quality of life. Moreover, establishing the economic costs of marine litter is complicated by the wide variety of approaches available for valuing the environment and detrimental anthropogenic impacts. However despite the inherent limitations there is a growing body of evidence on the negative externalities created by marine litter (Mouat et al, 2010; Brouwer et al, 2015; Watkins et al, 2016).

Very few studies to date have explored the socio-economic implications of marine litter worldwide, while in the Mediterranean there are no such studies at all. Within the framework of the IPA-Adriatic funded DeFishGear project a survey-based assessment of the socio-economic implications of marine litter was carried out in the seven countries

sharing the Adriatic and Ionian Seas, namely: Albania, Bosnia & Herzegovina, Croatia, Greece, Italy, Montenegro and Slovenia.

This study aims to be a direct and concrete contribution to the implementation of the main legislative marine litter related frameworks in the Adriatic-Ionian macroregion, the EU Marine Strategy Framework Directive (Box.1.1) and the UNEP/MAP Regional Plan for Marine litter Management in the Mediterranean (Box.1.2). This study also provides valuable insights of use to the EU Strategy for the Adriatic and Ionian Region that aims to address a number of pressing socio-economic and environmental challenges facing the region, among which marine litter.

This study aims to deepen the understanding of the socio-economic implications of marine litter and facilitate the efforts of policy makers and stakeholders in effectively dealing with the issue of marine litter in the Adriatic-Ionian macroregion, towards litter free coasts and sea. Moreover, it provides strategic input to regional efforts in successfully achieving good environmental status in the Mediterranean Sea.

## 1.2 THE DEFISHGEAR PROJECT IN A NUTSHELL

The DeFishGear project was a 3-year long project piloting coordinated and harmonized actions on the science-policy-society interface for litter-free Adriatic and Ionian Seas (Tab.1.1.). It was implemented within the framework of the IPA-Adriatic Cross-border Cooperation Programme, co-funded by the European Union (Fig.1.1). The overarching aim of the project was to facilitate efforts for integrated planning to reduce the environmental impacts of litter-generating activities and ensure the sustainable management of the marine and coastal environment of the Adriatic and Ionian Seas. The DeFishGear project provides strategic input to European and European Regional Seas efforts in successfully achieving good environmental status with regards to marine litter.

The DeFishGear main lines of action included the following:

- carrying out a comprehensive assessment of the status (amounts, composition, impacts) of marine litter (macro-litter & micro-litter) in the Adriatic and Ionian Seas through harmonized and coordinated monitoring activities;
- development of recommendations and policy options based on sound scientific evidence and knowledge to meet regional and national objectives regarding marine litter (EU Marine Strategy Framework Directive, UNEP/MAP Regional Action Plan on Marine Litter Management in the Mediterranean and Ecosystem Approach, EU Strategy for the Adriatic and Ionian Region, etc.);
- establishment of a Regional Network of Experts on marine litter;
- development of capacities to monitor marine litter in a harmonized way through reinforced exchange of experiences, techniques and know-how;
- setting up schemes to collect and recycle derelict fishing gear; to carry out 'fishing for litter' activities in an environment-friendly way; to implement targeted recovery of ghost nets; to raise awareness of different target groups (fishermen, policy makers, educational community, etc.) on the impacts of marine litter and the types of action they should undertake to effectively address this issue.

**Box. 1.1.** The Marine Litter Descriptor, criteria, and respective Indicators within the framework of the EU MSFD.

### Marine Litter within the EU MSFD

*Properties and quantities of marine litter do not cause harm to the coastal and marine environment (Descriptor 10)*

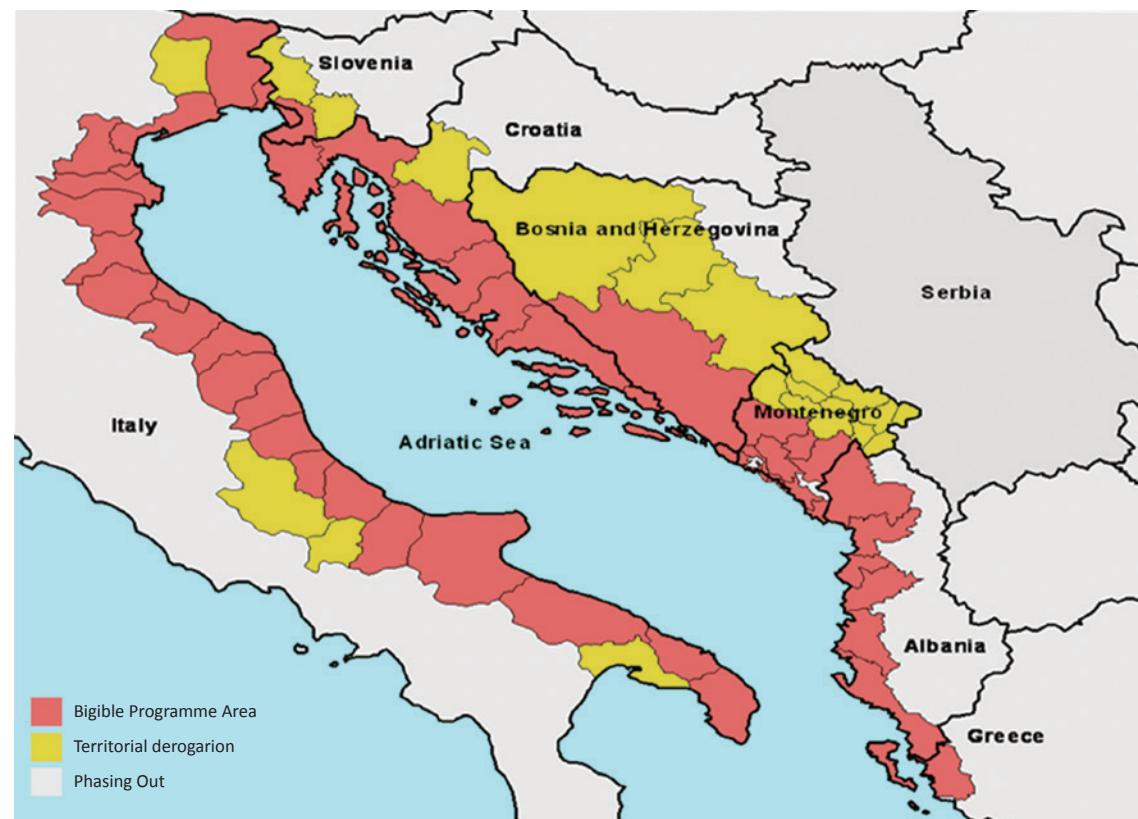
*Criteria 10.1 Characteristics of litter in the marine and coastal environment*

- *trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source (10.1.1)*
- *trends in the amount of litter in the water column (including floating at the surface) and deposited on the seafloor, including analysis of its composition, spatial distribution and, where possible, source (10.1.2)*
- *trends in the amount, distribution and, where possible, composition of microparticles (in particular microplastics) (10.1.3)*

*Criteria 10.2 Impacts of litter on marine life*

- *trends in the amount and composition of litter ingested by marine animals (e.g. stomach analysis) (10.2.1)*





**Figure 1.1.** Map of the eligible areas under the IPA-Adriatic Cross-border Cooperation Programme.

**Table 1.1.** Key facts and figures for the DeFishGear project.

Title	Derelict Fishing Gear Management System in the Adriatic Region
Acronym	DeFishGear
Funding instrument	IPA-Adriatic Cross-border Cooperation Programme
Theme	Improving marine, coastal and delta rivers environment by joint management in the Adriatic area
Project duration	1 November 2013 – 30 September 2016 (35 months)
Project budget	5,254,186 €
Partnership	<p>National Institute of Chemistry (Slovenia) - Lead Partner</p> <p>Italian National Institute for Environmental Protection and Research (Italy)</p> <p>Ca' Foscari University of Venice, Department of Philosophy and Cultural Heritage (Italy)</p> <p>Mediterranean Consortium (Italy)</p> <p>Regional Agency for Environmental Protection in the Emilia-Romagna region (Italy)</p> <p>Institute for Water of the Republic of Slovenia (Slovenia)</p> <p>University of Nova Gorica, the Laboratory for Environmental Research (Slovenia)</p> <p>Institute of Oceanography and Fisheries (Croatia)</p> <p>Hydro-Engineering Institute of the Faculty of Civil Engineering (Bosnia and Herzegovina)</p> <p>University of Montenegro, Institute of Marine Biology (Montenegro)</p> <p>Agricultural University of Tirana, Laboratory of Fisheries and Aquaculture (Albania)</p> <p>Regional Council of Lezha (Albania)</p> <p>Mediterranean Information Office for Environment, Culture and Sustainable Development (Greece)</p> <p>Hellenic Centre for Marine Research (Greece)</p> <p>Public Institution RERA SD for coordination and development of Split County (Croatia)</p> <p>Euro-Mediterranean Centre on Climate Change (Italy)</p>
Website	www.defishgear.net

### 1.3 KEY FINDINGS OF THE DEFISHGEAR MARINE LITTER ASSESSMENT

The DeFishGear marine litter assessment was based on one-year long monitoring surveys carried out in all marine compartments in the seven countries of the Adriatic-Ionian macroregion. More specifically: (i) 180 beach transects were surveyed in 31 locations, covering 31.000m<sup>2</sup> and extending over 18.000m (18km) of coastline; (ii) 66 floating litter transects were conducted with small scale vessels covering a distance of 415km, while a total of 9062km were surveyed by observers on ferries; (iii) for the seafloor litter 11 locations were investigated with bottom trawl surveys and 121 hauls were performed, while 38 transects were performed in 10 locations with underwater visual surveys with scuba/snorkelling; (iv) for litter in biota 81 hauls were conducted and 614 fish individuals were studied.

The key findings of this assessment (Vlachogianni et al., 2016) can be summarized as follows:

- **Amounts of marine litter.** The Adriatic and Ionian Seas are affected by marine litter with average densities for the different marine compartments found to be: 0.67 items/m<sup>2</sup> for litter on beaches; 332 items/km<sup>2</sup> for floating litter when assessed with the use of small scale vessels and 4 items/km<sup>2</sup> when measured by observers on ferries; 510 items/km<sup>2</sup> on the seafloor when assessed by bottom trawl surveys and 2.78 /100 m<sup>2</sup> when assessed by surveys with scuba/snorkelling.
- **Composition of marine litter.** The majority of litter found in all marine compartments of the Adriatic and Ionian seas were artificial polymer materials accounting for 91.1% of all beach litter; 91.4% of all floating litter; 89.4% of all seafloor litter (bottom trawl surveys); 36.4% of all seafloor litter (visual surveys with scuba/snorkelling); 98% of biota. The most abundant items for beaches included: plastic pieces 2.5cm > < 50cm (19.89%), polystyrene pieces 2.5cm > < 50cm (11.93%), cotton bud sticks (9.17%), plastic caps/lids from drinks (6.67%), cigarette butts and filters (6.60%), unidentified plastic caps/lids (2.47%), mussel & oyster nets (2.43%), crisp packets/sweet wrappers (2.11%), etc. The most abundant floating litter items were: plastic bags (26.5%), plastic pieces (20.3%), sheets (13.3%), fish polystyrene boxes (11.4%), cover/packaging (8.1%), other plastic items (6.0%), etc. Results obtained from the bottom trawl surveys showed that sheets, industrial packaging, plastic sheeting are the most abundant types of litter (27.8%), followed by bags and food containers including fast food containers, both accounting for about 11% of all items recorded. The data obtained highlighted the emerging issue of mussel nets ranking in the 7<sup>th</sup> position of the top 20 items found on beaches, while in Italy these items were the 3<sup>rd</sup> most abundant items recorded on the seafloor (8.4%).
- **Sources of marine litter.** Litter items from shoreline, tourism and recreational activities accounted for 33.4% of total litter items collected on beaches; for the sea surface they accounted for 38.5%; and for the seafloor 36.6% (bottom trawl surveys). When looking at the sea-based sources of litter (fisheries and aquaculture, shipping) these ranged from 1.54% to 14.84% between countries, with an average of 6.30% at regional level for beach litter. For floating litter fisheries and aquaculture related items accounted for 8.75% of total sampled litter. The contribution of fisheries and aquaculture related items to the total number of items collected by the seafloor trawl surveys and the seafloor visual surveys with scuba/snorkelling was at regional level 17% and 6%, respectively. This value is much higher than the 5% calculated for the Mediterranean (UNEP/MAP, 2015) and adds to the growing body of evidence that the fisheries and aquaculture industries are also responsible for marine debris.

**Box 1.2.** The Marine Litter Operational Objectives and respective Indicators within the framework of the Barcelona Convention Ecosystem Approach.

#### Marine Litter and the Barcelona Convention Ecosystem Approach

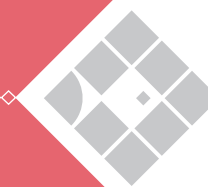
**10.1.** The impacts related to properties and quantities of marine litter in the marine and coastal environment are minimized.

- Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source. (10.1.1)
- Trends in amounts of litter in the water column, including microplastics, and on the seafloor (10.1.2)

**10.2.** Impacts of litter on marine life are controlled to the maximum extent practicable

- Trends in the amount of litter ingested by or entangling marine organisms, especially mammals, marine birds and turtles (10.2.1)





# THE SURVEY

2





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## 2.1 METHODOLOGY

Within the framework of the DeFishGear project MIO-ECSDE undertook the task to develop and coordinate a survey-based assessment of the socio-economic implications of marine litter for the Adriatic-Ionian macroregion. The survey was carried out in all seven countries sharing the Adriatic and Ionian Seas, namely: Albania, Bosnia & Herzegovina, Croatia, Greece, Italy, Montenegro and Slovenia.

The methodology that was used for the socio-economic analysis of marine litter deployed a sector-based approach to investigate the increased costs (e.g. cost of repairs of damaged nets or other equipment; cost of divers to cleanup aquaculture facilities, etc.) and potential losses of revenue associated with marine litter for vital economic sectors, such as tourism, fisheries, aquaculture and navigation. Furthermore, efforts were made to shed light on the associated costs and losses for individuals and local communities.

The methodology built upon the KIMO pioneering activities in this field and was further elaborated and fine-tuned by MIO-ECSDE with the contribution of the DeFishGear partners involved, namely AUT (Albania), HEIS (Bosnia & Herzegovina), IOF & RERA (Croatia), ISPRA & ARPA (Italy), HCMR (Greece), IBM (Montenegro), IWRS (Slovenia) (Tab.2.1).

The aforementioned methodology and corresponding approach didn't include the economic and social costs linked to the degradation of the ecosystem services and the reduced quality of human welfare and therefore the findings presented in this report do not address the full spectrum of the socio-economic costs of marine litter.

Six (6) tailor-made questionnaires were developed to provide a better understanding and quantify, to the extent possible, the socio-economic impacts of marine litter on the aforementioned key economic sectors and local communities. These targeted:

- **Fisheries:** fishermen's associations, individual fishermen (professionals and amateurs), skippers of vessels, sailors, etc.
- **Aquaculture:** companies, individuals working in aquaculture farms, etc.
- **Harbours and marinas:** competent staff members from harbours and marinas of various sizes (big, medium, small) and type (industrial, touristic, etc.).
- **Tourism sector:** hotel associations and chains, hotel owners of various sizes (from resorts to 'bed and breakfast' units); beach bars, entertainment parks, restaurants, travel agency associations, etc.
- **Municipalities** and prefectures: competent environmental or waste management staff within each coastal municipality and prefecture.
- **NGOs:** environmental organizations, small volunteer groups such as local environmental initiatives, scuba diving associations, eco-tourism initiatives, management bodies of protected areas, volunteer rangers, etc.

The data collection process was launched in July 2015 and was completed by December 2015. The target number of respondents per target group was decided jointly with the national partners and also via the use of a sample size calculating formula (margin of error 5%, confidence level 95%). The questionnaires were built around two thematic areas: information related to the targeted sector, the associated costs of marine litter and whether measures are in place; information related to marine litter found on coasts and/or at sea.

**Table 2.1. Main survey locations and partners involved.**

Survey Countries	Survey locations	Surveying organization
Albania	<i>Butrint, Durres, Lezhe, Plepa, Shengjin, Skhoder, Velipoje</i>	Agricultural University of Tirana (AUT)
Bosnia & Herzegovina	<i>Neum</i>	Hydro-Engineering Institute of the Faculty of Civil Engineering (HEIS)
Croatia	<i>Bistrina, Brač, Cres, Fortica, Pag, Dubovac, Drače, Dubrovnik, Dugi otok, Hvar, Janjina, Komiža, Korčula, Krk, Lastovo, Makarska, Mali Lošinj, Mali Ston bay, Mimice, Mljet, Novalja, Pelješac, Sveti Vid bay, Podgora, Poreč, Rab, Rabac, Rijeka, Rogoznica, Rovinj, Seline, Starigrad, Senj, Šibenik bay, Šolta, Split, Sućuraj, Tar-Vabriga, Tutvi, Janjina, Ubli, Umag, Vela Luka, Vinišće, Vrsar, Zadar</i>	Institute for Oceanography and Fisheries (IOF) & NGO Sunce & Public Institution RERA SD for coordination and development of Split Dalmatia County
Greece	<i>Ammoudia, Corfu, Drepano, Filiates, Igoumenitsa, Patra, Paxi, Plataria, Preveza, Sagiada, Sivota, Vonitsa</i>	Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSDE) & Hellenic Centre for Marine Research (HCMR)
Italy	<i>Ancona, Bellaria, Boccasette, Brindisi, Campobasso, Campomarino, Caorle, Cattolica, Cavallino Treporti, Cervia, Cesenatico, Chioggia, Civitanova Marche, Comacchio, Cupra Marittima, Fano, Foggia, Gatteo, Giovinazzo, Grado, Isola di San Domino, Lecce, Licata, Lido di Jesolo, Manfredonia, Massignano, Melendugno, Mola di Bari, Molfetta, Monfalcone, Muggia, Ortona, Ostuni, Otranto, Pesaro, Porto San Giorgio, Ravenna, Riccione, Rimini, Rosolina, San Benedetto del Tronto, San Michele al Tagliamento, San Salvo, Santa Maria di Leuca, Senigallia, Sistiana, Sottomarina, Staranzano, Termoli, Tricase, Trieste, Udine, Vasto, Venice</i>	Italian National Institute for Environmental Protection and Research (ISPRA) & Regional Agency for Environmental Protection in the Emilia-Romagna region (ARPA)
Montenegro	<i>Bar, Budva, Dobrota, Herceg Novi, Kamenari, Kotor, Krasici, Obala Djurasevica, Orahovac, Perast, Petrovac, Sveta Nedjelja, Tivat, Ulcinj, Velika Plaza</i>	Institute of Marine Biology of Kotor (IBM)
Slovenia	<i>Ankaran, Debeli rtič, Fiesa, Izola, Koper, Piran, Portorož, Secovlje, Strunjan</i>	Institute for water of the Republic of Slovenia (IWRS)

## 2.2 DATA COLLECTION AND PROCESSING

The surveys were successfully implemented in Albania, Bosnia & Herzegovina, Croatia, Greece, Italy, Montenegro and Slovenia (Nazlić et al., 2016; Ronchi et al., 2016; Mandić et al., Cepuš, 2016; Vlachogianni et al., 2016). Out of the 1480 targeted respondents, a total of 548 filled in the questionnaires (Tab.2.2), mostly through direct interviews in person, over the phone or via e-mail communication. The 548 responses represent a 37% response rate on average at regional level (Tab.2.3). The target number of respondents per target group was decided to be as follows: around 30-50 respondents from the fisheries and the tourism sectors and around 5-10 from the rest of the sectors.



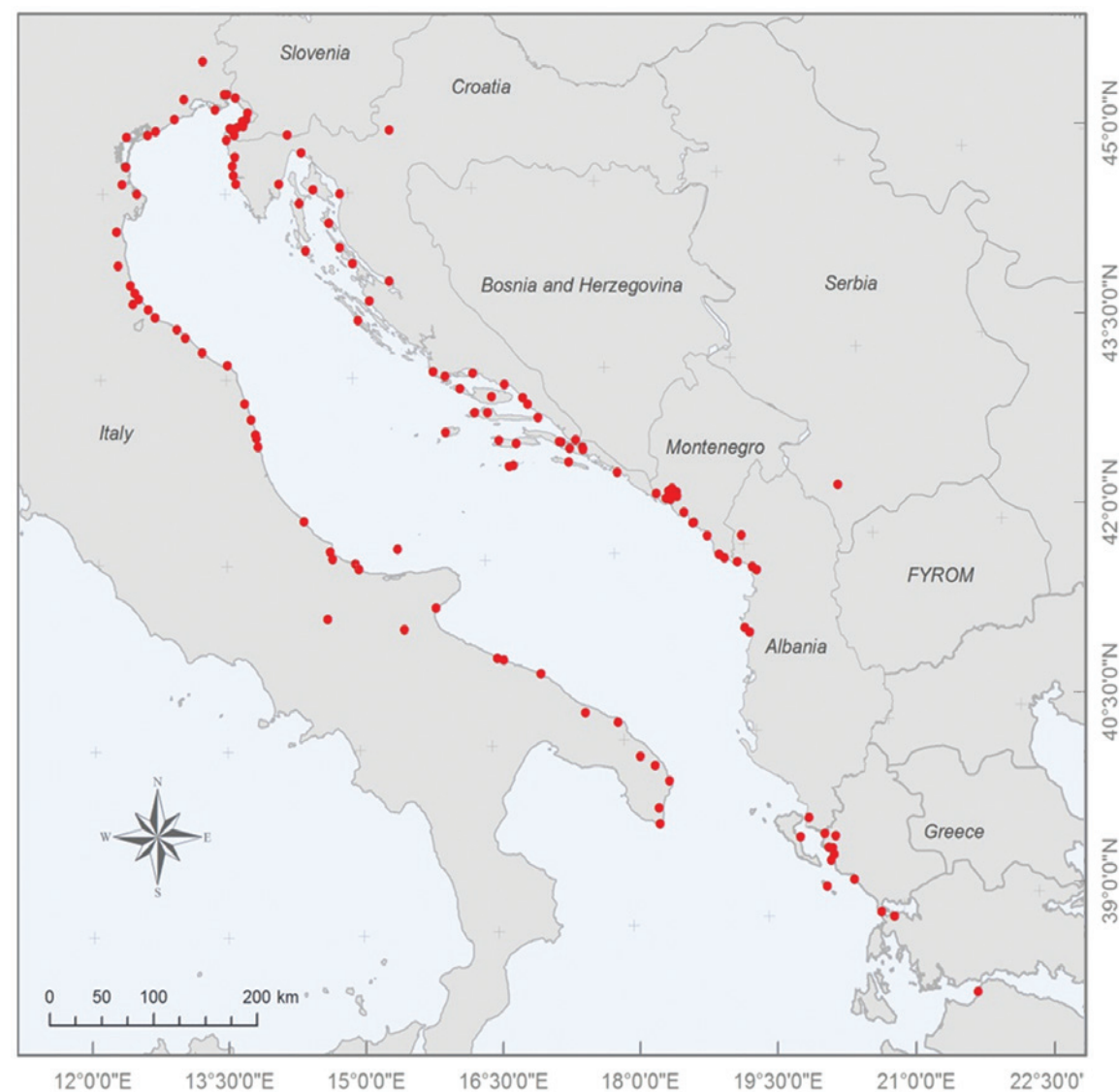


Figure 2.1. Map of the locations where the survey was carried out.

Table 2.2. Survey target groups and completed questionnaires.

Targeted sector	All countries	Albania	B & H	Croatia	Greece	Italy	Montenegro	Slovenia
Fisheries	213	43	-	40	59	30	16	25
Aquaculture	61	9	2	26	7	10	5	2
Harbours and marinas	43	1	1	11	3	23	1	3
Tourism sector	147	25	1	30	51	16	8	16
Municipalities	48	3	-	9	2	29	3	2
NGOs	36	-	-	2	8	19	3	4
Total	548	81	4	118	130	127	36	52

Table 2.3. Survey response rates per country and on aggregated basis at regional level.

Country	Number of questionnaires distributed	Number of completed questionnaires collected	Average response rate (%)
Albania	150	81	54.0
Bosnia & Herzegovina	-	4	-
Croatia	329	118	35.9
Greece	395	130	32.9
Italy	329	127	38.6
Montenegro	48	36	75.0
Slovenia	225	52	23.1
Adriatic & Ionian Seas	1480	548	37.0

The results and findings of the regional survey presented below are clustered on the basis of the two key thematic areas: (a) information related to marine litter found on coasts and/or at sea; (b) information related to the targeted sector. The results are presented on the level of aggregated information from all surveys, per all respondents, per country and per target group, respectively.





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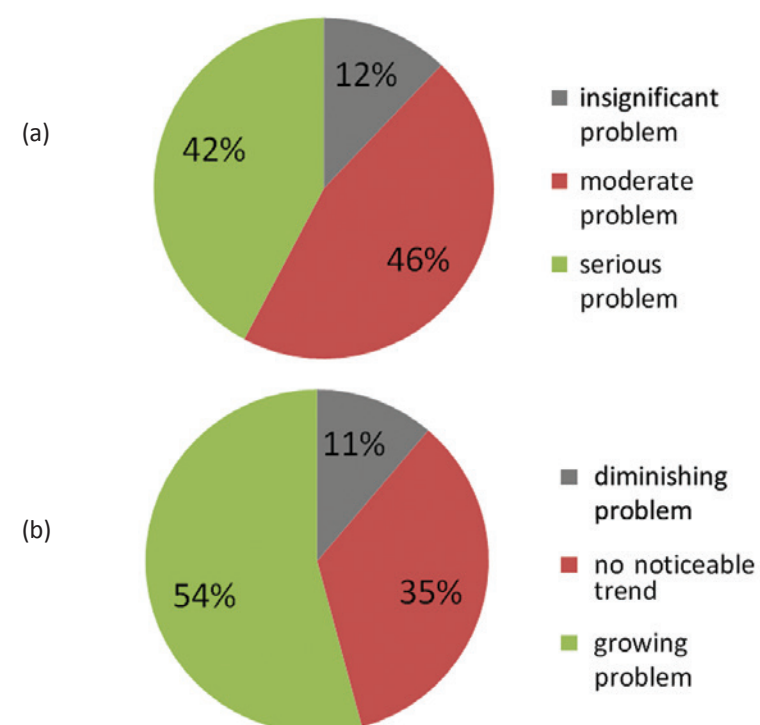
# RESULTS AND FINDINGS

3



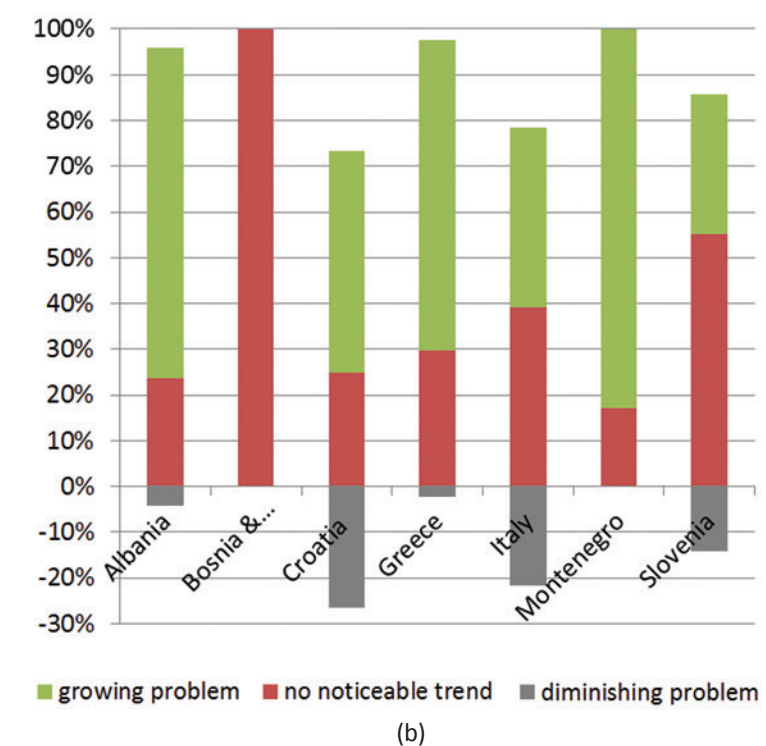
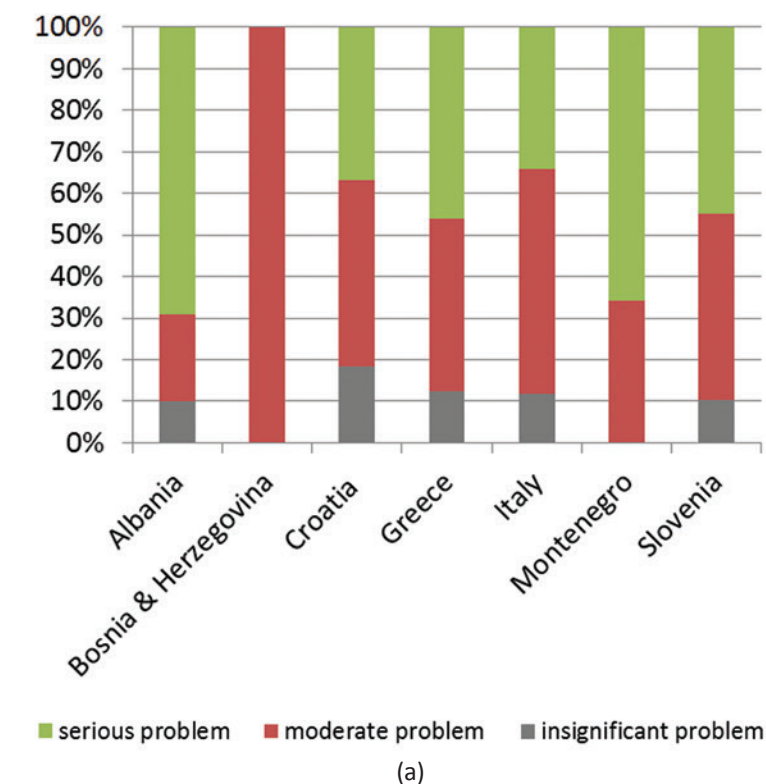
### 3.1 THE MARINE LITTER ISSUE

On an aggregated level, the vast majority (86%) of all stakeholders targeted by this study consider that marine litter found on beaches and/or at sea represents a serious or moderate problem. Almost half of them (46%) are of the opinion that marine litter is a serious environmental problem in their area, while 42% felt that this is a moderate problem. Only 12% thought that it is an insignificant problem [Fig. 3.1.1(a)]. When it comes to the trend of the marine litter problem, more than half of the respondents replied that this is a growing (54%) or a stable one (35%) [Fig. 3.1.1(b)].



**Figure 3.1.1.** Aggregated results on respondents' perception of the: (a) occurrence of marine litter observed on coasts and/or at sea; (b) trend relating to marine litter observed on the coasts and/or at sea.

Aggregated results at the country level show that the big majority of respondents from Albania (70%) and Montenegro (66%) perceive the gravity of the marine litter issue as very serious [Fig. 3.1.2(a)]. 35-45% of the survey participants from Croatia, Greece, Italy and Slovenia were of the opinion that marine litter is a serious issue. In all countries most of the respondents (~90%) consider the marine litter issue as a serious and/or moderate problem, with the exception of respondents from Croatia where a substantial percentage of participants (19%) are of the view that marine litter is an insignificant problem. Most of the respondents from all countries, except those from Bosnia & Herzegovina are of the opinion that marine litter is a growing problem [Fig. 3.1.2(a)]. The highest percentages were recorded for respondents from Albania (~72%) and Montenegro (83%). Interestingly, in Croatia (~27%) and Italy (~22%) many respondents felt that marine litter is a diminishing problem.

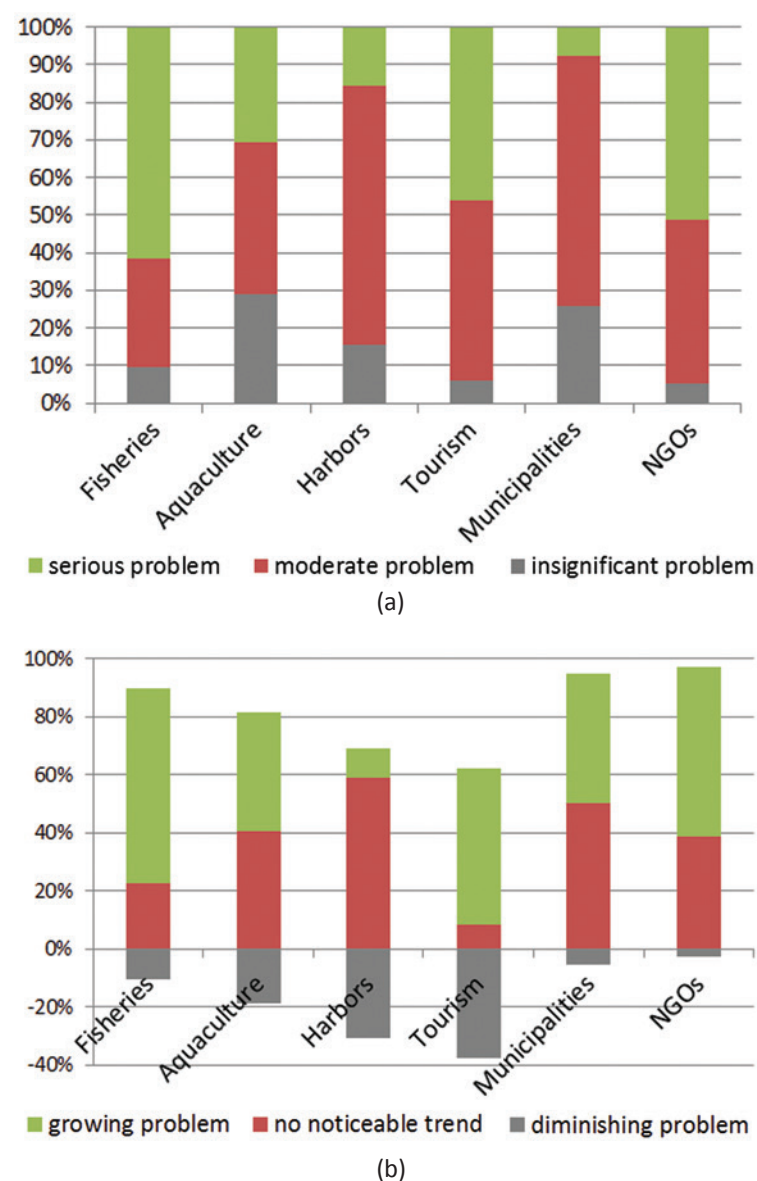


**Figure 3.1.2.** Aggregated results at the country level on respondents' perception of the: (a) occurrence of marine litter observed on coasts and/or at sea; (b) trend relating to marine litter observed on the coasts and/or at sea.





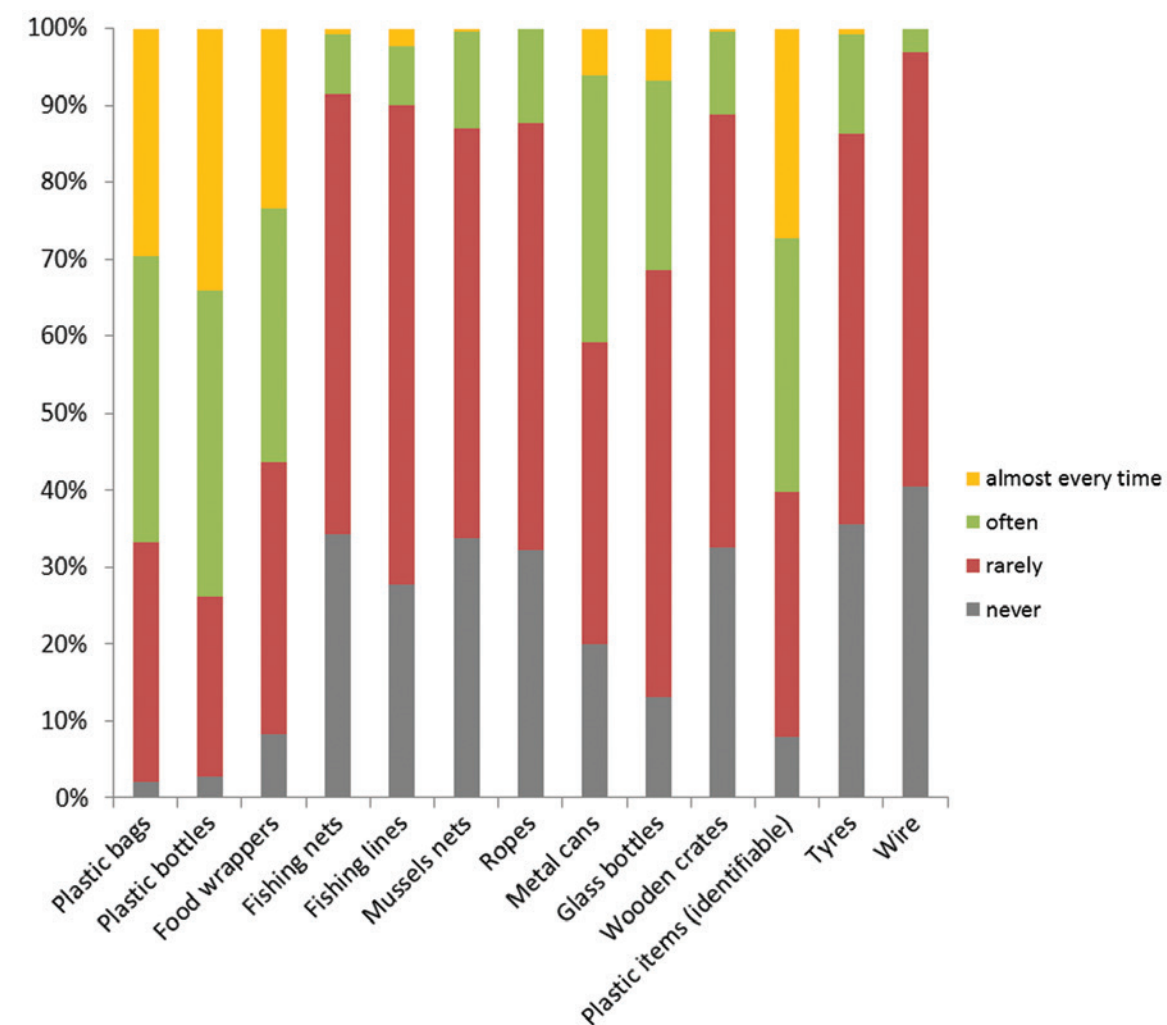
Aggregated results at the stakeholder group level show that most of the interviewees from all sectors are of the opinion that marine litter is a serious or moderate problem [Fig. 3.1.3(a)]. In particular, more than half of the respondents from the fisheries sector (62%) and from NGOs (51%) perceive the marine litter issue as a serious problem. 46% of the respondents from the tourism sector also consider marine litter as a serious problem. When asked about the trend, 67% of the interviewees from the fisheries sector felt that this is a growing problem [Fig. 3.1.3(b)]. Of the same view were more than half of the respondents from the tourism sector (54%) and the NGO community (58%). Interestingly, a large number of respondents from the tourism sector (38%) and from harbours and marinas (31%) felt that the marine litter issue is an insignificant problem.



**Figure 3.1.3.** Aggregated results at the stakeholders group level on respondents perception of the: (a) occurrence of marine litter observed on coasts and/or at sea; (b) trend relating to marine litter observed on the coasts and/or at sea.

Each participant from the fisheries, aquaculture, harbours & marinas and tourism sector was asked to assess the frequency with which specific items of marine litter (the main marine litter items encountered in the Mediterranean according to recent reports and surveys) are found in the areas they live and work. Plastic bags, plastic bottles, food wrappers and other plastic items are most frequently seen on coasts and at sea, followed by metal cans and glass bottles (Fig 3.1.4).

When stakeholders from the fisheries and aquaculture sectors were asked to assess the percentage that the various types of marine litter represent in terms of number of items, plastic bags ranked highest (27%), closely followed by plastic bottles (25%). Often seen are also plastic items (10%), food wrappers (9%), metal cans (7%) and wooden crates (5%), while less frequently seen are glass bottles (4%), fishing lines (4%), synthetic ropes (4%) and fishing nets (3%).



**Figure 3.1.4.** Aggregated results on respondents' assessment of the frequency with which top items of marine litter are found in their region on coasts and/or at sea.

Interviewees from the tourism sector, from municipalities and NGOs, were asked to identify the main source of marine litter in the areas they live and work. On an aggregated level, participants were of the opinion that the most prominent reason for marine litter occurrence is the irresponsible behaviour of tourists and local residents (Fig. 3.1.5). Overseas sources (floating litter) were perceived to be very important sources together with coastal and maritime tourism related activities (e.g. touristic establishments on beaches, cruise ships, etc.). Riverine inputs, fishing activities and waste water outlets were also perceived as quite significant sources. The marine litter inputs from industrial facilities in nearby coastal areas, aquaculture activities and run- or fly-off from dumpsites in the hinterland were perceived as rather insignificant.



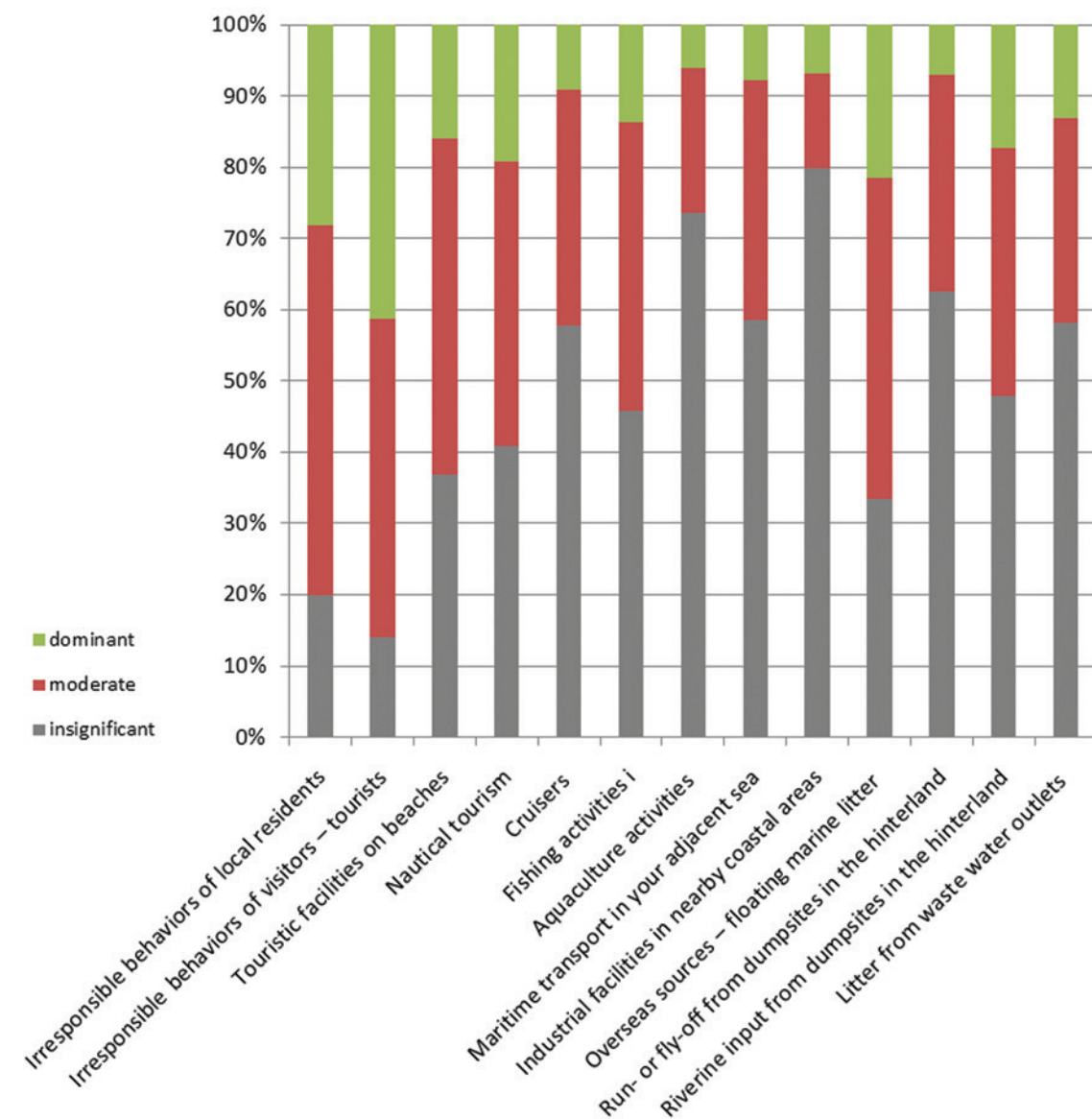


Figure 3.1.5. Aggregated results on respondents' perception on the main sources of marine litter.



## 3.2 FISHERIES

### 3.2.1. Introduction

Fisheries are extremely important for the Adriatic-Ionian macroregion, as they continue to be a key source of income and employment. Within the Adriatic-Ionian ecoregion, vessels registered exceed 21,000 ships, accounting for over 24% of the total European registered vessels (Eurostat, 2014). At country level the largest fishing fleet is found in Italy with 4,981 vessels in the Adriatic (Ronchi et al., 2016), followed by Croatia with 4,039 vessels registered. The Greek fisheries sector is also significant with some 4,000 registered fishing vessels in the Ionian Sea (Kavadas et al, 2013; European Fleet Register, 2013). The Slovenian and Montenegrin fishing fleets are much smaller with 169 (Cepuš, 2016) and 130 (Mandić et al., 2016) registered vessels respectively. As far as fish catches are concerned, the region accounts for around 39% of the total fish catches of the Mediterranean Sea (Med-IAMER, 2015). In the Adriatic Sea, the production of the fishery sector in Italy was about 131,000 tonnes, with a value of about € 492 million (Ronchi et al., 2016), followed by Croatia with a total value of production reaching € 200 million (Nazlić et al., 2016). In Slovenia in 2014, the total revenue in this sector was € 13 million (Cepuš, 2016).

The fishing industry is subject to economic costs due to marine litter but is also a source of marine litter together with the aquaculture sector. The results of the DeFishGear marine litter assessment in the Adriatic and Ionian Seas add to the growing body of evidence that the fisheries and aquaculture industries are largely responsible for marine debris. The contribution of fisheries and aquaculture related items on beaches was found to be 6%, on the sea surface 9% and on the sea floor 17% (Vlachogianni et al, 2016). These values are much higher than the 5% calculated for the Mediterranean (UNEP/MAP, 2015(a)). According to the DeFishGear marine litter assessment, the most frequently encountered fisheries related items (among the top 20) on the coastline of the Adriatic and Ionian Seas are polystyrene fish boxes and string and cord, while on the seafloor the most frequently encountered ones are fishing nets.

### 3.2.2. Fishing operations

As shown in Fig.3.2.1 out of a total of 211 questionnaires, 58% were completed by fishermen, 12% by sailors, 20% by skippers and the remaining 15% by other target groups (including vessel owners, divers, representatives of unions and cooperatives of fishermen, etc.).

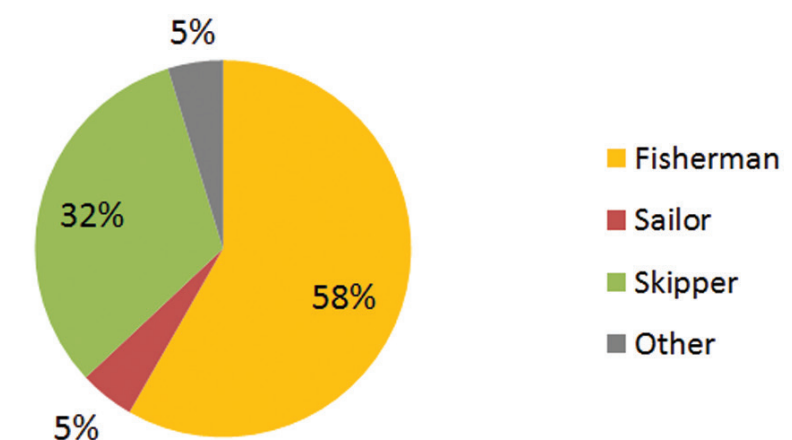
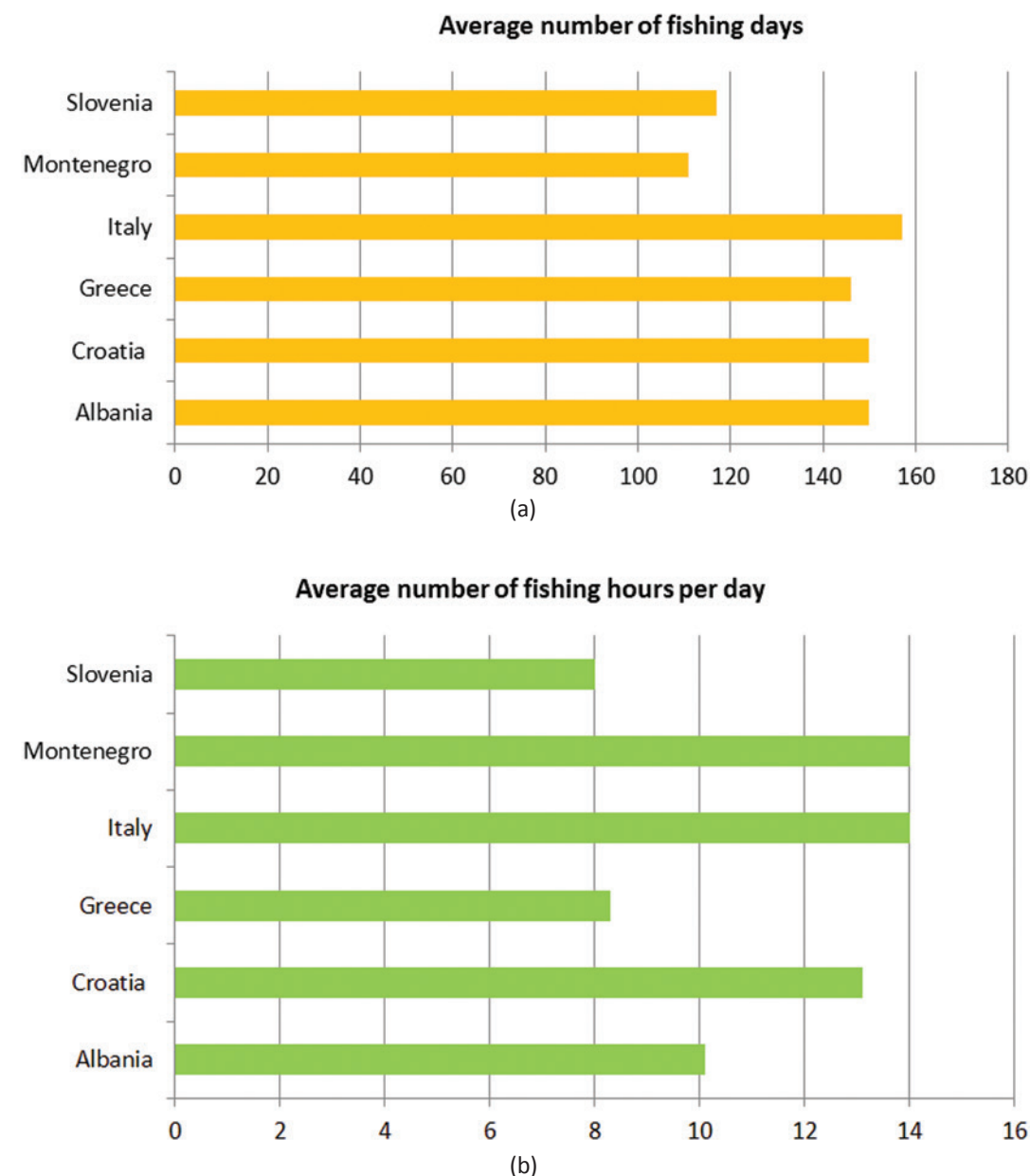


Figure 3.2.1. Survey respondents per target group.

The majority of the interviewees (66%) claimed to fish or work within their country's national waters with 34% working outside national waters. This was expected since most of the fishing activity in several of the countries of the survey takes place relatively close to the coast. The majority of the respondents (77%) claimed to spend over 120 days a year at sea and around 4-12 hours on each of these days. However, it should be noted that country averages varied (Fig. 3.2.1).

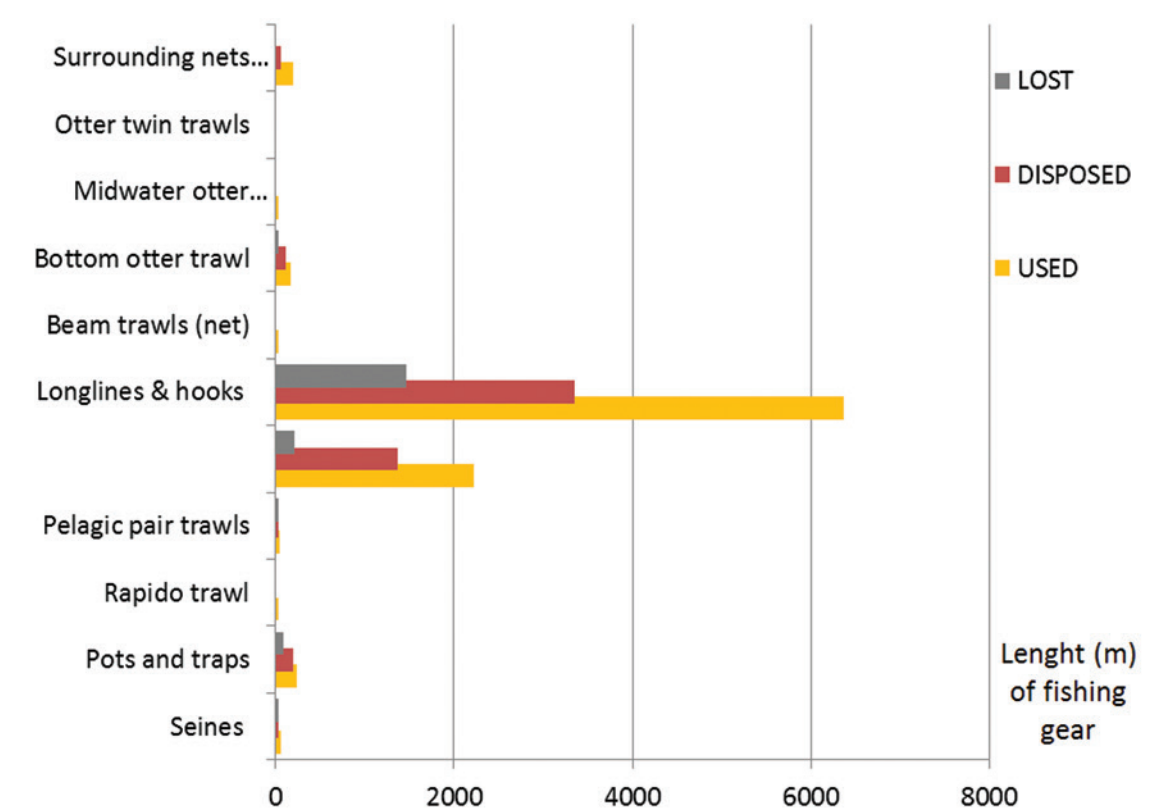




**Figure 3.2.2.** Aggregated results at the national level on respondents' claims related to: (a) average number of fishing days per year; (b) average number of fishing hours per day.

### 3.2.3. Abandoned, lost or discarded fishing gear

The most common types of fishing gear used in terms of amounts expressed in length (m) are longlines and hooks (52%), gillnets and similar nets (44%), trawls (2%), pots and traps (1%), surrounding nets and lift nets (1%). When these are expressed in numbers, the prevailing types of gear used are longlines and hooks (72%) and gillnets and similar nets (18%). In Fig. 3.2.3 one can see the relation between gear that is used, disposed of (end of use) and lost within a year. Apparently, longlines & hooks (23%), gillnets & similar nets (10%) and pots & traps (38%) are considered as the most commonly lost gear, with thousands of meters lost annually. Similar results were obtained in a Mediterranean-wide survey that was carried out by MIO-ECSDE within the framework of the UNEP/MAP MEDOL project on the implementation of the ecosystem approach in the Mediterranean (UNEP/MAP, 2015(b)). Trawl nets and purse seines may be lost or abandoned less, but often small pieces are torn. Fish cages are commonly damaged, destroyed and lost during storms. Chains, cables, etc. are rarely lost, but lead weights are frequently lost.



**Figure 3.2.3.** Estimates of types and amounts of fishing gear used, disposed and lost throughout the year (length, m).

The majority of the interviewed people (94%) stated that fishing gear is managed in a way that minimizes rather than increases the risk of its loss into the sea (Fig. 3.3.4(a)). The driver for such behaviour is that they want to avoid additional costs to the extent possible, so they recover, reuse and repair as much as possible.

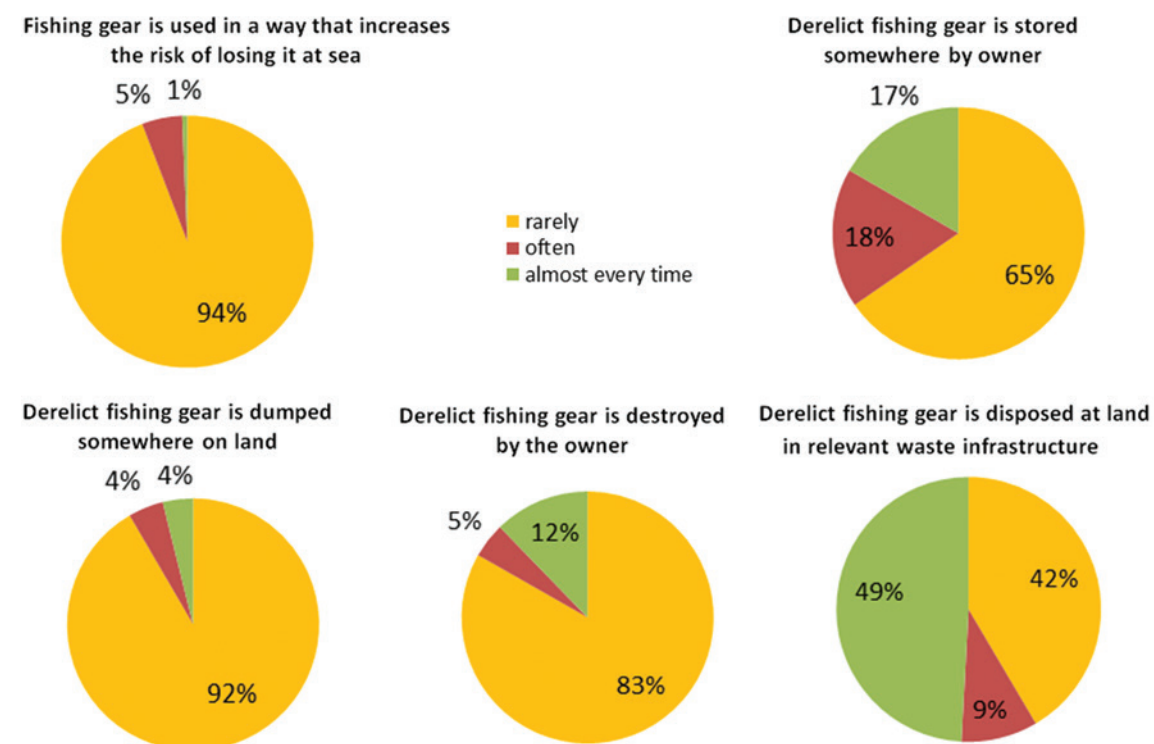
A third of the fishermen (35%) store derelict nets themselves with a little less than a fifth of them (17%) admitting to destroying them as well (e.g. burning) [Fig. 3.2.4(d)]. Only 8% admitted to eventually dumping it on land (illegal dumpsites) (Fig. 3.2.4(c)) and 49% claimed to always dispose of nets and equipment in the relevant waste facility on land (Fig. 3.2.4(e)).

When asked about the existence of specific collection points for derelict fishing gear at ports and marinas, only 16% replied that they do not exist (Fig. 3.2.5(a)). In the cases where they do exist they are disposed of together with other types of waste (Fig. 3.2.5(d)) while 88% pointed out that even when they do exist, they have no specific infrastructure in place (Fig. 3.2.5(c)). Accessibility to such facilities is not a problem though (Fig. 3.2.4(b)).

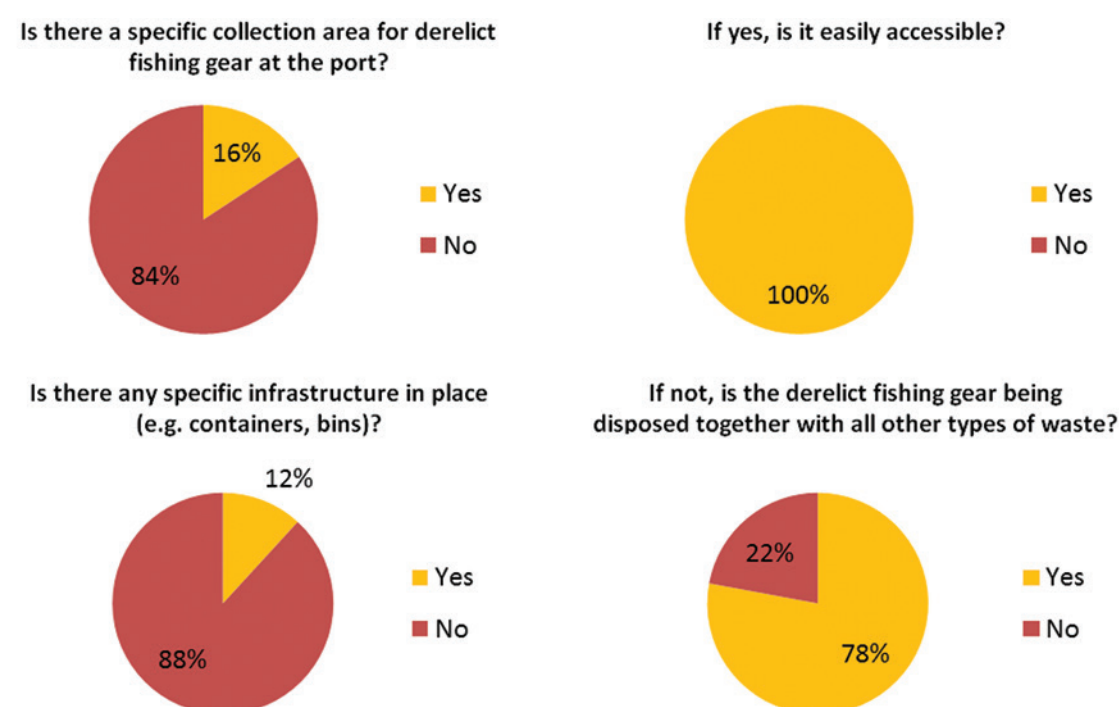
The overwhelming majority (89%) replied that there have not been specific measures taken that support the sustainable management of used fishing gear nor for lost fishing gear (Fig.3.2.6) and the mostly indirect legal provisions that do exist are hardly enforced. However, there were some initiatives mentioned that are being piloted or in the making, linked mostly with cleanup measures and actions taken (by NGOs, divers, volunteer groups, etc.) or projects (e.g. the DeFishGear project). These efforts may potentially contribute to the reduced occurrence of ghost nets and to minimizing the amounts of litter found ashore.

The aggregation of results at the national level reveals that in Albania, Croatia and Greece no specific measures have been undertaken to ensure the sustainable management of derelict fishing gear, while the vast majority of fishermen from Montenegro (92%) claimed that there are such measures in place. However, all these were actually referring to the actions undertaken within the framework of the DeFishGear project.

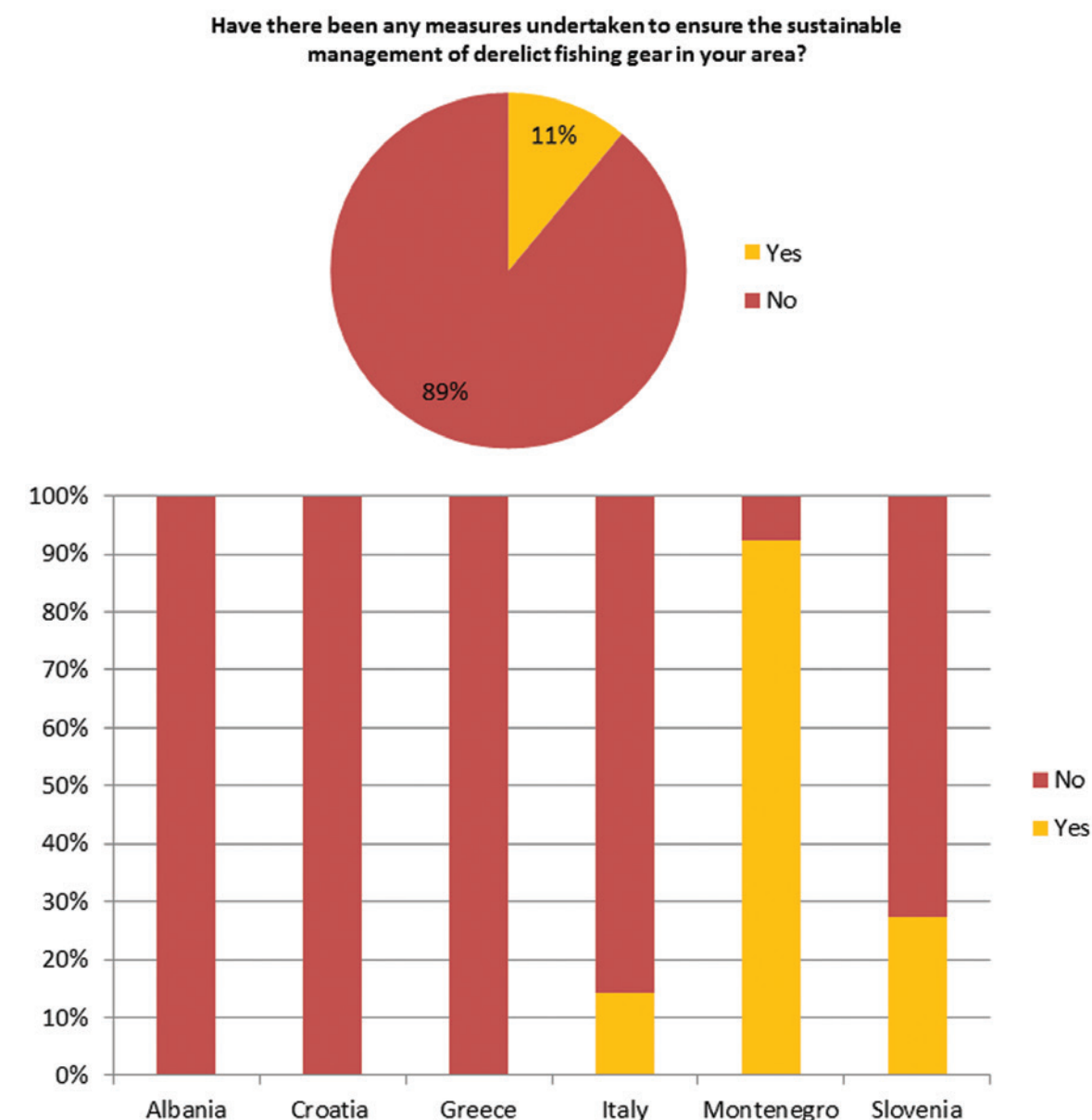




**Figure 3.2.4.** Respondents' assessment of the occurrence of the following practices within the fishing community regarding the usage and disposal of fishing gear: (a) Fishing gear is used in a way that increases the risk of losing it at sea; (b) Derelict fishing gear is stored somewhere by owner; (c) Derelict fishing gear is dumped somewhere on land (illegal dumpsite); (d) Derelict fishing gear is destroyed by the owner (burned?); (e) Derelict fishing gear is disposed at land in relevant waste infrastructure.



**Figure 3.2.5.** Respondents' replies related to disposal schemes in place: (a) Is there a specific collection area for derelict fishing gear at the port?; (b) If yes, is it easily accessible?; (c) Is there any specific infrastructure in place (e.g. containers, bins)?; (d) If not, are the derelict fishing gear being disposed together with all other types of waste?



**Figure 3.2.6.** Respondents' replies related to whether specific measures (regulations, establishment of derelict fishing gear schemes, awareness raising, etc.) have been taken that support the sustainable management of used, discarded or lost fishing gear: (a) aggregated results; (b) aggregated results at the national level.

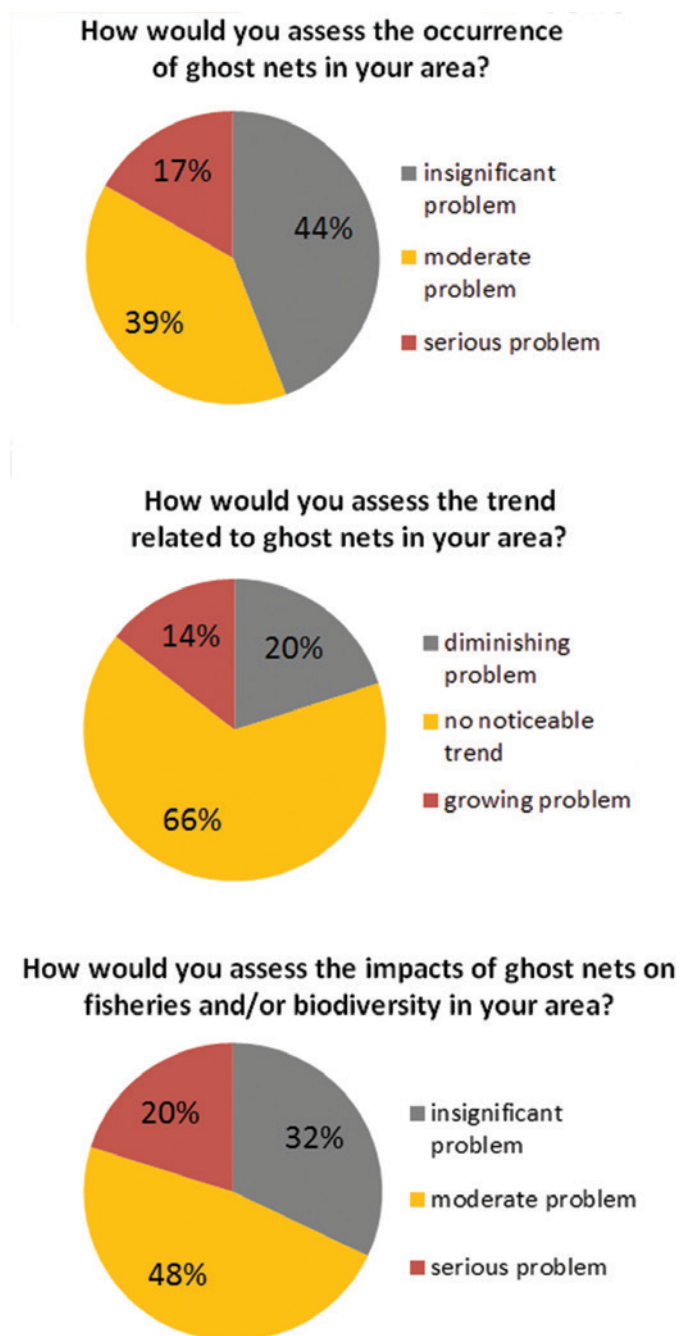
### 3.2.4. Ghost nets

The perception of whether ghost nets are a problem or not, varies from country to country, and port to port depending on (a) the level of awareness on the issue of derelict fishing gear as part of the overall marine litter problem and its implications on biodiversity and fisheries, (b) the actual scale of the problem. For example, towards the north-eastern part of the Adriatic Sea (Montenegro, Croatia, Slovenia) the interviewees felt that ghost nets are a significant problem in higher numbers than in the rest of the countries (20-40%) (Fig. 3.2.8). In Albania and Greece, the problem is considered insignificant by the majority of the fishermen in terms of occurrence (60-70%). Interestingly, when asked about the impacts of ghost nets a similar percentage of respondents from all countries (~20%) considered it a serious problem with the exception of Greece, where none of the respondents felt that it is a serious problem.



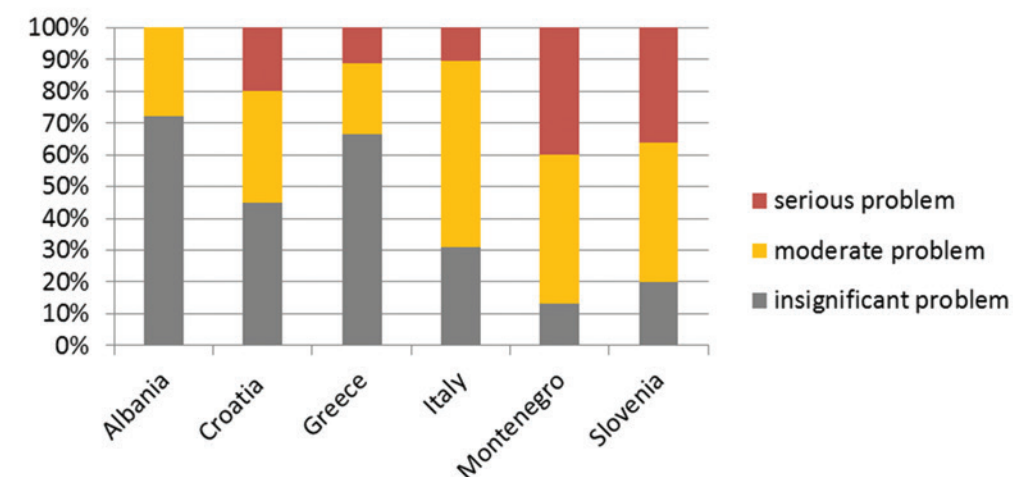


Overall, 56% of the respondents considered the issue of ghost nets as a serious (17%) or moderate (39%) problem. Only 14% of the respondents felt that this is a growing problem, while 66% claimed that there is no noticeable trend. 20% thought that the problem is actually diminishing. Similarly to the occurrence related perceptions, some 20% of the respondents considered the impacts of ghost nets as a serious problem, while some 32% felt that it is not a problem at all (Fig. 3.2.7).

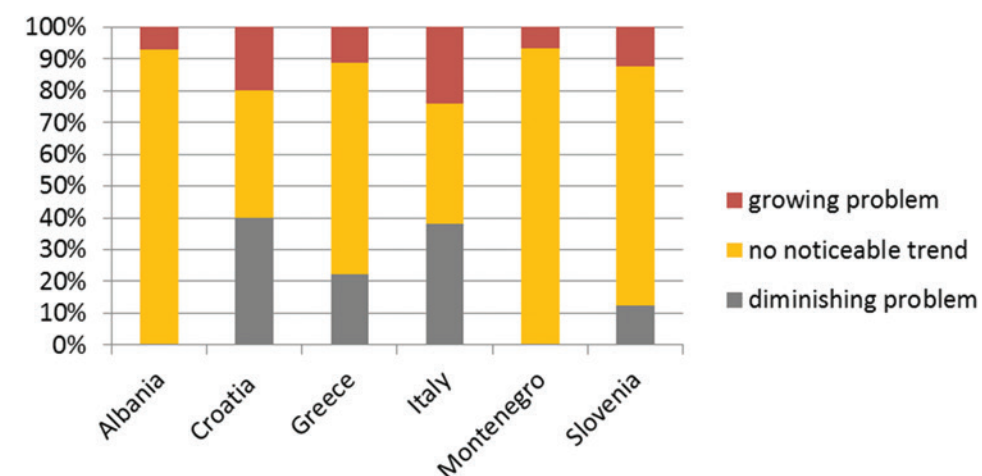


**Figure 3.2.7.** Respondents' perception of: (a) whether ghost nets are a problem or not, (b) whether there is an associated trend, (c) the impacts.

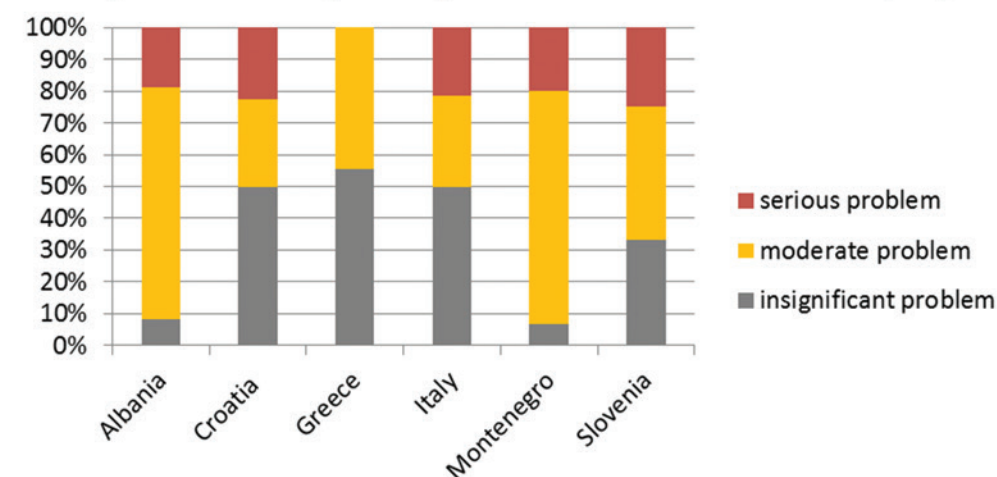
**How would you assess the occurrence of ghost nets (lost fishing gear) in your area?**



**How would you assess the trend related to ghost nets in your area?**



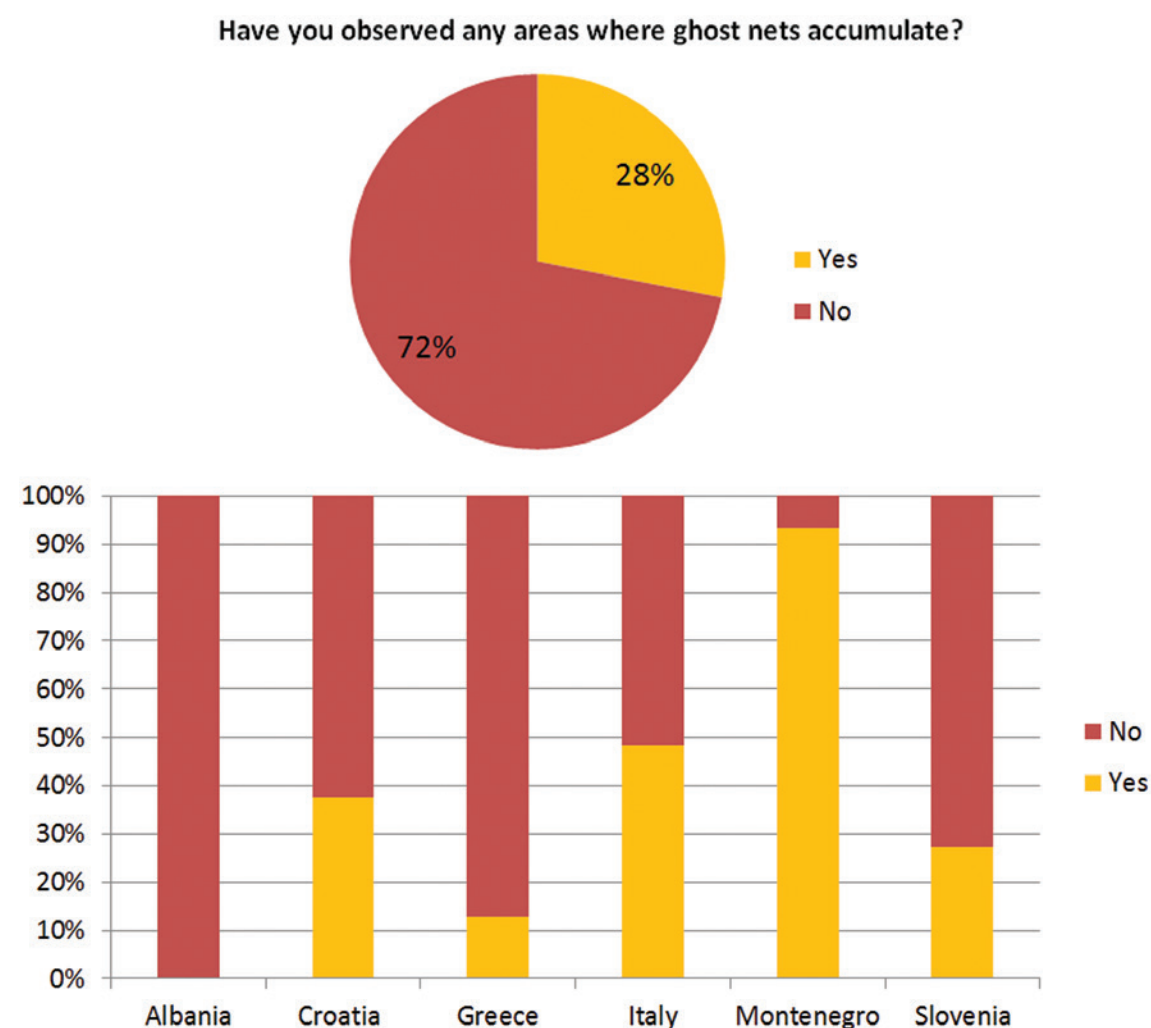
**How would you assess the impacts of ghost nets on fisheries & biodiversity in your area?**



**Figure 3.2.8.** Respondents' perception of (a) whether ghost nets are a problem or not, per country; (b) whether there is an associated trend, per country; (c) of the impacts per country.



It was clear from the survey results that over one fourth of the interviewees were in a position to identify areas where ghost nets tend to accumulate (Fig.3.2.9). These respondents came mainly from Croatia, Italy, Montenegro, Italy, Slovenia and Greece. The identified accumulation areas are shown in table 3.2.1.



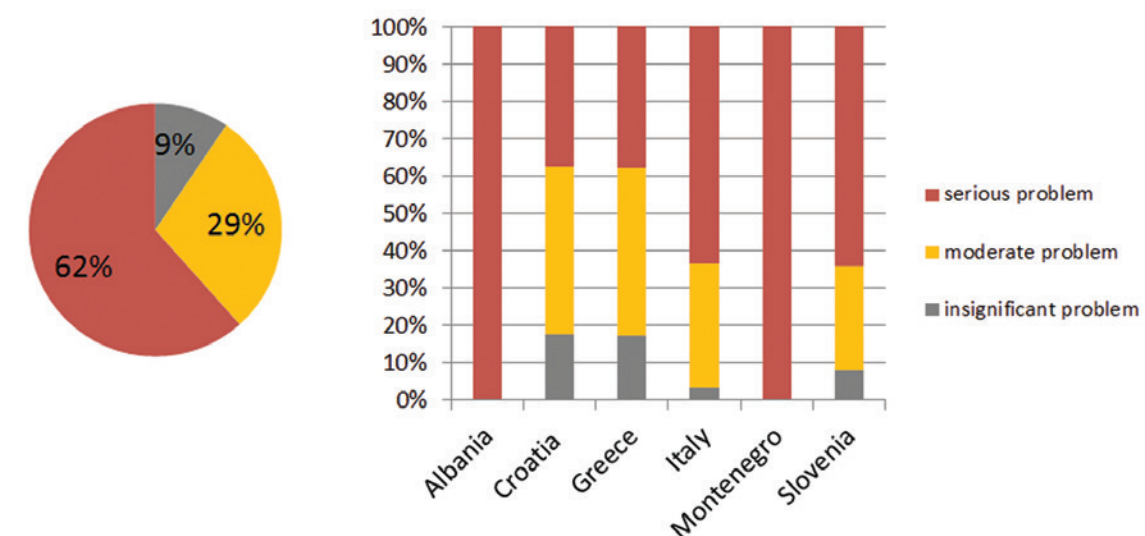
**Figure 3.2.9.** Respondents' replies on accumulation areas of ghost nets (a) on an aggregated level, (b) per country.

**Table 3.2.1.** Accumulation areas of ghost nets identified by the respondents.

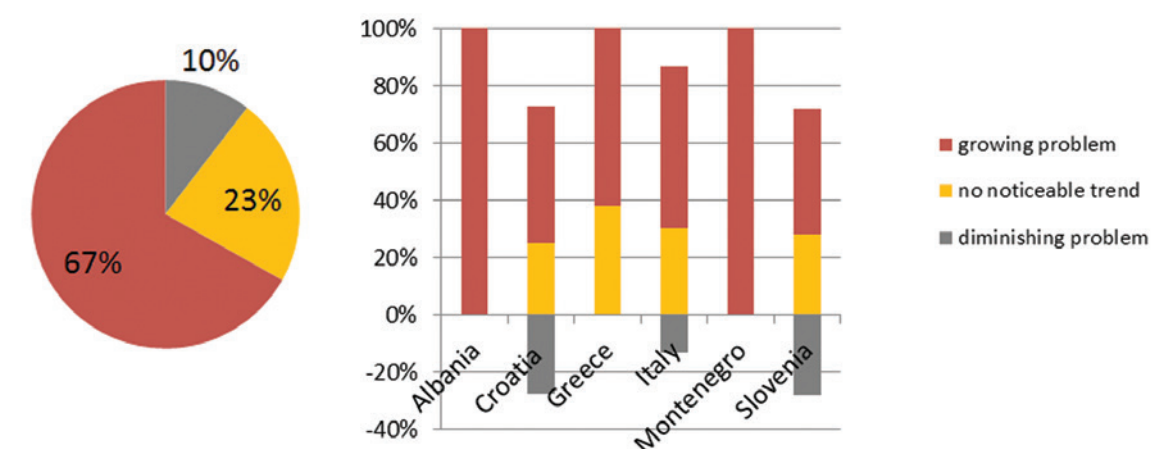
Country	Accumulation areas of ghost nets
Croatia	Dugi Otok island, between the islands of Korcula and Jabuka island, south of Lastovo island, shipwreck at Szent Istvan, south of Mljet island, shipwrecks at Lagnjici islets, Rt Barjaci, Komiza cave near the island Vis, Vis aquatorium, Lastovo Aquatorium.
Greece	In the vicinity of the port of Parga (1.5 km away), near Gouvia at Corfu, Diapontian islands, Othoni Island, Potami, Messonghi.
Italy	Gulf of Trieste, delta of river Po, Chioggia inlet, Tegnùe of Chioggia.
Montenegro	In the vicinity of Kumbor, Petrovac, Cape Volujica, near Buna/Bojana river, Cape Djeram near Ulcinj, around islands nearby Perast, Platamuni near Budva, area between Budva and Sveti Stefan, the most inner part of Kotor Bay, Cape Ostra, Kamenari.
Slovenia	In the vicinity of Rex between Koper and Izola, at Izola dockyard.

### 3.2.5. Marine litter implications and associated costs

On an aggregated level, the big majority of the sea-based economic sector targeted by this study is of the opinion that marine litter is a serious (62%) or a moderate problem (29%) and only 9% of the participants felt that this is an insignificant problem (Fig. 3.2.10). 10% were of the opinion that it is a diminishing problem, while the rest felt it is a growing problem (67%) or a stable one (23%) (Fig. 3.2.11). Interestingly all respondents from Albania and Montenegro consider marine litter as a serious problem and feel that it has an increasing trend.



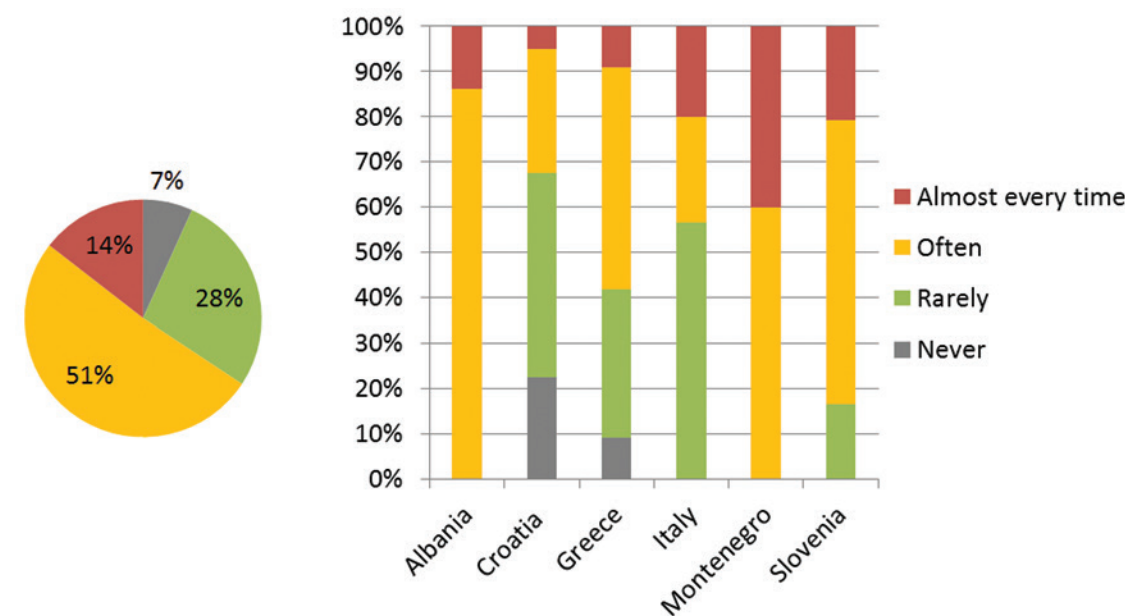
**Figure 3.2.10.** Results on respondents' perception of the occurrence of marine litter observed at sea and the gravity of the problem: (a) on aggregated level, (b) at national level.



**Figure 3.2.11.** Results on respondents perception of the trend related to marine litter observed at sea: (a) on aggregated level, (b) at national level.

As to marine litter getting caught in hauls/nets, occurrence seems to vary from country to country (Fig.3.2.12). The most frequent occurrence (almost every time and often) was reported for Albania, Montenegro and Slovenia. On an aggregated level, some 65% of the respondents replied that they do experience problems often (51%) or almost every time (14%), underlining the significant implications of marine litter for the fisheries sector. Only 7% never experience such a problem.

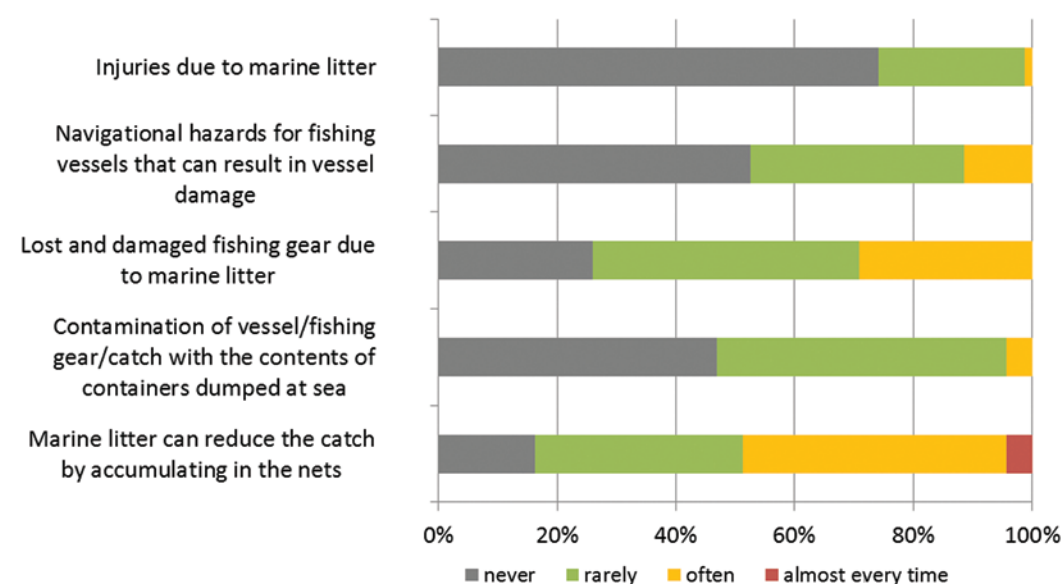




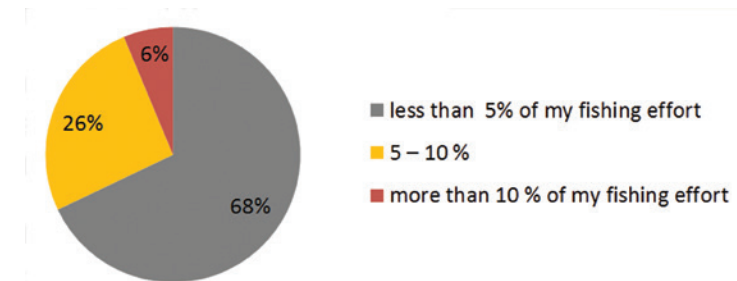
**Figure 3.2.12.** Respondents' experiences with marine litter caught in their hauls/nets: (a) on aggregated level, (b) at national level.

As to the impacts and damages caused by marine litter during fishing activities, according to fishermen's responses, the most important one seems to be related to the reduced catch by accumulated debris in their nets (Fig. 3.2.13). Almost half of the respondents claim that marine litter often (44%) or almost every time (5%) leads to reduced catches, highlighting the significance of the marine litter problem for the fisheries sector. Another important impact seems to be the loss or damaged fishing gear due to marine litter, with 30% of the respondents reporting that this occurs often. Less significant or less frequent impacts seem to be those related to contamination of the vessel, fishing gear and catch with the contents of containers recovered from the sea; navigational hazards for fishing vessels and vessel damages; injuries caused by marine litter.

On aggregated level, the big majority of fishermen (68%) spends up to 5% of their fishing effort for cleaning and and/or repairing damages due to marine litter (Fig. 3.2.14). 26% of the respondents waste 5-10% of their fishing time for addressing the marine litter impacts while 6% dedicates more than 10% of their fishing time.



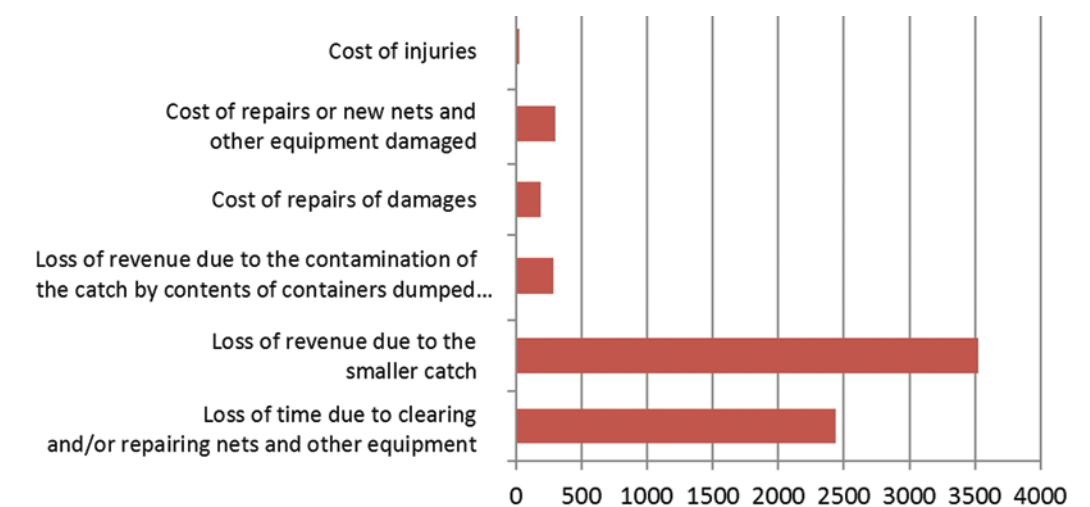
**Figure 3.2.13.** Responses on the impacts/damages caused by marine litter during fishing activities.



**Figure 3.2.14.** Responses on fishermen's time wasted for cleaning and/or repairing damages due to marine litter.

Revealing where the results related to the fishermen's assessment of the direct and indirect costs arising from marine litter. On average, the annual cost per fishing vessel reaches the amount of € 5,378. This amount is much higher in comparison to the figure reported for Portuguese vessels (€ 2,930) but much lower than the Scottish figures (€ 17,219-€ 19,165) (Mouat et al, 2010). The EU annual average marine litter related cost per vessel as calculated in another report (Acoleyen et al, 2013) reaches the amount of € 3,542 which is much lower than the average cost calculated for vessels fishing in the Adriatic and Ionian Seas. These discrepancies might be due to the different features and specificities of the fishing vessels and fishing operations, but also due to the different ways of calculation. In the DeFishGear survey, fishermen were requested to calculate the annual direct and indirect costs, while for example in the KIMO study, costs were calculated using the average value of one hour's fishing time as estimated at the time of the survey. The highest costs arise from the loss of revenue due to the smaller catch and the loss of time spent on clearing and repairing nets and other equipment.

Within the Adriatic-Ionian ecoregion, currently registered fishing vessels exceed 21,000 ships, accounting for over 24% of the total European registered vessels (Eurostat, 2014). Assuming that the numerical composition of the fishing fleet in the Adriatic has not changed much since 2003 when relevant data were last reported (Manini et al, 2003), roughly 30% (3,383) of the fishing vessels use bottom trawl gear (demersal, pelagic) and dredges (most relevant for the purpose of this assessment). The total losses to the fisheries sector in the Adriatic-Ionian macroregion are therefore calculated to be € 18.19 million per year (3,383 vessels multiplied by the average annual cost per fishing vessel of € 5,378 caused by marine litter). This amount is very significant since it is one third (29.5%) of the marine litter related costs accounted for the overall EU fishing fleet (€ 61.7 million per annum) (Acoleyen et al, 2013). To put this in perspective, in Italy, marine litter knocks 2.5% (2,101 related fishing vessels multiplied by the average annual cost per fishing vessel of € 5,378 due to marine litter) off the total annual revenue (€ 452 million) of the related Italian fishing fleet (2,101 trawls and dredges, Ronchi et al., 2015). This is clearly a substantial cost to an industry that is important to coastal communities.



**Figure 3.2.15.** Aggregated results (average) on respondents' assessment of the direct and indirect costs arising from marine litter (per fishing vessel/per year).

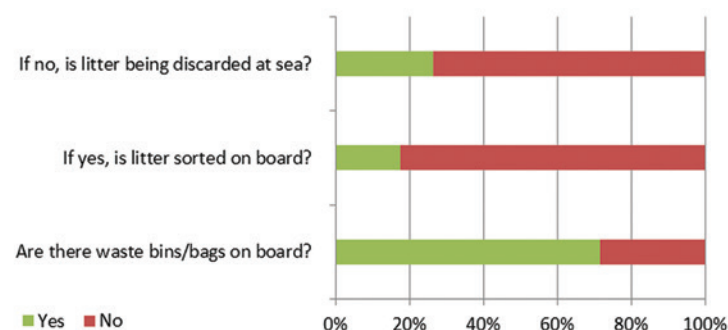


All the respondents highlighted that they are not insured for damages/ costs arising from marine litter and that they cannot be somehow compensated for these damages and costs. Only a small minority of the respondents (3%) are of the opinion that the marine litter challenge deterred employment in the fisheries sector.

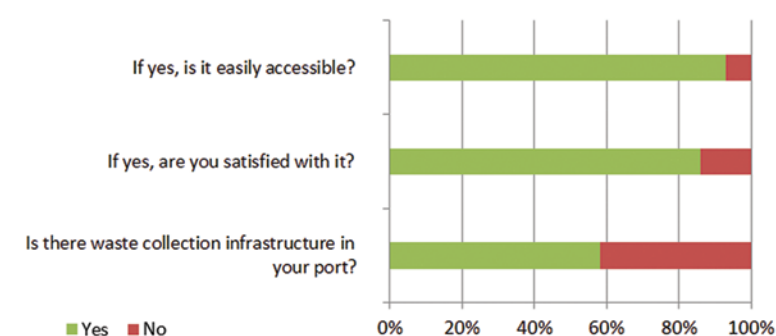
### 3.2.5. Waste collection and marine litter management

Fishermen were asked about waste and marine litter management practices on board and on shore. The big majority of the respondents (71%) claim to have waste bins on board but only 18% sort the litter on board. Of the 29% of the respondents that do not have bins on board, some 26% admit to throwing litter back overboard (Fig. 3.2.16).

Waste collection facilities back at ports exist in 58% of the cases, with only 14% complaining that they are sub-standard and not satisfied with them (Fig. 3.2.17). Accessibility is not an issue, with only a small minority of 7% saying that they are not easily accessible.



**Figure 3.2.16.** Respondents' claims related to marine litter management on board vessels.



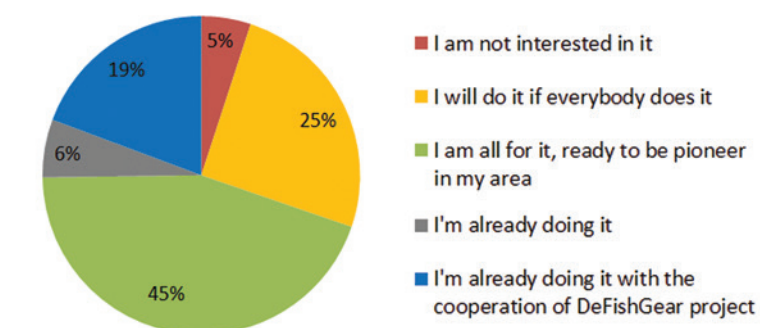
**Figure 3.2.17.** Respondents' claims related to marine litter management on shores.

The Fishing for Litter (FfL) measure is one of the key measures identified in the Regional Plan for Marine Litter Management in the Mediterranean (UNEP/MAP IG.21/9), therefore fishermen were asked about their opinion on this measure. The measure refers to the practice whereby fishermen collect marine litter caught in their nets at sea and dispose it in waste collection infrastructure at the port



upon return, instead of throwing it back into the sea. Some 25% of the respondents are already carrying out Fishing for Litter activities and only a small minority of 5% said that they would not support or participate in this measure (Fig. 3.2.18). It is encouraging to see that close to half of the respondents (45%) are willing to be a pioneer and implement the measure and an additional 25% will implement it if everybody does. These encouraging intentions were confirmed also by a complementary question asked on how they assess the interest of the fishing community with regards to the FfL measure and whether their colleagues would actually do it. 54% of the respondents claimed that their colleagues' interest would be high. Regarding the feasibility of the measure, the vast majority (94%) of the respondents were of the opinion that this is a technically feasible action.

It is worthwhile highlighting that even though the amounts of litter collected by FfL initiatives and targeted recovery of ghost nets is on the rise, the real added value of this measure lies in enhancing the awareness of the fisheries sector with regards to prevention measures and this is where this sector can and do make a difference.



**Figure 3.2.18.** Aggregated results on respondents' opinion about the Fishing for Litter measure.

## 3.3 AQUACULTURE

### 3.3.1. Introduction

Marine aquaculture has been a growing sector in recent years and an important contributor to food supply, food security and economic growth in the Adriatic-Ionian macroregion. From the seven countries of the region, Greece and Italy are the largest aquaculture producers. In terms of weight, Italy produces 13% of the EU aquaculture production and Greece 11%, while in terms of value Greece is the third largest producer in the EU, responsible for 15% (€ 525 million) of the EU aquaculture value (€ 3.5 billion). Italy ranks fifth with 10% (350 million) (€ 3.5 billion) (FAO, 2016; CTEFC, 2015). On the eastern side of the Adriatic-Ionian macroregion, marine aquaculture focuses on intensive farming and mussel culture, whereas on the western side, Italy is increasing its production of marine species, namely molluscs and finfish. Greece ranks first among EU Member States and Mediterranean



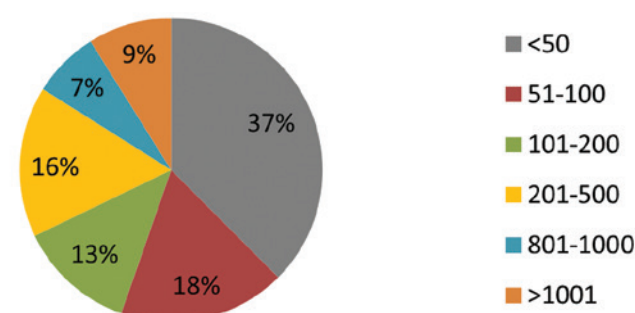


countries in production of commercial aquaculture finfish species (FAO, 2014). It is noteworthy that in the last decades the production of mussels has increased drastically in the region (ADRIPLAN, 2014).

Marine litter may impact the aquaculture industry with additional costs arising particularly from time spent removing litter from around fish farm sites and costs associated with fouled propellers on work boats (Mouat et al, 2010). However, the aquaculture sector may in turn contribute to the marine litter pressure as shown by the results of the DeFishGear project in the Adriatic-Ionian region. The DeFishGear marine litter assessment highlighted the emerging issue of mussel nets ranking in the 7<sup>th</sup> position of the top 20 items found on beaches, while in Italy these items were the 3<sup>rd</sup> most abundant items recorded on the seafloor (8.4%) (Vlachogianni et. al, 2016; Pasquini et al, 2016). Mussel nets are often accidentally lost at sea due to storms which cause their detachment from the farm's installations, or due to farmers' negligence, or due to intentional discharges.

### 3.3.2. Aquaculture farming operations

A total of 61 completed questionnaires were collected from all countries of the Adriatic-Ionian macroregion. More than half (55%) of the respondents represented aquaculture farms with an annual production capacity ranging from 10 to 100 tons. 13% of the contacted aquaculture farms produce 101-200 tons per year, 16% produce 201-500 tons per year, 7% produce 801-1001 tons per year and 9% produce more than 1001 tons per year. The vast majority of the aquaculture farms that participated in the survey focus on mussel and oyster farming (72%), while almost all the rest farm sea bass and sea bream (25%). Mainly mussel rafts, cages and longlines are used. In terms of number of employees 75% of the aquaculture farms have up to 8 employees, 10% have 10-20 employees, 14% have 20-40 employees and only 1% was a big aquaculture producer from Croatia with 313 employees.

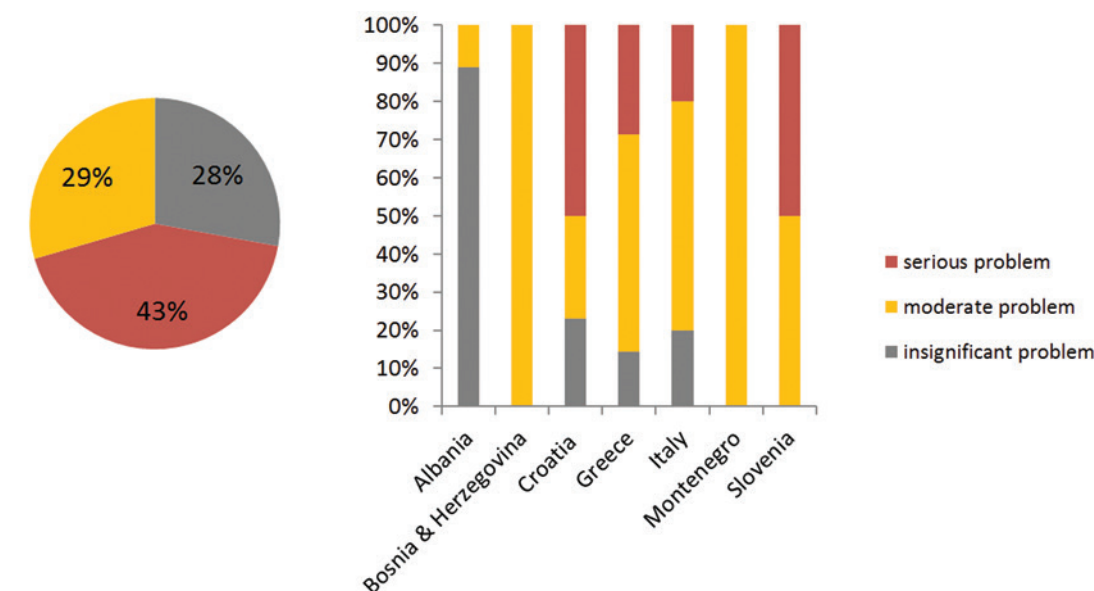


**Figure 3.3.1.** Annual production capacity (tons per year) of aquaculture farms surveyed.

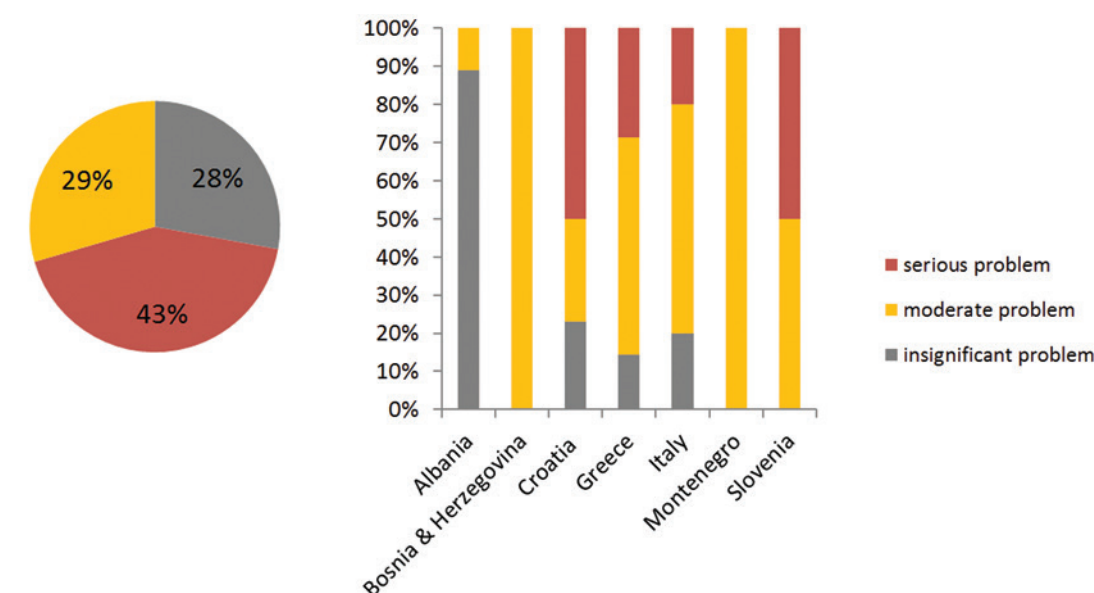
### 3.3.3. Marine litter implications and associated costs

On an aggregated level, the big majority of the aquaculture sector is of the opinion that marine litter is a serious problem (43%) or a moderate problem (29%). However, more than one fourth of the participants (28%) felt that this is an insignificant problem (Fig. 3.3.2). Almost one

fifth (19%) of the respondents were of the opinion that marine litter is a diminishing problem, while the rest felt it is a growing problem (39%) or a stable one (43%) (Fig. 3.3.3). Interestingly, the big majority of respondents from Albania consider marine litter as an insignificant problem with no noticeable trend. In addition, most of the respondents from Albania, Bosnia & Herzegovina, Montenegro and Slovenia feel that the marine litter issue is not characterized by a noticeable trend (Fig. 3.3.3).



**Figure 3.3.2.** Results on respondents' perception of the occurrence of marine litter observed at sea and the gravity of the problem: (a) on aggregated level, (b) at national level.



**Figure 3.3.3.** Results on respondents' perception of the trend related to marine litter observed at sea: (a) on aggregated level, (b) at national level.

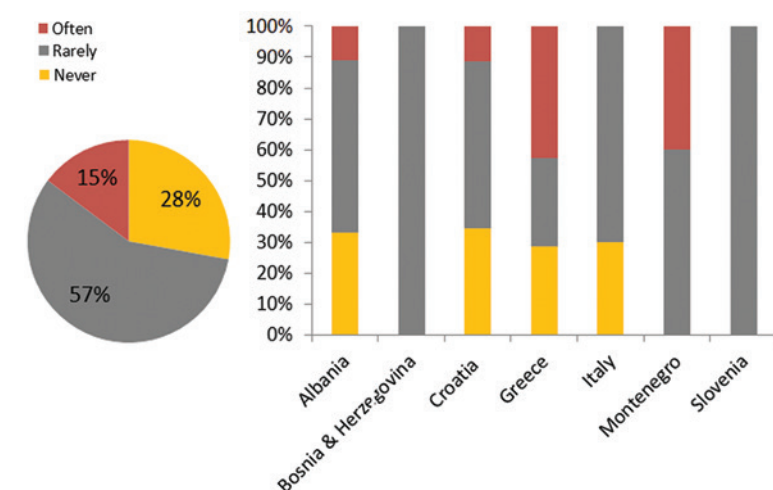
As to marine litter accumulating in the farming facilities (ponds, cages, pens, mussel rafts, etc.), occurrence seems to vary from country to country (Fig. 3.3.4). The most frequent occurrence was reported for Greece (43%) and Montenegro (40%). On an aggregated level though, only some 15% of the respondents replied that they do experience problems with marine litter often, while the remaining 85% claimed that they



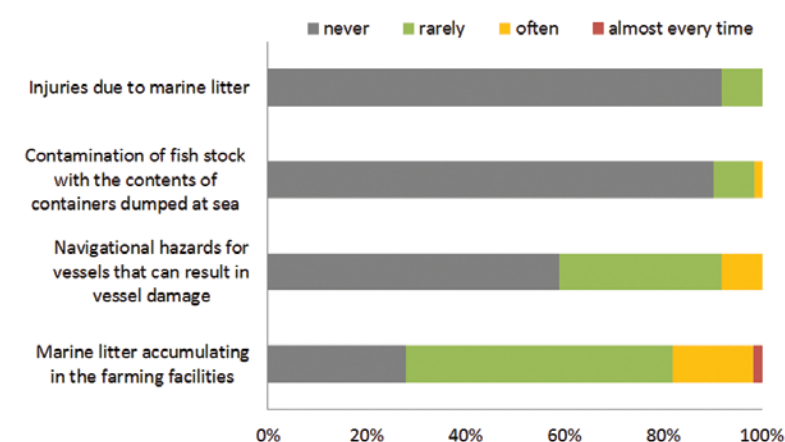
rarely (57%) or never (28%) experience problems. In general, it seems that marine litter is perceived as less of a problem by the aquaculture sector than to the fishermen in the area.

As to impacts and damages caused by marine litter, according to the aquaculture farmers the most important ones seem to be related to marine litter accumulated in the farming facilities and the navigational hazards for vessels that can result in vessel damage (Fig. 3.3.5). Only 16% of the respondents claim that marine litter is often accumulated in the farming facilities, while only 8% of them reported that marine litter can result in vessel damage. On national level, the countries that reported the most frequent impacts from litter accumulated in the farming facilities were Croatia, Greece and Montenegro (Fig. 3.3.6). When it comes to marine litter causing vessel damages, the countries that reported the most frequent incidents were Croatia, Italy and Montenegro (Fig. 3.3.7).

When it comes to the types of litter accumulating in the farm facilities the items most frequently encountered are plastic bags, plastic bottles, food wrappers, other identifiable plastic items, fishing lines, mussel nets, ropes and metal cans.



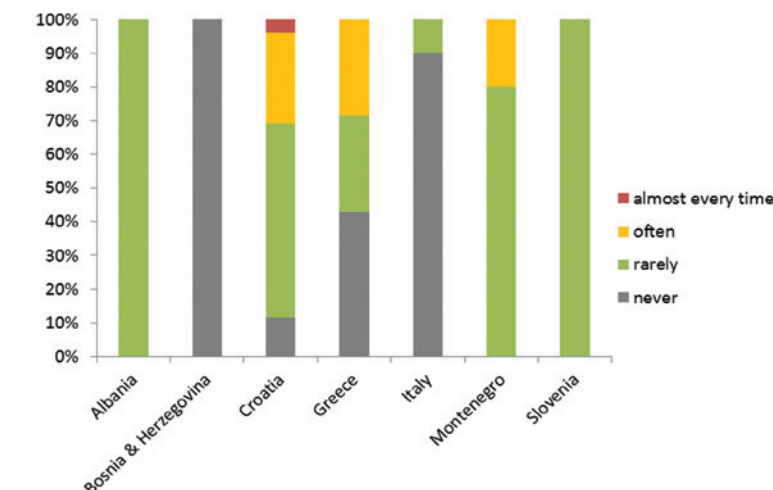
**Figure 3.3.4.** Respondents' experiences with marine litter accumulating in their farming facilities: (a) on aggregated level, (b) at national level.



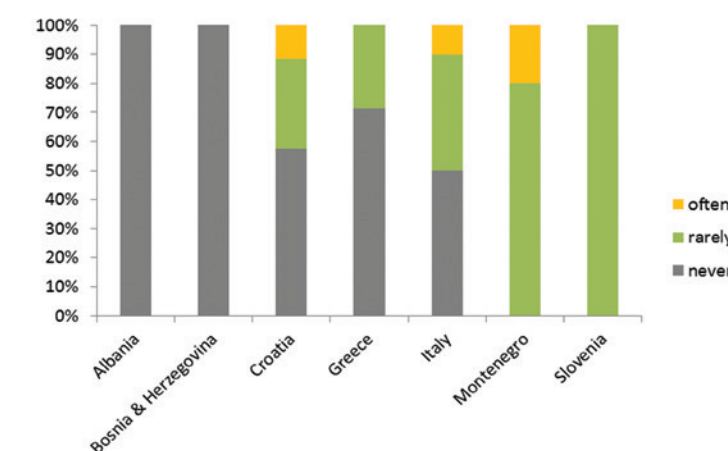
**Figure 3.3.5.** Responses on the impacts/damages caused by marine litter.



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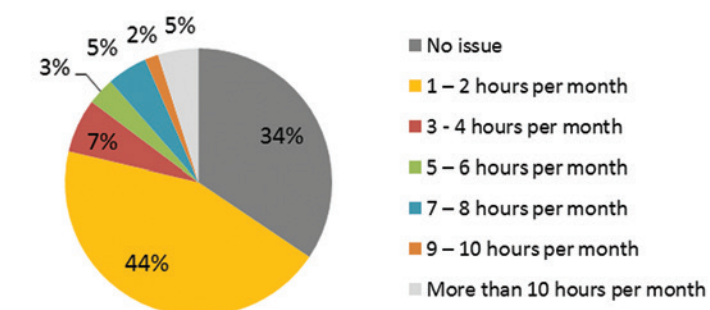


**Figure 3.3.6.** Responses on the gravity of the problem related to marine litter accumulating in the farming facilities, on country level.



**Figure 3.3.7.** Responses on the gravity of the problem related to marine litter that results in vessel damages, on country level.

On an aggregated level, around 44% of the aquaculture working staff spends 1-2 hours per month to remove marine litter from the farming facilities, some 7% claim to spending 3-4 hours per month, while only 15% claim spending more than 5 hours per month (Fig. 3.3.8). 34% of the respondents claim that marine litter is not an issue for them.

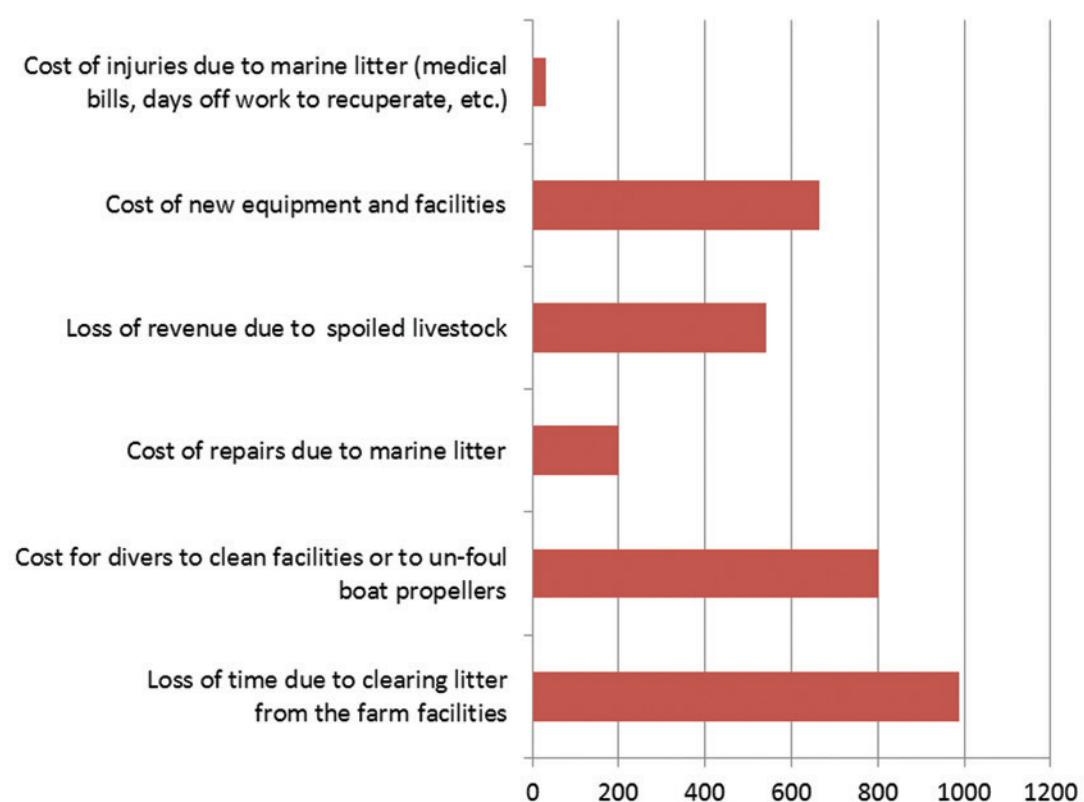


**Figure 3.3.8.** Responses on the working staff time wasted for removing marine litter from the aquaculture farm facilities.



Revealing where the results related to the assessment of the direct and indirect costs arising from marine litter to the aquaculture sector. Based on the responses of 38% of the respondents who reported an economic loss from marine litter, on average, the direct and indirect costs arising per aquaculture farm unit per year are 3,228 €/year. The remaining 62% of the respondents, including all respondents from Bosnia & Herzegovina and Slovenia, reported that no costs were incurred due to marine litter. The average amount reported for Montenegro was 500 €/year, for Greece 1,888 €/year, for Albania 2,146 €/year, for Croatia 2,352 €/year, while for Italy the costs reported were much higher reaching 15,000 €/year. In comparison to the average cost of marine litter to aquaculture producers recorded at 580 € per year in Scotland (Mouat et al, 2010), the costs assessed in the Adriatic-Ionian macroregion were considerably higher. The total costs for the aquaculture sector in the region is difficult to be estimated. However, given the large-scale operations of this sector the overall costs seem to be of significant magnitude.

In general, most costs were incurred because of: loss of time due to clearing litter from the farm facilities (989 €/year); costs for divers to clean facilities or to un-foul boat propellers (803 €/year); cost of new equipment and facilities (663 €/year); loss of revenue due to spoiled livestock (541 €/year); costs of repairs due to marine litter (200 €/year); cost of injuries due to marine litter (32 €/year).

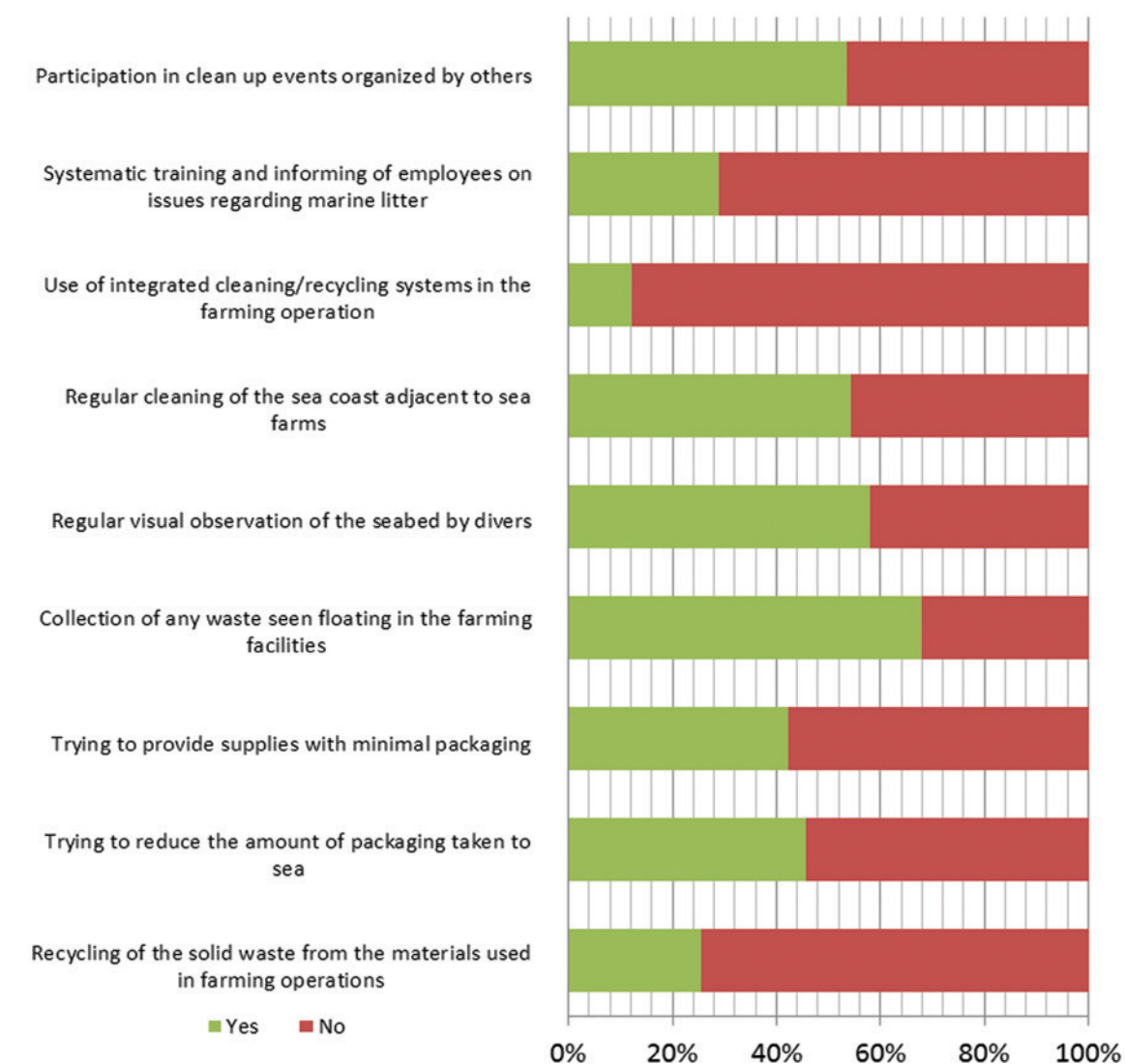


**Figure 3.3.9.** Aggregated results (average) on respondents' assessment of the direct and indirect costs arising from marine litter (per aquaculture farm unit/year).

### 3.3.3. Waste and marine litter management

Aquaculture farmers were asked about waste and marine litter management practices applied by their respective companies (Fig. 3.3.10). Around 67% of the respondents claim that there are waste collection and/or recycling systems in place for the solid waste produced by their facility and the collected marine litter, while almost one third of the respondents claim that no such systems are in place. Only a minority of the aquaculture companies (15%) recycle the solid waste produced in farming operations. Less than half try to reduce the amount of packaging taken to sea (46%) and try to provide supplies with minimal packaging (42%). 68% claim to collect any waste floating in the farming facilities and some 54% that they

regularly clean the sea and/or coast adjacent to the aquaculture farms. More than half of the respondents (58%) claim that divers survey the seafloor for litter on a regular basis. Only a small minority of aquaculture companies (12%) use integrated cleaning/recycling systems in their farming operations (from the hatchery all the way to the packaging facilities) and less than one third of the companies (29%) systematically train and informs the employees on issues related to marine litter. Last but not least, more than half of the respondents claim that they participate in cleanup events organized by others.



**Figure 3.3.10.** Respondents' claims related to marine litter management applied by their respective companies.

## HARBOURS AND MARINAS

### 3.4.1. Introduction

The Adriatic and Ionian Seas have been a trade and transport route since antiquity and in recent years are characterized by intensified maritime activities facilitated by a large number of ports, harbours and marinas. There are more than 20 harbours in the macroregion and each handles more than a million tonnes of cargo per year. Indicatively, among these are the harbours of Bari, Ancona, Brindisi, Ravenna, Venice, Koper, Trieste, Split, Durres, Igoumenitsa, etc. Ports and marinas generate income and employment opportunities to coastal communities. In Croatia for the total income of ports in 2015 amounted to approximately €



100 million (Nazlić et al., 2016). The main economic impacts of marine litter to harbours and marinas is the cost of removing marine litter in order to ensure that these facilities remain clean, safe and attractive for users (Mouat et al., 2010).

### 3.4.2. Harbours and marinas

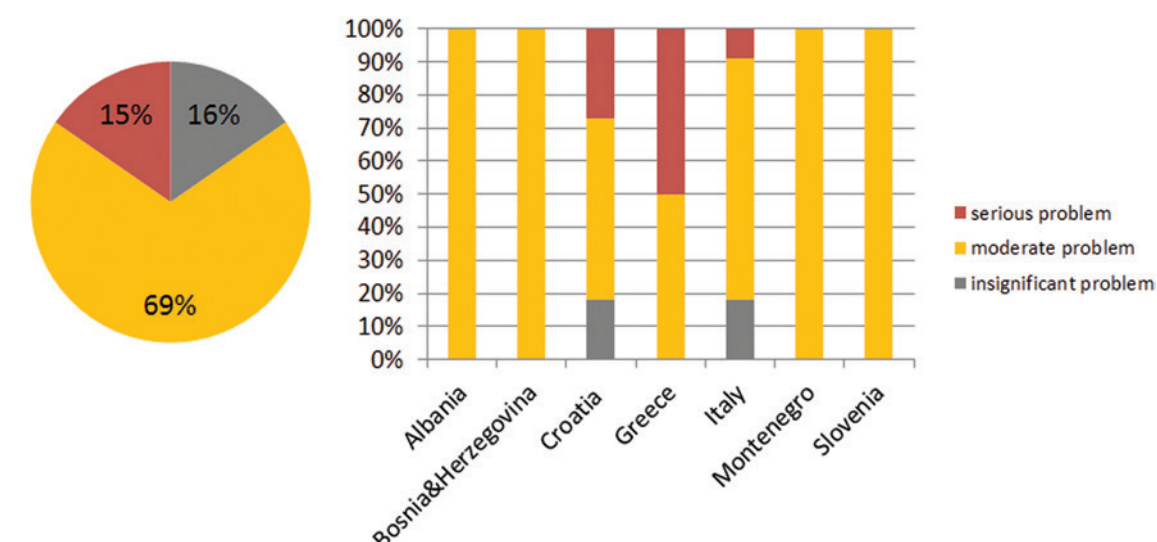
A total of 43 completed questionnaires were collected from harbours and marinas located throughout the Adriatic-Ionian macroregion. The respondents represented competent staff members that are employed in harbours and marinas of varying sizes (big, medium, small) and type (industrial, touristic, etc.) (Tab. 3.4.1). The majority of the harbours and marinas (72%) where the survey was performed were rather small with some 2-20 employees. 20% of the respondents worked at rather medium-sized ports with 21-65 employees and only 10% of the respondents were employed in rather large scale ports (e.g. Venice, Koper, Durres).

**Table 3.4.1.** Harbours and marinas that participated in the survey.

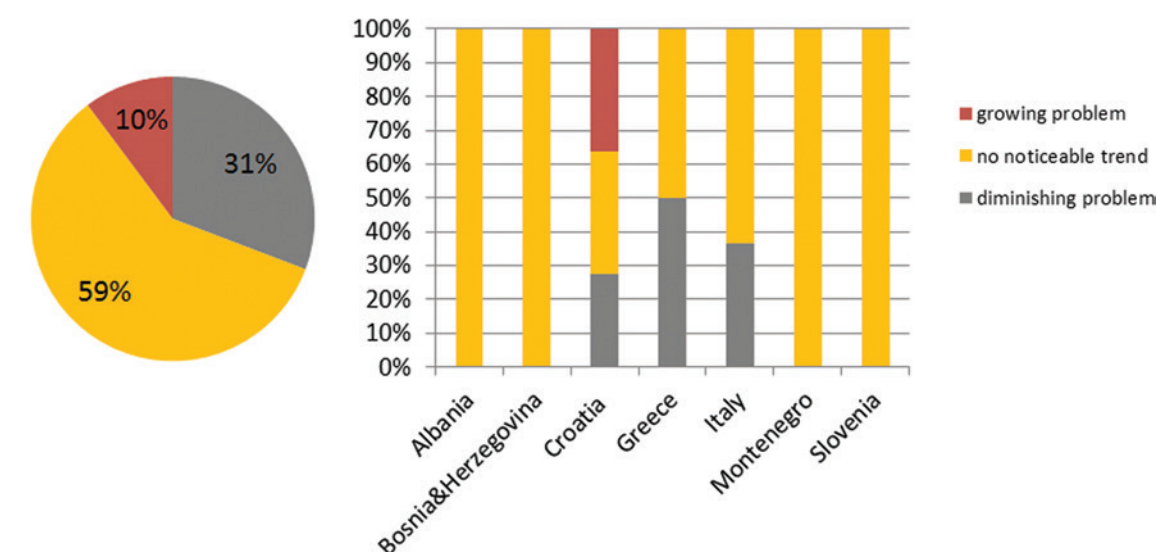
Country	Locations of harbour and/or marina
Albania	Durres
Bosnia & Herzegovina	Neum
Croatia	Bakar, Beli, Cervar-Porat, Cres, Porozina, Funtana, Komiza, Korcula, Lim, Makarska, Martinscica, Merag, Omisalj, Porec, Rab, Rasa-Brsica, Rijeka, Sjeverna Luka, Split, Torpedo, Valun, Vrsar
Greece	Corfu, Erreikousa, Gajios, Igoumenitsa, Lakka, Lefkimmi, Loggos, Mathraki, Othoni, Plataria, Sagiada, Sivota
Italy	Ancona, Bellaria, Brindisi, Cattolica, Duca della Rovere Senigallia, Fano, Grado, Monfalcone, Numana, Ortona, Pesaro, San Giorgio, Baia Vallugola, Ravenna, Riccione, Rimini, San Benedetto del Tronto, San Salvo, Santa Maria di Leuca, Termoli, Triase, Vasto, Venezia
Montenegro	Kotor
Slovenia	Izola, Koper, Portorož

### 3.4.3. Marine litter implications and associated costs

On an aggregated level, the big majority of the port authorities are of the opinion that marine litter is a moderate problem (69%) or an insignificant problem (16%). Only 15% of the respondents felt that marine litter is a serious problem (Fig. 3.4.1). At national level, a considerable percentage of respondents from Croatia (~30%) and Greece (~50%) were of the opinion that marine litter is a serious problem. Almost one third (31%) of the respondents were of the opinion that marine litter is a diminishing problem, while the rest felt it is a stable problem (59%) or a growing one (10%) (Fig. 3.4.2). Interestingly, all respondents from Albania, Bosnia and Herzegovina, Montenegro and Slovenia consider marine litter as a moderate problem with no noticeable trend.

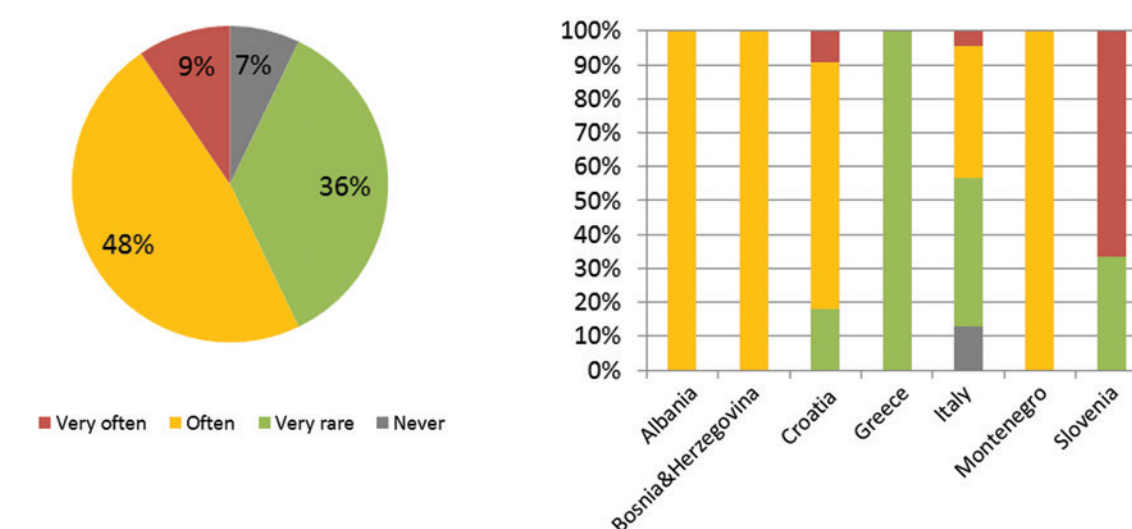


**Figure 3.4.1.** Results on respondents' perception of the occurrence of marine litter and the gravity of the problem: (a) on aggregated level, (b) at national level.



**Figure 3.4.2.** Results on respondents' perception of the trend related to marine litter observed: (a) on aggregated level, (b) at national level.

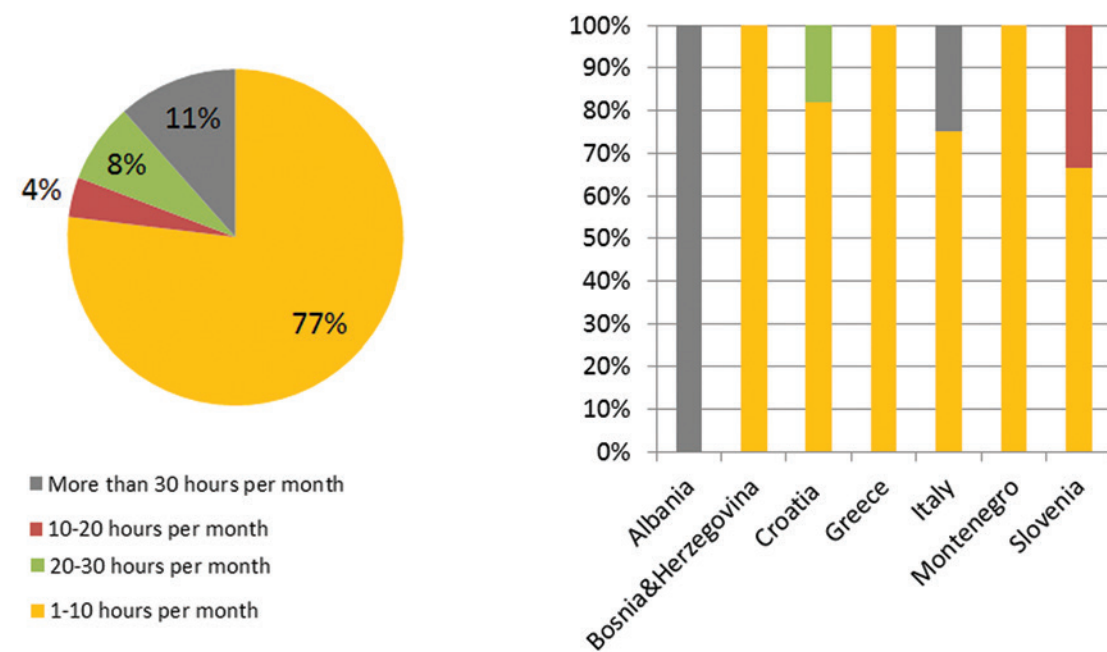
Despite the existing regulations it seems that harbours and marinas do suffer from accumulation of marine litter and need to undertake rather frequent cleanups in order to ensure that their facilities are clean, safe and attractive for users. More than half of the respondents (57%) reported that they carry out cleanups at harbours and marinas either often (48%) or very often (9%) (Fig. 3.4.3). The most frequent marine litter removals are undertaken in Albania, Bosnia & Herzegovina, Croatia, Montenegro and Slovenia. All respondents from Greece reported that they very rarely carry out cleanups, while almost half of the respondents from Italy reported that they carry out cleanups often and very often and the other half very rare and never.



**Figure 3.4.3.** Responses on the frequency of marine litter cleanups in harbours and marinas: (a) on aggregated level, (b) at national level.

The main marine litter cleanup method applied is manual removal, including with divers (~92%). Out of these only 35% use a dedicated boat for this activity. Only one harbour (Durres) reported dredging as the main method applied to remove marine litter. 70% of the respondents were in a position to give a specific reply to the time spent for marine litter clearance activities which varied depending on the method applied and perhaps also the size of the port. In Albania, where dredging was also complemented by manual removal of litter, more than 30 hours per month were required to manually remove marine litter, while dredging was performed every few years. In the rest of the countries the vast majority of respondents reported that 1-10 hours per month were needed for the manual removal, including diving for litter (Fig. 3.4.4.).

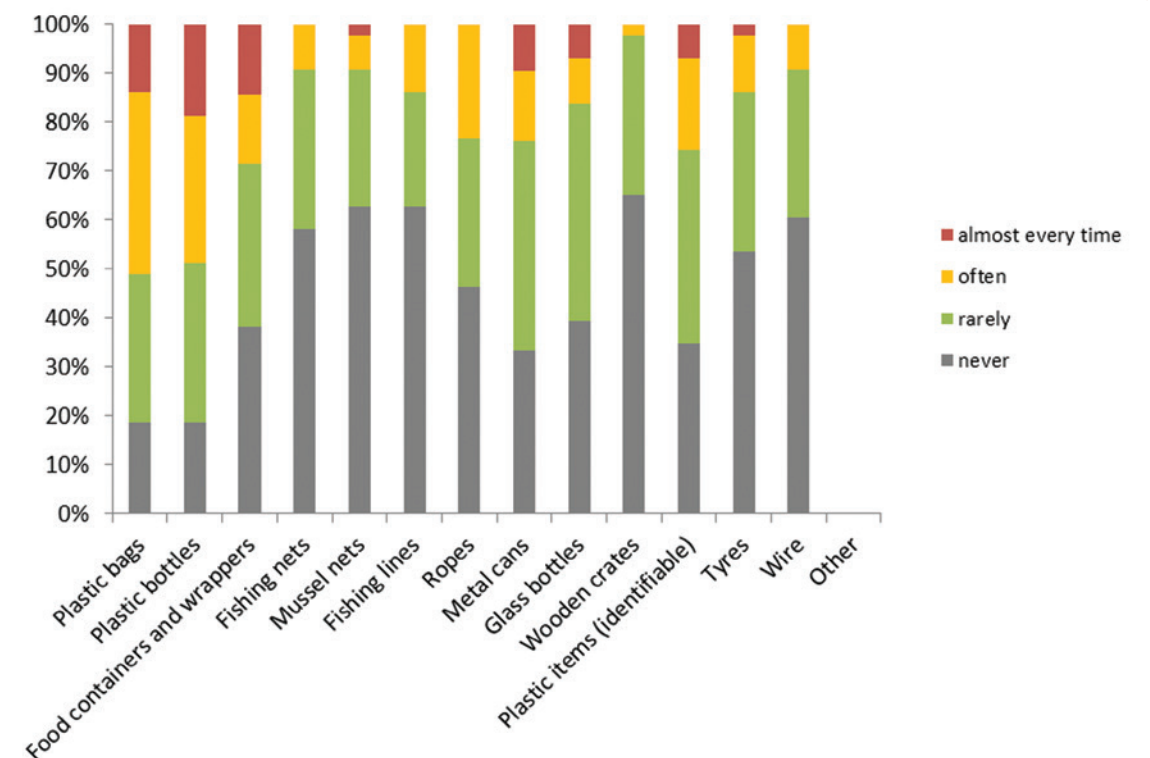




**Figure 3.4.4.** Responses on the frequency of marine litter cleanups in harbours and marinas: (a) on aggregated level, (b) at national level.

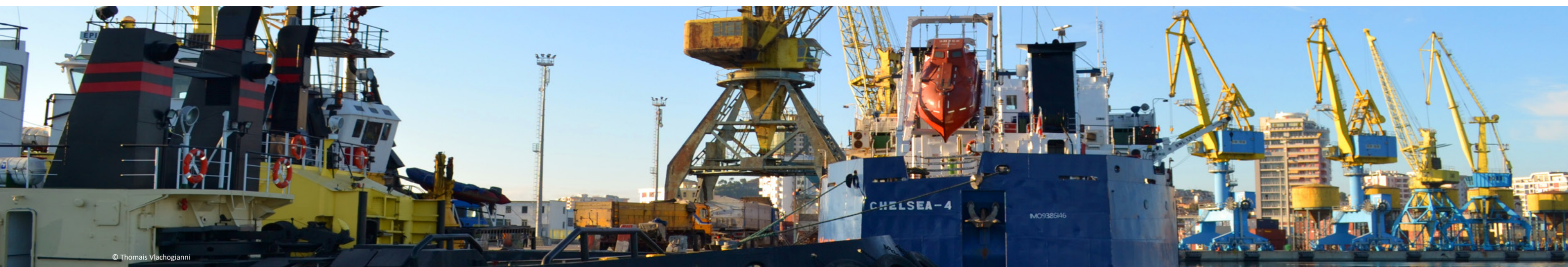
The total annual amount of litter reported from the clearance activities per harbour was mainly (79%) less than 10 m<sup>3</sup> or in the range of 10-30 m<sup>3</sup> (12%) and 30-50 m<sup>3</sup> (6%). Only the respondent from the harbour of Durres estimated the total annual amount of litter removed to be more than 100 m<sup>3</sup>. The amounts of litter collected are either disposed of at waste collection facilities of the harbour and marinas or collected and disposed of by private companies responsible for waste management in ports. Marine litter eventually ends up in landfills.

The most common litter items removed from cleanup operations in harbours and marinas were plastic bags (51% of responses reported a frequency of almost every time and/or often), plastic bottles (49% of responses reported a frequency of almost every time and/or often), food containers and food wrappers (28% of responses reported a frequency of almost every time and/or often), other identifiable plastic items (26% of responses reported a frequency of almost every time and/or often), ropes (23% of responses reported a frequency of almost every time and/or often) and metal cans (51% of responses reported a frequency of almost every time and/or often) (Fig. 3.4.5).



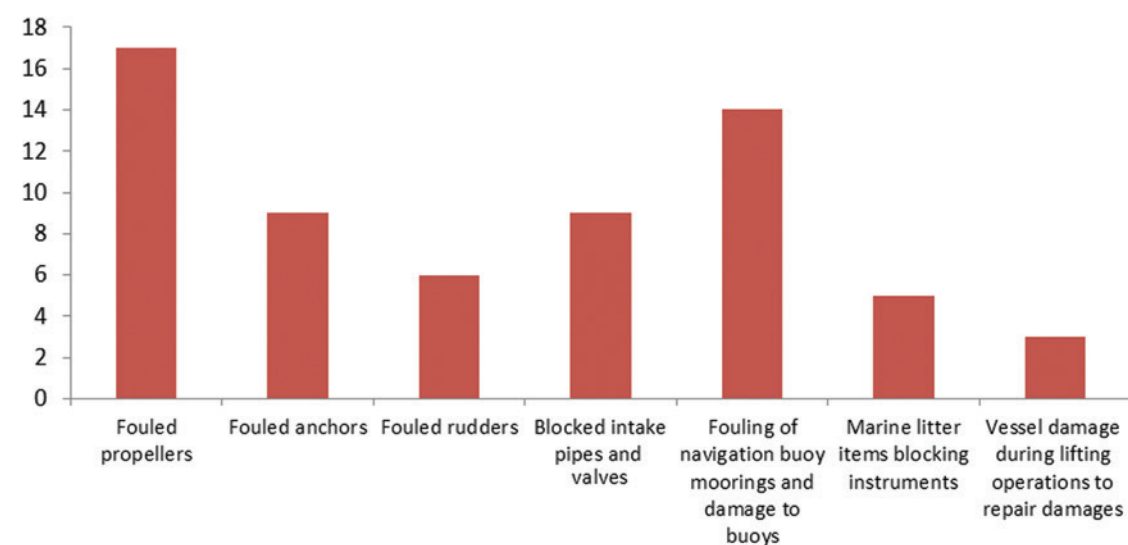
**Figure 3.4.5.** Aggregated responses on the identity and the frequency of the most common types of marine litter removed during the manual and dredging cleanup actions.

Within the scope of this survey an effort was made to assess the frequency of marine litter problems reported to the authorities of harbours and marinas by the respective port users. Firstly, the majority of the respondents (61%) claimed that they are always informed about the problems caused by marine litter to vessels/instruments/infrastructures, while some 36% of the respondents claimed that they are notified only when serious marine litter problems occur. The vast majority of the respondents (67%) reported that their users rarely experience incidents with marine litter and only 14% of their users experience marine litter problems often. These problems are mainly related to fouled propellers (27%), fouling of navigation buoy moorings and damage to buoys (22%), fouled anchors (14%) and blocked intake pipes and valves (14%) (Fig. 3.4.6). The frequency of incidences per type of incidents in 2014 were reported as follows:





- **Fouled propellers:** 59% of the related respondents reported 1 to 5 incidences in 2014, while the remaining 41% reported 6 to 20. The most common types of litter causing fouled propeller ropes (63%), other fishing gear (14%), plastic bags (11%) and plastic sheets (8%).
- **Fouling of navigation buoy moorings and damage to buoys:** 71% of the related respondents reported 1 to 5 incidences in 2014, while the remaining 29% reported 6 to 20.
- **Fouled anchors:** 56% of the related respondents reported 1 to 5 incidences in 2014, while the remaining 44% reported 6 to 20.
- **Blocked intake pipes and valves:** 78% of the related respondents reported 1 to 5 incidences in 2014, while the remaining 22% reported 6 to 20.



**Figure 3.4.6.** Aggregated responses on the types of marine litter incidences reported by the harbours and marinas users.

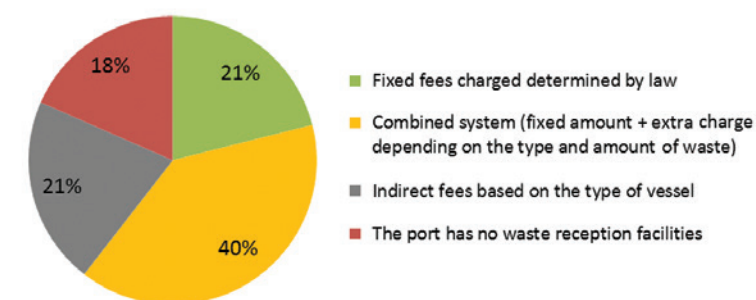
The total annual cost of managing marine litter reported by 38 harbours and marinas in the Adriatic-Ionian macroregion was € 323,550 with an average cost of € 8,518 per harbour. This average is similar to the average reported for the ports and harbours industry in the UK, which equal to € 8,034 per year (Mouat et al, 2010).

Less than half of the aforementioned harbours and marinas (15 out of 38) were in a position to provide further info on the breakdown of the average annual cost of managing marine litter. According to their replies manual marine litter removal, including diving, represents the biggest cost, followed by the collection and disposal costs.

#### 3.4.4. Waste and marine litter management

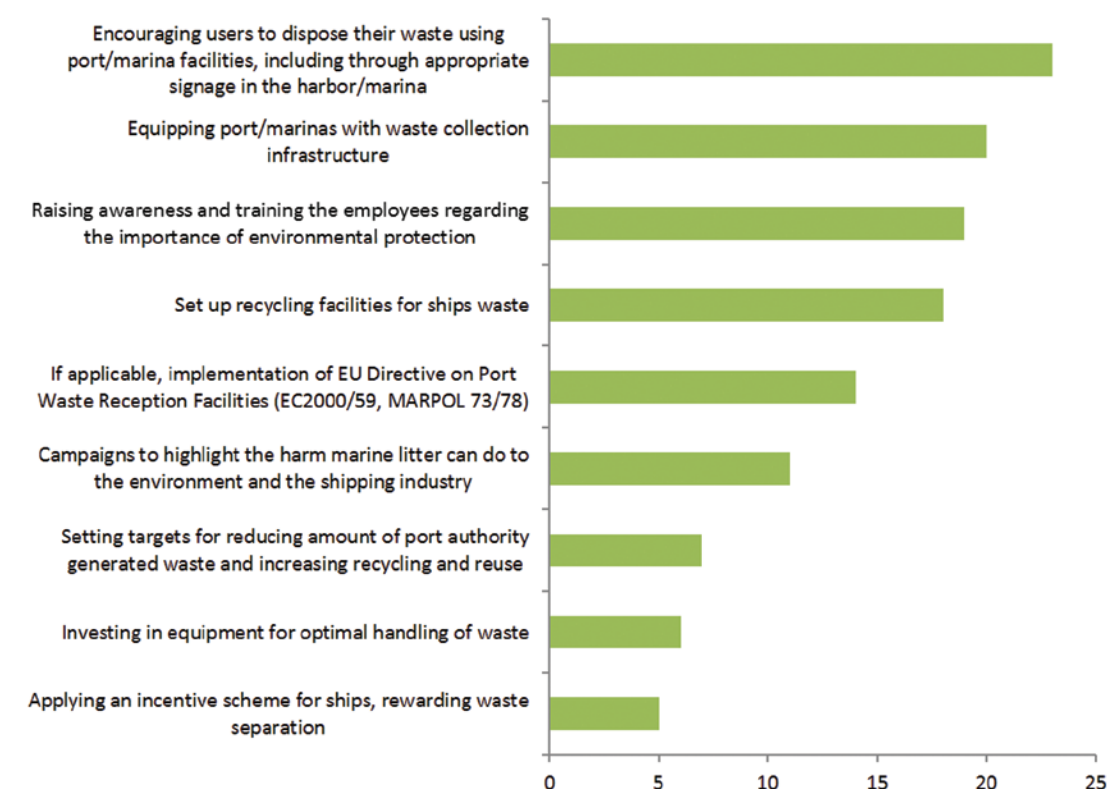
The authorities of the harbours and marinas were asked about the waste and marine litter management measures they apply. Regarding the fee collection scheme applied in the harbours and marinas in their jurisdiction, about 40% of the respondents reported the application of a combined system, where a fixed amount is charged and an extra fee is required depending on the type and amount of waste brought ashore (Fig. 3.4.7). 21% of the respondents reported that a fixed fee scheme determined by national law is applied, while some 21% reported the application of indirect fees based on the type of vessel. A considerable percentage of almost one fifth of the interviewees reported the port has no waste reception facilities.

More than half of the respondents (58%) also reported that their harbours and marinas don't apply a certified Environmental Management System. The remaining 42% of respondents specified in their vast majority that they are certified with the ISO 14001 for Environmental Management. Only two respondents reported that their ports meet the requirements of the Blue Flag award.



**Figure 3.4.7.** Aggregated responses on the fee collection scheme applied at harbours and marinas.

The authorities of the harbours and marinas were also asked to qualitatively assess the situation of the waste collection infrastructure (bins, containers, etc.) provided in the harbours and marinas within their jurisdiction. More than half of the respondents (56%) felt that the infrastructure provided is moderately satisfying; some 33% reported that it is very satisfactory, while 11% consider the infrastructure provided insufficient.



**Figure 3.4.8.** Aggregated responses on the major waste and marine litter related measures initiated in harbours and marinas.

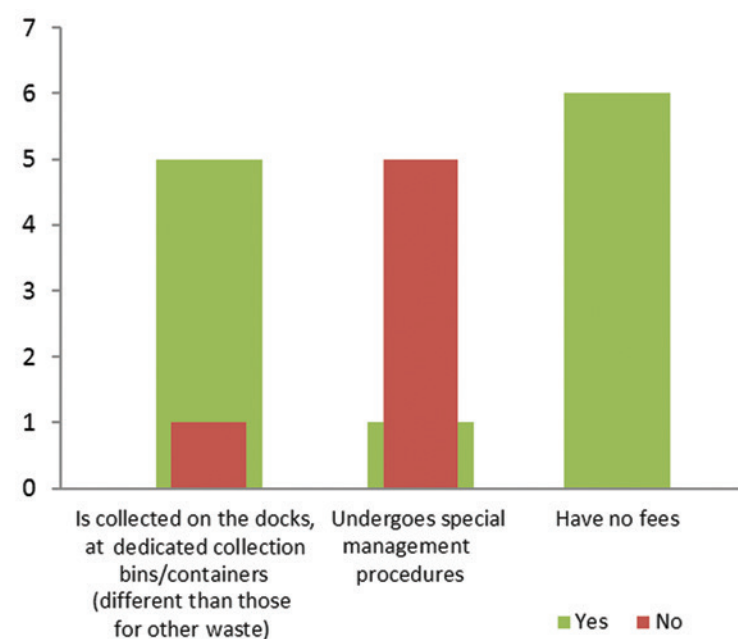
The harbours and marinas that participated in this survey are making an effort to prevent marine litter accumulation in their facilities. In this respect they are applying a series of different measures as shown below (Fig. 3.4.8.). More than half of the respondents (53%) claim that they encourage their users through appropriate signs to dispose their waste properly using the related facilities of the harbours and marinas. Some 47% of the respondents reported that they are equipping the harbours and marinas with waste infrastructure. Similarly, some 44% is investing on awareness raising and training targeted to the employees on the importance of environmental protection, including sound waste management and marine litter prevention. 41% of the respondents reported that they are setting up recycling facilities for ships' waste. A bit less than one third of the respondents (33%) reported the implementation of the EU Directive on port reception facilities for ship-generated waste, despite the fact that the vast majority of



the respondents (93%) were employed in harbours and marinas located in EU Member States (Croatia, Greece, Italy, Slovenia). Close to one fourth of the respondents are carrying out campaigns to highlight the harm that marine litter can cause to the environment and the shipping industry (26%) and perform monitoring and management of ships' waste. Only 16% of the respondents reported that they are working on reducing the amount of waste generated by the port authority and/or making an effort to increase recycling and reuse. Small is the number of harbours and marinas that are focusing on investing in equipment for optimal handling of waste (14%) or on applying an incentive scheme for ships, rewarding waste separation (12%).

Only one fifth (21%) of the interviewees reported that they have undertaken surveys during cleanup operations in order to identify the types and categories of marine litter items and their respective sources. This highlights the need for filling in the data gaps with regards to marine litter found in harbours and marinas in order to support the implementation of tailored-made measures.

Regarding Fishing for Litter (FfL) related activities all fishing ports that participated in the survey (~14% of total survey ports) reported that they have been implementing it. However, when asked whether fishing boats are equipped with dedicated bags and bins on board for the storage of the marine litter collected, all of them replied negatively. The vast majority of the respondents (83%) reported that marine litter from the FfL operations is collected on the docks, in dedicated collection bins and containers (different than those for other waste) (Fig. 3.4.9). Almost all respondents admitted that this collected marine litter doesn't undergo any special management procedure. All respondents reported that no special fees are charged to the fishermen for the marine litter brought ashore. Last but not least, all interviewees reported that they do not perform any data collection activities regarding the types of litter fished out.



**Figure 3.4.9.** Aggregated responses on the way marine litter collected from FfL operations is managed ashore.



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## 3.5 TOURISM AND RECREATION

### 3.5.1. Introduction

Tourism is one of the fastest growing economic activities in the Adriatic-Ionian macroregion and one of the main contributors to the area's gross domestic product (GDP). In 2011 the Italian Adriatic regions hosted 34.400.000 tourists for a four-night stay on average and the Economic Value Added (EVA) reached € 16.190 million, corresponding to 31% of Italian EVA of activities of the same type and to 1.1% of Italian Gross National Product (GNP) (Ronchi et al., 2016). In Croatia, in 2015, the total revenue in tourism was € 7,950 million and it represented around € 43,845 million of added value, accounting for some 18% of national GDP (Nazlić et al., 2016). A yearly total of 14,323 million visitors created 71,605 million overnight stays in Croatia. In Greece, the direct tourism expenditure in 2013 was € 1,634 million and € 195 million for the Ionian Islands and Epirus respectively. The Ionian Islands are one of the three Greek regions (together with Crete and the South Aegean) that have the highest contribution to their GDP from tourism (48%) (Ikkos, 2015). Tourism is an important sector also for Slovenia. In 2014, the total revenue in tourism represented around € 700 million of added value, accounting for 1.9 % of national GDP. With the exception of two years at the beginning of the recent economic crisis, the sector has been growing steadily (Cepuš, 2016). A yearly total of 3.5 million visitors created 9.6 million overnight stays on the national level.

Marine litter has an impact on the aesthetic value of coastal areas and clean coastlines are mostly preferred by tourists. Therefore marine litter can act as a deterrent to tourists. On the other hand tourism and recreation activities are one of the main sources of marine litter on coasts and at sea as also highlighted by the DeFishGear marine litter assessment (Vlachogianni et al., 2016). More specifically, shoreline, tourism and recreational activities contributed 33.4%-38.5% of the amount of litter found in the different marine compartments of the Adriatic and Ionian Seas. A large fraction of the top 20 items found in the Adriatic and Ionian Seas were short-lived single-use plastic items related to tourism and recreational activities such as plastic cups/lids from drinks, crisp packets and sweet wrappers, food wrappers and fast food containers, straws and stirrers, cups and cup lids, shopping bags, drink bottles, etc.

Coastal communities and the tourism industry are affected financially by marine litter, primarily through the direct cost of keeping beaches clear of litter. The direct costs of marine litter for the tourism sector include the collection, transportation and disposal of litter, and administrative costs such as tendering processes and managing bids and contracts (contract management). Littered beaches can discourage visitors, reduce their numbers and lead to reduction in revenues and loss of jobs in the tourism sector (ten Brink et al., 2016).

### 3.5.2. Coastal tourism

As shown in Fig. 3.5.1 out of a total of 147 collected questionnaires, 58% were completed by hotel owners and employees coming from hotels of various sizes, from resorts and hotel chains to 'bed and breakfast'



units; some 11% were completed by employees of beach bars; 10% were completed by employees of coastal restaurants; 3% were completed by employees of coastal camps; and some 18% of the respondents represented hotel associations, entertainment parks and businesses, travel agencies, etc. (Fig. 3.5.1).

The vast majority of the surveyed hotels (74%) were small to medium scale with less than 50 rooms, while only 14% of the surveyed hotels were rather large scale with more than 100 rooms (Fig. 3.5.2(a)). Some 44% of the hotels were vacation rentals and 35% were 'bed and breakfast' and only 9% were resorts (Fig. 3.5.2(b)). 10% of the surveyed hotels were part of a chain hotel.

Within the Adriatic-Ionian macroregion different 'green' certifications are being applied, indicating that environment related standards are being met. Some 14% of the surveyed businesses applied some kind of environmental management scheme, including the ISO 14001, the Green Key Award, the Blue Flag certification, the Travelife certification dedicated to making holidays more sustainable, the Green Mark hotel certification, etc.

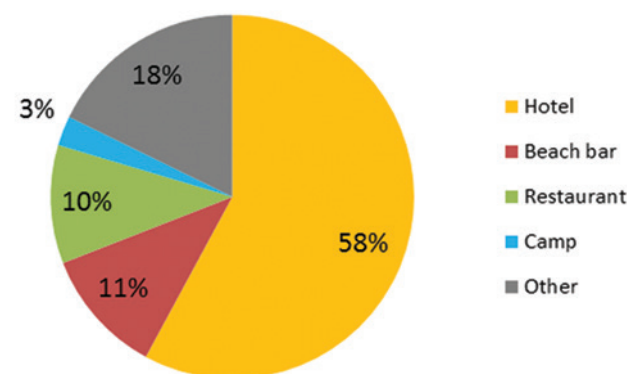


Figure 3.5.1. Survey respondents per type of tourism facilities.

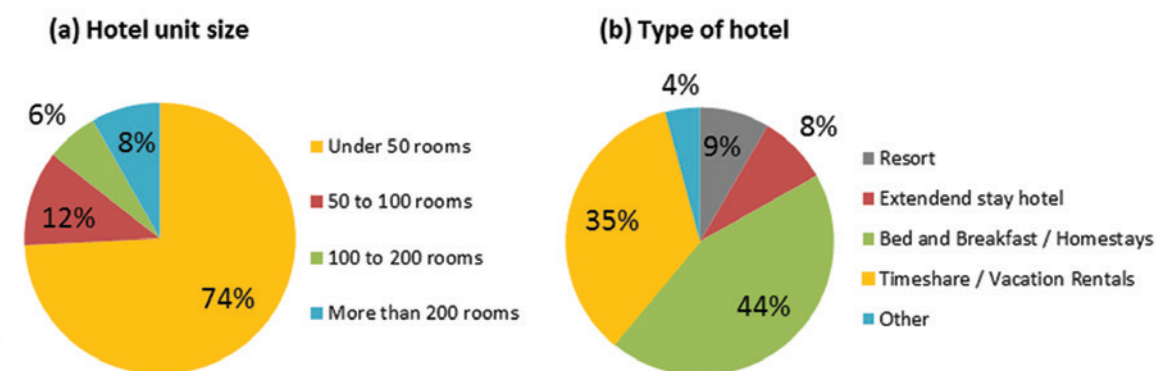


Figure 3.5.2. Aggregated results on: (a) the size of hotel units surveyed, (b) the type of hotel surveyed.

Out of the 147 respondents, 90 were able to provide a *numerical* estimate of the number of tourists visiting the areas in which the survey was conducted. They estimated a total of 42.7 million visitors to their areas, of which between 33.3-37.2 million visited the area specifically because of the beach and coastline. This means that based on this estimation 78-87% of total visitors visit the area specifically because of the beaches. When taking into account the *percentage* estimation made by all 147 respondents, some 68-79% of total visitors are visiting their areas due to the attractive beaches (Fig. 3.5.3). The lower and higher ranges of the two estimations meet at 78-79%.

Sixteen respondents were able to provide estimates of the tourism generated income in their areas during 2014. It accounted for about € 3.1 billion.

The vast majority of the respondents (98%) considered that the absence of litter is the main factor (51%) or an important factor (47%) that influences the decision of tourists to visit a particular beach. Similarly

most respondents (96%) agreed that the importance of a clean and high quality coastal environment is extremely significant (69%) or very important (27%) for tourism branding.

Clearly any reduction in tourist revenue due to marine litter could have a detrimental effect on coastal economies, particularly as tourism often contributes disproportionately high revenues to coastal economies (Mouat et al, 2010).

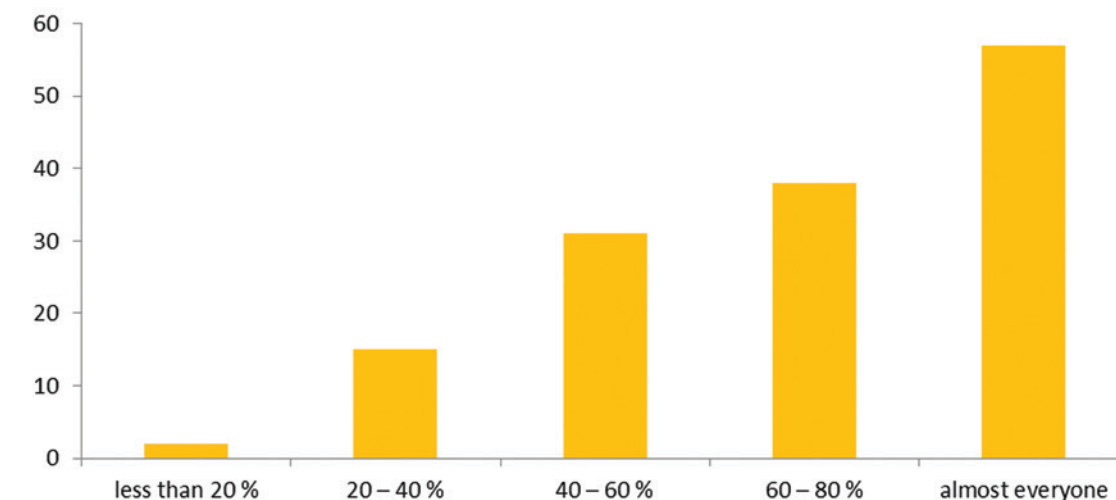


Figure 3.5.3. Respondents' assessment of the percentage of tourists that is specifically attracted by the beach or coastline.

### 3.5.3. Marine litter implications and associated costs

On an aggregated level, the big majority of the tourism sector is of the opinion that marine litter is a serious problem (46%) or a moderate problem (48%) and only some 6% of the participants felt that this is an insignificant problem (Fig. 3.5.4). Almost one tenth (9%) of the respondents were of the opinion that marine litter is a diminishing problem, while the rest felt it is a growing problem (54%) or a stable one (37%) (Fig. 3.5.5). Respondents from Albania, Greece, Italy and Montenegro were of the same view with regards to the gravity of the marine litter problem: that it is a serious one. Participants from Greece and Montenegro in their vast majority claimed that marine litter is a growing problem.

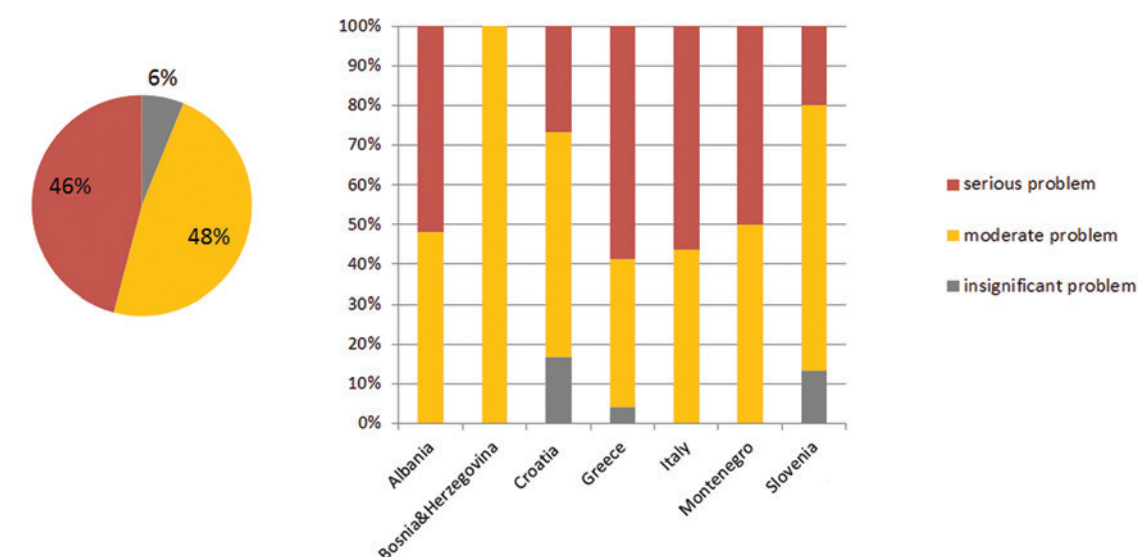
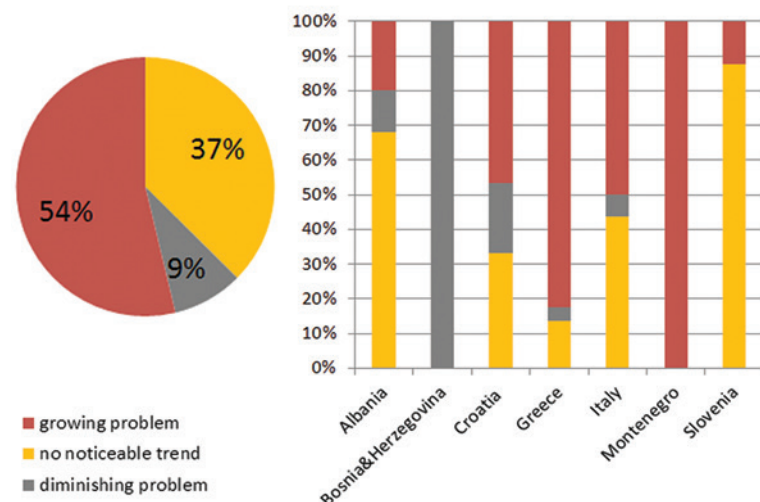


Figure 3.5.4. Results on respondents' perception of the occurrence of marine litter observed on beaches and the gravity of the problem: (a) on aggregated level, (b) at national level.





**Figure 3.5.5.** Results on respondents' perception of the trend related to marine litter observed on beaches: (a) on aggregated level, (b) at national level.

Regarding the sources of marine litter on beaches, 50% of the respondents from the tourism sector consider the irresponsible behaviour of tourists and visitors as the prevailing source and 30% feel that the irresponsible behaviour of local residents contribute substantially to the marine litter problem. According to the respondents the most frequently found items on the beaches are plastic bottles, plastic bags, food wrappers, other identifiable plastics, glass bottles and metal cans.

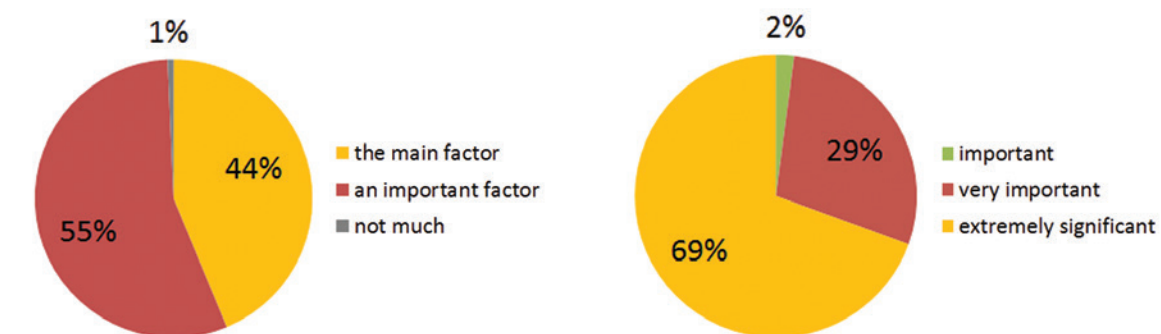
As stated above, marine litter plays a key role in the decision of tourists to visit a particular beach. Some 44% of the respondents felt that the absence of marine litter is the main factor for a tourist to visit a beach, while almost all the rest of the respondents are of the view that the absence of marine litter is an important factor (Fig. 3.5.6(a)). Furthermore, the interviewees in their vast majority (98%) considered that a clean and high quality coastal environment is extremely significant (69%) and very important (29%) for tourism branding (Fig. 3.5.6(b)).

Given how important it is for their business to keep the beaches and the coastline litter-free, some 68% of the respondents invest in keeping them clean and attractive. Only half of these respondents (50 interviewees out of 97), were in a position to provide figures with regards to the annual amount invested in keeping beaches litter-free. The total amount reported was € 284,260 per year making the average burden per tourism related business at € 5,685 per year.

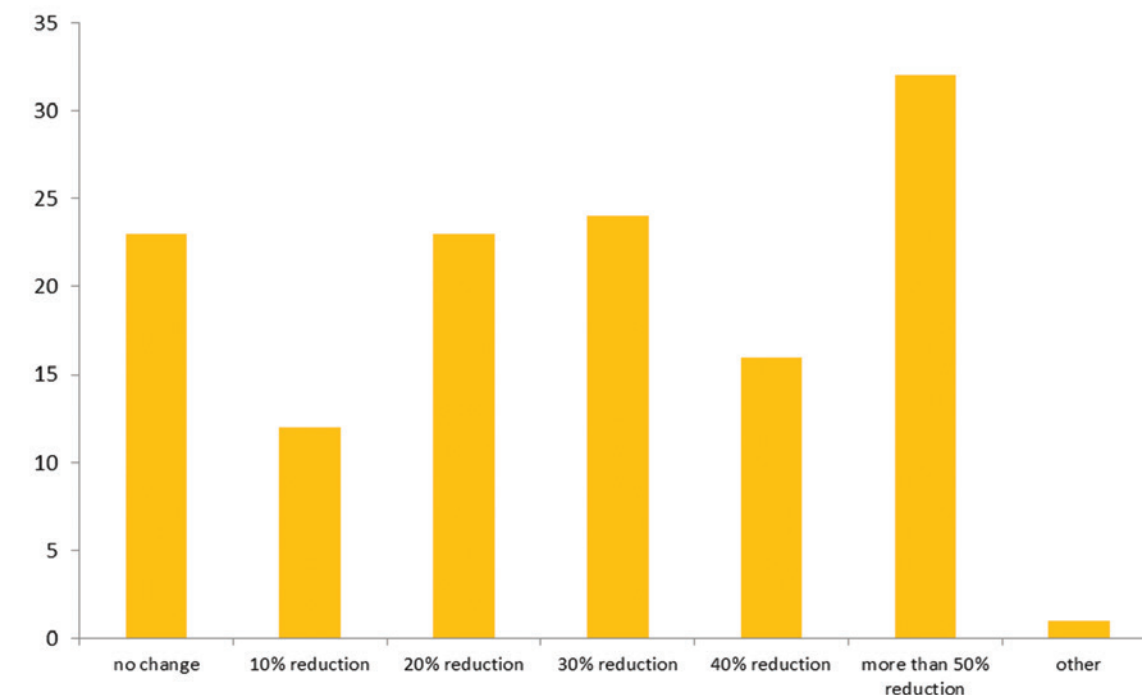
In order to avoid the negative economic impacts of marine litter in terms of reduced revenue and cleanup costs, more than three fourths of the respondents (76%) put pressure on the local authorities in charge of the beaches and coastline to keep them litter-free.

The survey participants, based on their experience in the tourism sector were also asked to gauge the loss of revenue from a potential significant increase of marine litter on the coasts within their area. One

third of the respondents were of the view that there will be a 40% to 50% or even higher reduction of revenue if marine litter significantly rises. Some 18% estimates the loss of revenue to be around 30% and another 18% to be around 20%. The same percentage of respondents (18%) felt that significant increases of litter will have no impact on their revenue (Fig. 3.5.7).



**Figure 3.5.6.** Respondents' assessment of: (a) how the absence of litter influences the decision of tourists to visit a particular beach; (b) how important is a clean and high quality coastal environment for tourism branding.



**Figure 3.5.7.** Estimated loss of revenue in a hypothetical scenario of significant increase of marine litter on coasts.

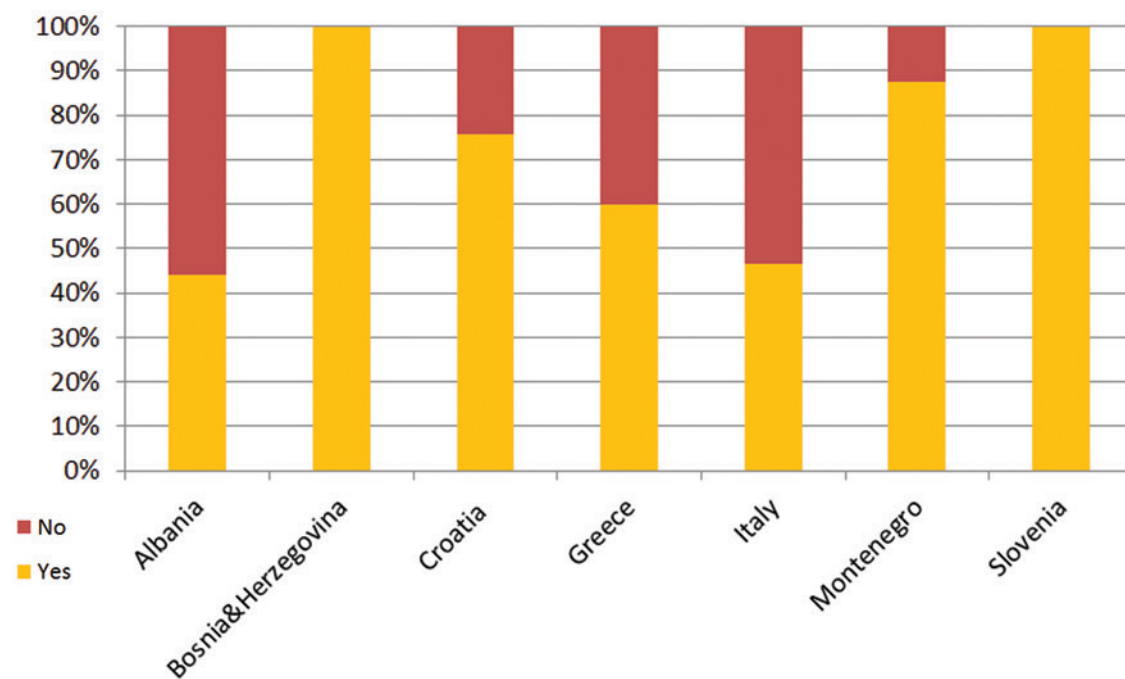
When it comes to the frequency of complaints received concerning the state of the coastline/beaches (e.g. sewage, litter), 46% of the respondents stated that they receive relatively few complaints, while a significant percentage of 22% claimed that they often receive complaints. Taking into consideration another 4% of the respondents who receive complaints almost every day during the peak tourist season, it can be concluded that one out of four tourists is disappointed with the poor condition of the beaches.

Concerning marine accidents, the majority of the interviewees (48%) said that they have never noticed an accident caused due to marine litter, while some 51% answered that there were few.

More than half of the interviewees (65%) from the tourism sector stated that there are joint efforts in their area to address the issue of marine litter, while 68% of them claimed that their enterprises participate actively in these actions. The enterprises which declared that they do not participate in such efforts (32%) identified



as main reasons: the lack of time; the fact that businesses do not want to spend money and change their ways of operation; the inappropriate way that municipalities function (e.g. do not record infringements, do not punish those who litter, do not impose fines to businesses that litter, etc.), that such activities are not carried out within the timeframe of the working season, etc. On a national level it is noteworthy to mention that in the two countries (Bosnia & Herzegovina, Slovenia) with the shortest coastline all respondents reported that there are joint efforts to address the issue of marine litter (Fig. 3.5.8). More than 45% of the respondents from Albania and Italy reported that there are no such efforts in their area, highlighting perhaps the need to raise the awareness of local communities on the importance of the marine litter issue.



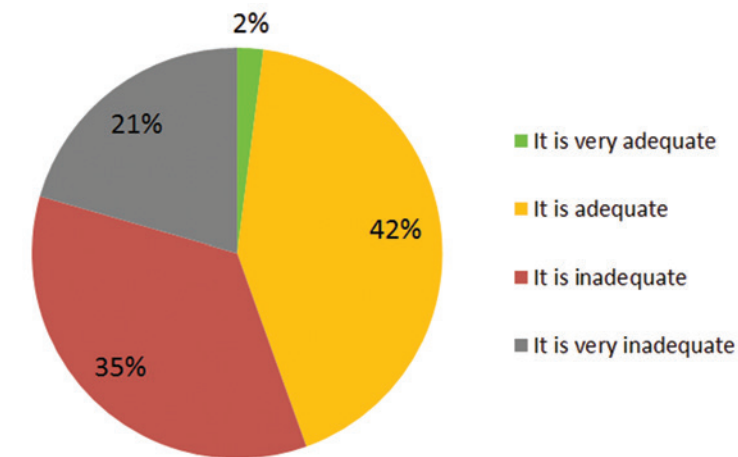
**Figure 3.5.8.** Respondents' replies on whether there are joint efforts in their area to address the issue of marine litter.

### 3.5.4. Waste and marine litter management

Staff members working in tourism facilities were asked to assess the quantity of waste generated by their facility. An average of 521 tonnes of waste per year was calculated. When it comes to assessing the local municipal waste collection infrastructure, more than half of the respondents rated it as inadequate (35%) or very inadequate (21%), while more than one third of the respondents find it adequate (35%) and 2% very adequate.

Almost one third of the respondents (29%) reported that waste collection infrastructure is found everywhere on beaches within their area. However, the big majority of respondents claimed that such infrastructure exists only on the popular beaches in the main urban centres and touristic resorts (44%) or only in urban centres and major touristic areas (22%), while 5% said that such infrastructure isn't provided anywhere. When asked to assess the adequacy of the waste collection infrastructure on their beaches, in terms of rubbish outside the bins and overloaded bins, a bit less than half of the respondents (43%) reported that this is the prevailing image or the one seen often and/or everywhere. Some 36% claimed that this situation can be seen only on more distant beaches and on major beaches during exceptional events, while 20% claimed that the numbers of bins are adequate and overflowing bins are never seen.

Last but not least, when it comes to signs promoting environmentally responsible behaviour at beaches within their territory, the majority of the respondents (75%) claimed that either they are almost nowhere to be found or they exist only on popular beaches (less than 10% of beaches).



**Figure 3.5.9.** Respondents' assessment of the local waste collection infrastructure.

Regarding waste collection and/or prevention measures, the majority of the tourism sector respondents claimed that they do invest in these, mainly via dedicated staff for waste collection and separation, recycling, participation in cleanups, undertaking educational activities for staff members, hiring private companies to keep beaches litter-free, etc.

Only 41 out of 147 respondents were in a position to assess the cost their facility has invested for additional waste collection and prevention measures. The cost for these actions is estimated to be at € 2,505 per action for each facility. One of the main difficulties in assessing the direct costs incurred by the tourism sector was that these are not usually recorded by companies. Also when these costs are recorded they tend to be underestimated as hidden costs just as staff salaries and contract management are not usually included.

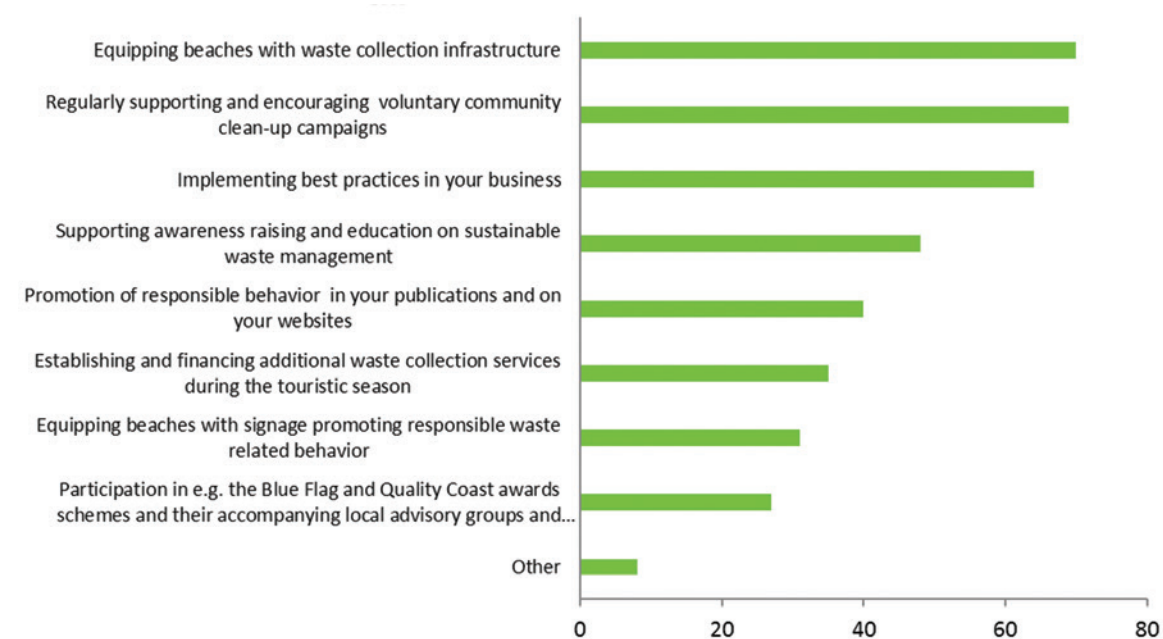
In an effort to get a more precise picture regarding the prevailing types of action undertaken by the tourism sector to prevent and/or reduce marine litter on beaches and the associated costs, the survey participants were asked to specify within a given list the major activities that their facility has in place in order to more effectively address the marine litter problem on the beaches and the sea near them. As shown in Fig. 3.5.10 the most favoured measures focus on equipping beaches with waste collection infrastructure, supporting and encouraging voluntary community cleanups, implementing best practices in their businesses and supporting awareness raising and educational programmes on sustainable waste management.

The survey participants were specifically asked about coast award schemes and any other similar activities in their area that are considered as effective incentive-based measures towards tackling marine litter. Concerning the percentage of beaches which have a Blue Flag or some other kind of award, the majority of the interviewees (54%) estimated that less than 20% of the beaches in their region have such an award, while some 18% responded that 20-40% of beaches have some kind of award (Fig. 3.5.11). 14% of respondents claim that almost all beaches in their area have obtained such an award.

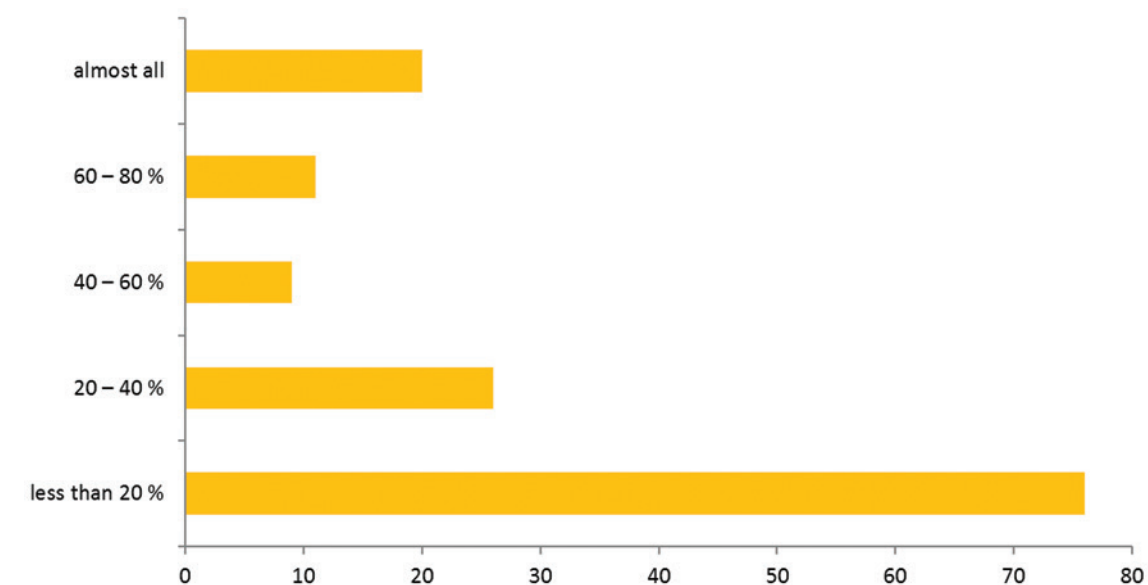


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**Figure 3.5.10.** Major activities that tourism related facilities are implementing in order to address more effectively the marine litter problem.



**Figure 3.5.11.** Percentage of beaches which have awards (e.g. Blue Flag, Quality Coast Awards).

## 3.6 LOCAL AUTHORITIES

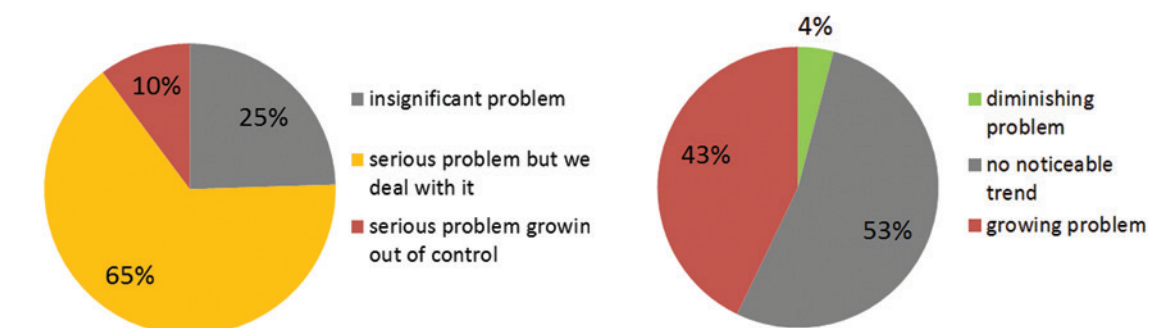
### 3.6.1. Introduction

Coastal municipalities are impacted economically by marine litter primarily through the direct cost of keeping beaches clear of litter and its wider implications for tourism and recreation. Direct costs include the collection, transportation and disposal of litter, and administrative costs such as contract management (Newman et al., 2015). In addition, it should be noted that voluntary organisations also often play a significant role in litter removal, and that some value should be attributed to volunteers' time (Watkins et al., 2016). Ensuring that beaches are clean, attractive and safe for visitors is prioritised by municipalities when the economic case for protecting the local economy and tourism industry justifies the costs of removing the litter. In areas such as the Adriatic-Ionian macroregion where coastlines make a significant contribution to the economy, the costs incurred through marine litter can be substantial.

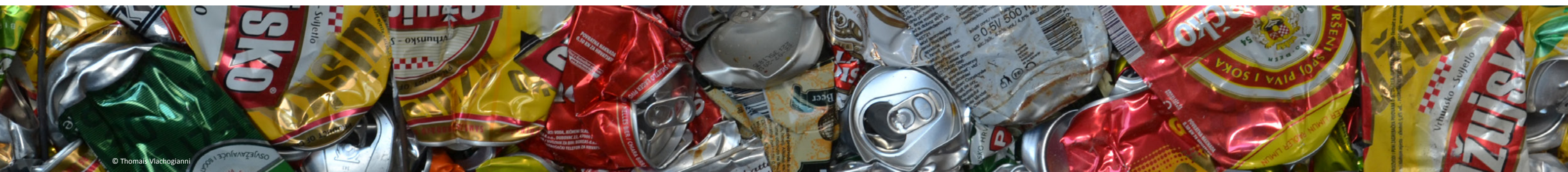
It should be stressed that estimating the marine litter associated costs borne by the municipalities is a difficult task given that there is no standard approach to waste management on beaches. There are large differences between coastal municipalities in how they organize their waste management, which parties are involved, and who is responsible for waste facilities and beach cleaning. Estimates can thus fail to capture all relevant authorities and can leave out costs that may not be under the remit of the same authority (Werner et al., 2016). Furthermore, the costs vary considerably depending on the location, the type of beach (e.g. rocky or sandy) and the intensity of use (e.g. for bathing and other tourism and recreational related activities) (Acoleyen et al, 2013).

### 3.6.2. Marine litter implications and associated costs

A total of 49 local authorities participated in the survey representing different entities, such as municipalities, prefectures or regions depending on the specificities of the involved countries of the region. Within each coastal local authority body effort was made to find the competent environmental or waste management staff to fill in the questionnaire.



**Figure 3.6.1.** Aggregated results on respondents' perception of the: (a) occurrence of marine litter observed on coasts and/or at sea; (b) trend relating to marine litter observed on the coasts and/or at sea.





On an aggregated level, most of the representatives of the local authorities (90%) targeted by this study consider that marine litter found on beaches and/or at sea represents a serious problem. Only one fourth of the respondents believe that marine litter is a serious problem growing out of control. Some 10% thought that it is an insignificant problem (Fig. 3.6.1(a)).

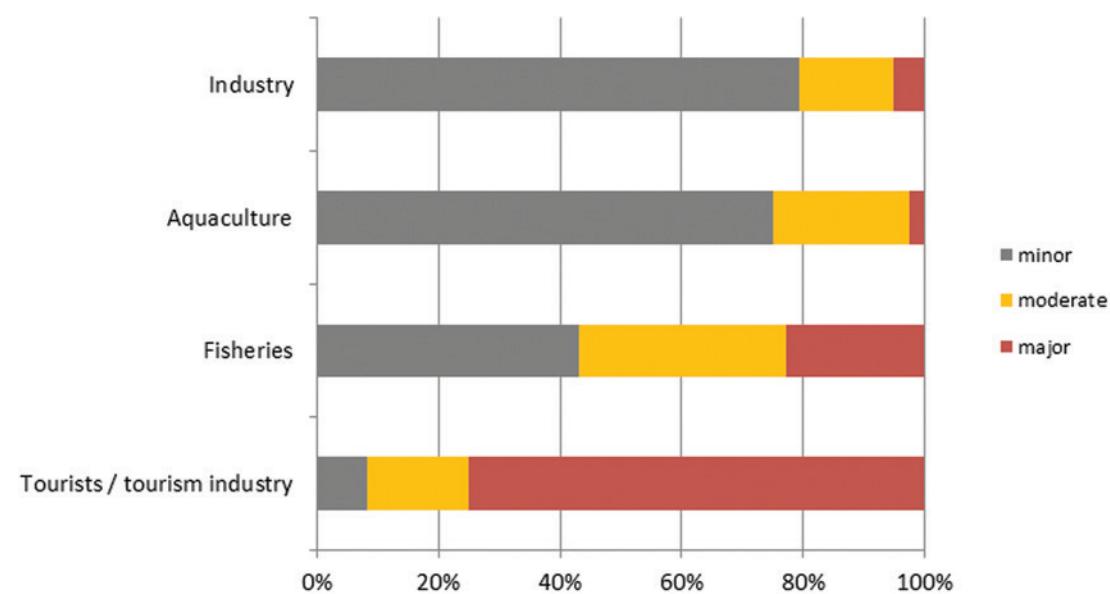
When it comes to the trend of the marine litter problem, more than half of the respondents replied that there is no noticeable trend while a big percentage (43%) that there is a growing one (Fig. 3.6.1(b)). Only a very small number of respondents (4%) felt that marine litter is a diminishing problem.

Aggregated results at the country level show that the big majority of respondents from Albania (100%), Bosnia & Herzegovina (100%), Croatia (80%), Italy (72%), Montenegro (100%) and Slovenia (100%) perceive the gravity of the marine litter issue as serious. All respondents from Greece, 28% of the respondents from Italy and 20% of the respondents from Croatia felt that this is an insignificant problem.

The majority of the respondents from Albania (100%), Bosnia & Herzegovina (100%) and Montenegro (67%) are of the opinion that marine litter is a growing problem. Half of the respondents from Slovenia, 40% of the respondents from 37% from Italy also felt that marine litter is a growing problem while the rest thought that there is no noticeable trend. Only five participants from the 30 respondents from Italy were under the impression that there is a diminishing trend.

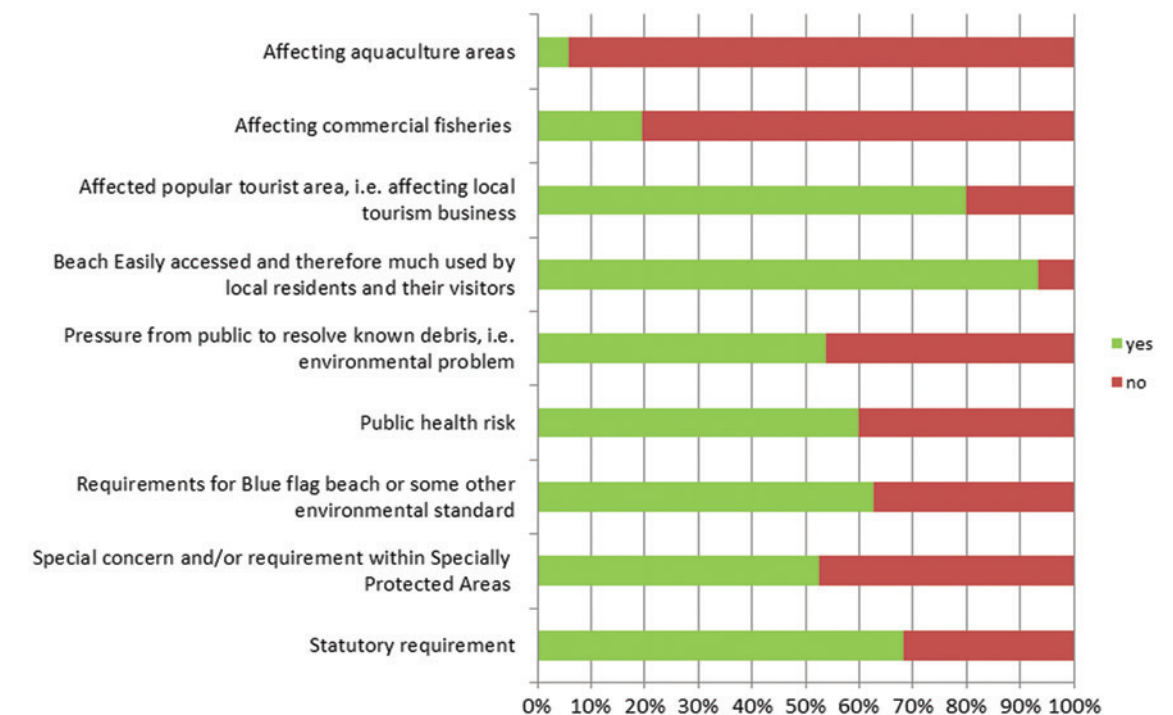
Regarding the sources of marine litter on beaches, the respondents from the local authorities consider the overseas sources-floating marine litter brought by sea currents, winds and waves and the irresponsible behaviour of tourists and visitors, including local residents as the prevailing sources.

Respondents were asked to identify the main users of the coastline in the region and to assess the use of the coastline by them. Tourists and the tourism industry and fisheries were identified as the most important users (Fig. 3.6.2). According to 74% and 21% of the respondents the usage of the coastline by these users is major or moderate, respectively.



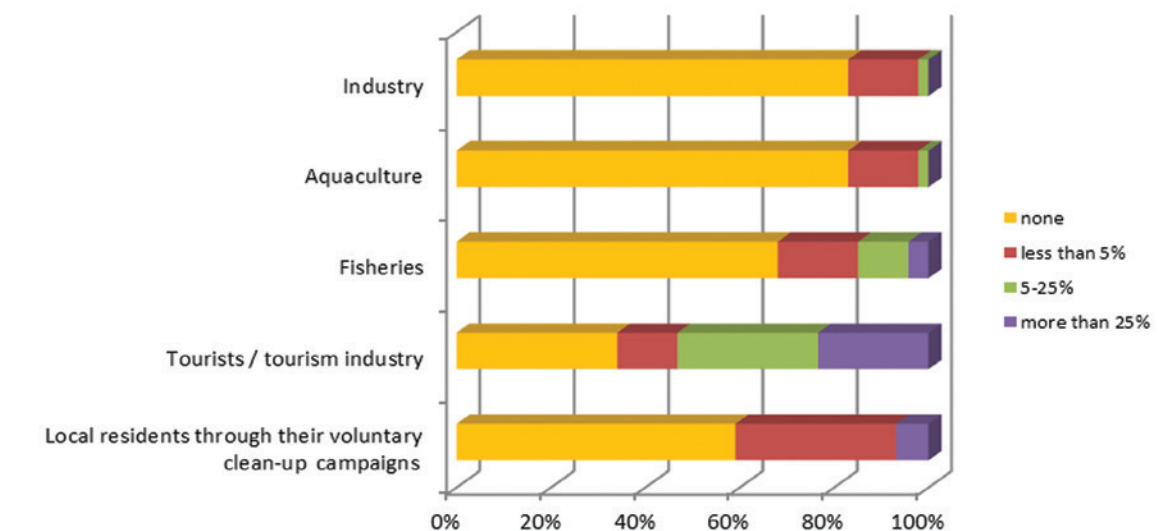
**Figure 3.6.2.** Aggregated results on respondents' replies about the main users of the coastline and the extent of usage.

The survey participants were asked to provide their opinion on the main reasons why cleanup operations are undertaken. In their vast majority (93%) they responded that cleanup operations take place in easily accessible beaches because they are used a lot by local residents and visitors. In addition, 80% of the respondents stressed that popular tourist beaches need to be kept clean and attractive as these affect local tourism business. The other main reasons for cleanup operations included statutory requirements, public health risks and prerequisite for Blue Flag or other kind of environmental standards certification.



**Figure 3.6.3.** Aggregated results on respondents' replies about why cleanup operations are undertaken.

Almost two thirds of the respondents (32 interviewees out of 49), were in a position to provide figures with regards to the annual amount invested in keeping beaches litter-free. The total cost of removing beach litter reported by the 32 local authorities was € 6,724,530 per year, with an average of € 216,920 per year per municipality. This is a significant cost and it is substantially higher in comparison to the average cost of € 139,043 reported for municipalities in the UK (Mouat et al. 2010). On average, municipalities spend about 5% of their budget for marine litter cleanup operations. The reported costs include costs of labour, equipment, transport, treatment and final disposal. When the local authorities were asked whether cleanup costs have increased over the past few years the majority of them (some 59%) responded negatively. The survey participants acknowledged that some of these costs in some cases are partially covered by other users of the coastline, mainly by the tourism sector and to some extent by the local residents through their voluntary cleanup campaigns (Fig. 3.6.4).



**Figure 3.6.4.** Aggregated results on respondents' replies about whether other users of the coastline partially cover the costs of the cleanup.

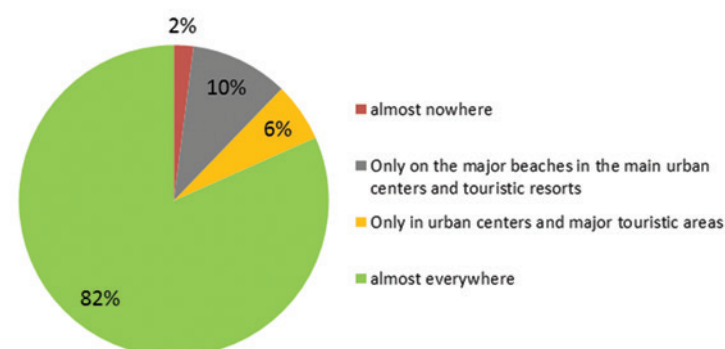




### 3.6.3. Waste and marine litter management

The local authorities representatives were asked to assess the local municipal waste collection infrastructure in the survey areas. Some 82% of the respondents reported that waste collection infrastructure is found everywhere on beaches within their area, while only a small percentage of 2% said that such infrastructure isn't provided anywhere (Fig. 3.6.5). Interestingly, the other targeted sectors gave very different replies to the same question

When it comes to signage promoting environmentally responsible behaviour on beaches within their territory, 42% of the respondents claimed that these exist on the majority of beaches (over 50% of



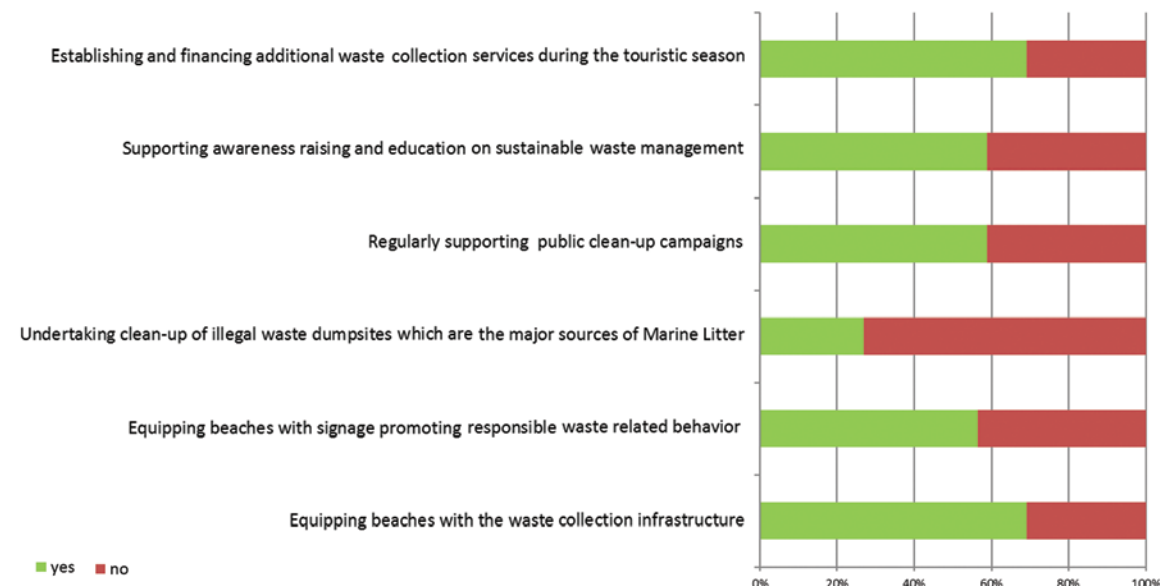
**Figure 3.6.5.** Respondents' assessment of the local waste collection infrastructure.

Regarding cleanup campaigns, the majority of the local authorities (68%) reported that there are public campaigns organized to remove marine litter from the marine environment and almost all municipalities (except one) claimed that they are supporting them.

In an effort to get a more precise picture regarding the prevailing types of action undertaken by the municipalities to prevent and/or reduce marine litter on beaches and the associated costs, the survey participants were asked to specify within a given list the major activities they have put in place in order to more effectively address the marine litter problem on the beaches and the sea in their area. As shown in Fig. 3.6.6 the most favoured measures focus on equipping beaches with waste collection infrastructure and signage promoting responsible waste related behaviour, establishing and financing additional waste collection services during the high touristic season, supporting and encouraging voluntary community cleanups, and supporting awareness raising and educational programmes on sustainable waste management.

Only 16 out of the 49 interviewed local authorities were able to provide a rough estimate of the costs involved in the implementation of the aforementioned measures up till now. The total amount reported for the 16 municipalities was € 721,000 with an average cost per municipality € 48,075.

Last but not least total of 64% of the respondents would be willing to participate in Europe-wide cleanup events such as the Let's Clean up Europe, held every May.



**Figure 3.6.6.** Major activities that tourism related facilities are implementing in order to address more effectively the marine litter problem.

## 3.7 NON-GOVERNMENTAL ORGANIZATIONS

### 3.7.1. Introduction

Non-Governmental Organizations (NGOs) play a crucial role and undertake a series of wide ranging actions on the science-policy-society interface to address the growing threat of marine litter (Vlachogianni, 2015). They contribute to public awareness raising and in building the capacities of stakeholder groups (e.g. on marine litter monitoring), they promote consensus building and co-responsibility via enhanced participation and partnership building, they fill in the knowledge gaps via marine litter surveys, implement marine litter related measures such as cleanups, FfL schemes in collaboration with fishermen, etc. Such NGOs vary from small grassroot organizations dedicated exclusively to marine litter and cleanups to large umbrella organizations dealing with wide-ranging coastal and marine issues, including marine litter.

In the countries of the Adriatic-Ionian macroregion, there are very few NGOs that have strong competences and are active on marine litter issues and these include grassroot, national and regional organizations. These organizations range from environmental NGOs, small volunteer groups, scuba diving associations, protected area management bodies, volunteer rangers, etc. Mainly their activities focus on cleanups and beach litter surveys, as well as awareness raising and educational activities.

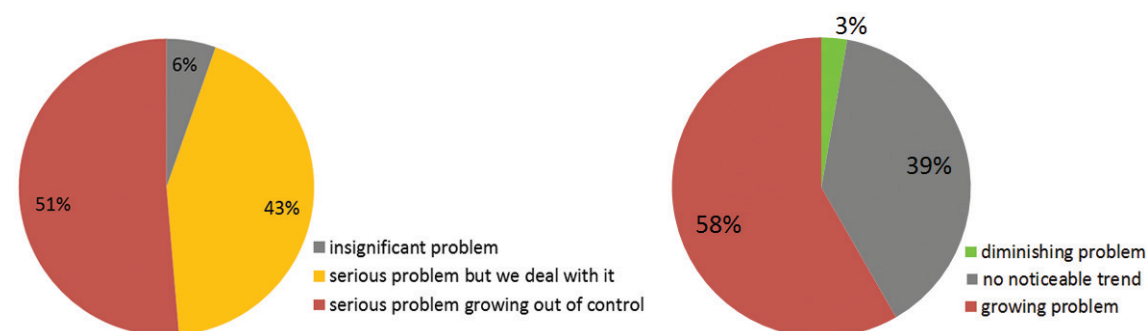
### 3.7.2. Marine litter implications

A total of 36 NGOs completed the questionnaire from 5 out of the 7 countries of the Adriatic-Ionian macroregion, namely from Croatia, Greece, Italy, Montenegro and Slovenia. The size and the type of the interviewed NGOs varied.

On an aggregated level, most of the NGOs (94%) targeted by this study consider that marine litter found on beaches and/or at sea represents a serious or moderate problem. Only 6% thought that it is an insignificant problem (Fig. 3.7.1(a)).

When it comes to the trend of the marine litter problem, more than half of the respondents replied that this is a growing (58%) or stable one (39%) (Fig. 3.7.1(b)). Only a very small number of respondents (3%) felt that marine litter is a diminishing problem.

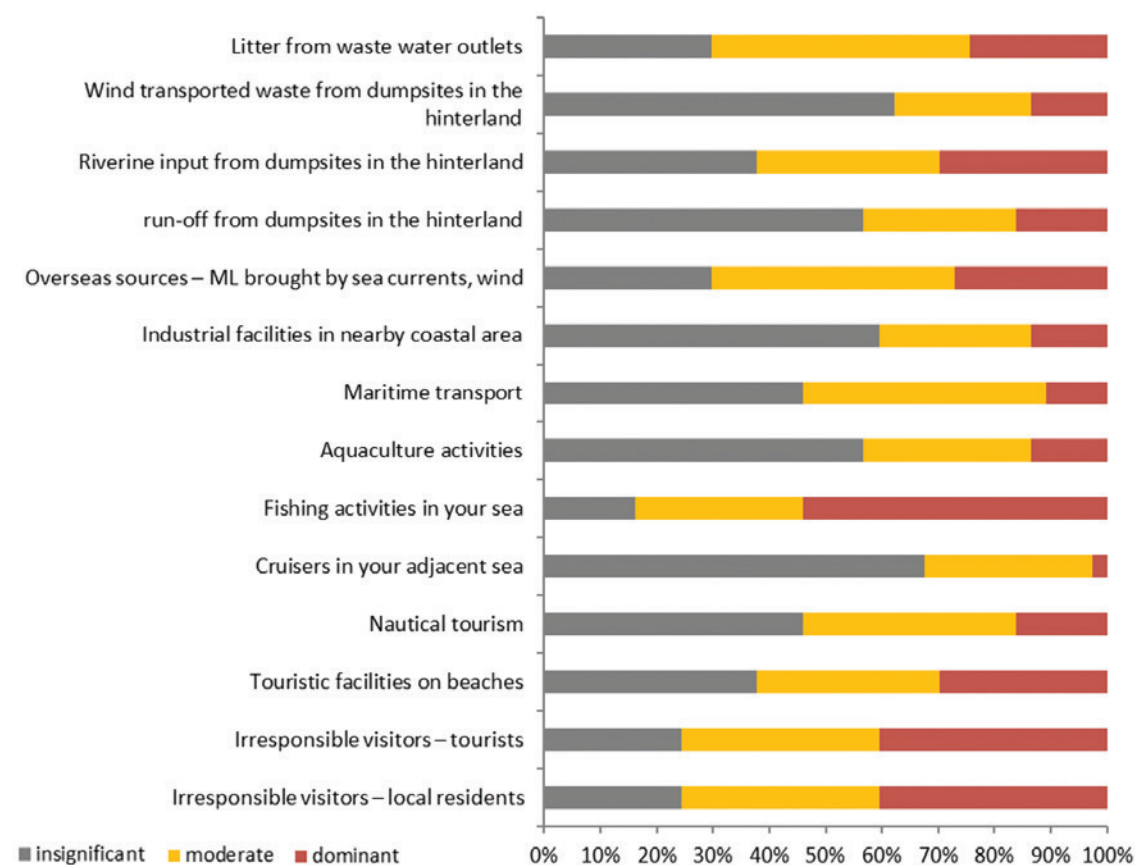




**Figure 3.7.1.** Aggregated results on respondents' perception of the: (a) occurrence of marine litter observed on coasts and/or at sea; (b) trend relating to marine litter observed on the coasts and/or at sea.

Aggregated results at the country level show that the big majority of respondents from Bosnia & Herzegovina (100%), Greece (88%), Italy (100%) and Montenegro (100%) perceive the gravity of the marine litter issue as serious or moderate. However, half of the respondents from Croatia and close to one third of the respondents from Slovenia felt that this is an insignificant problem. Similar results were obtained also from other stakeholder groups in Croatia and Slovenia.

The majority of the respondents from Croatia (100%), Greece (75%) and Montenegro (100%) are of the opinion that marine litter is a growing problem. Close to half of the respondents from Italy also felt that marine litter is a growing problem while the rest thought that there is no noticeable trend. Only one participant from the 19 respondents from Italy was under the impression that there is a diminishing trend. The vast majority of respondents from Bosnia & Herzegovina (100%) and Slovenia (67%) were of the view that there is no noticeable trend to the problem of marine litter.



**Figure 3.7.2.** Aggregated results on respondents' perception on the main sources of the marine litter.

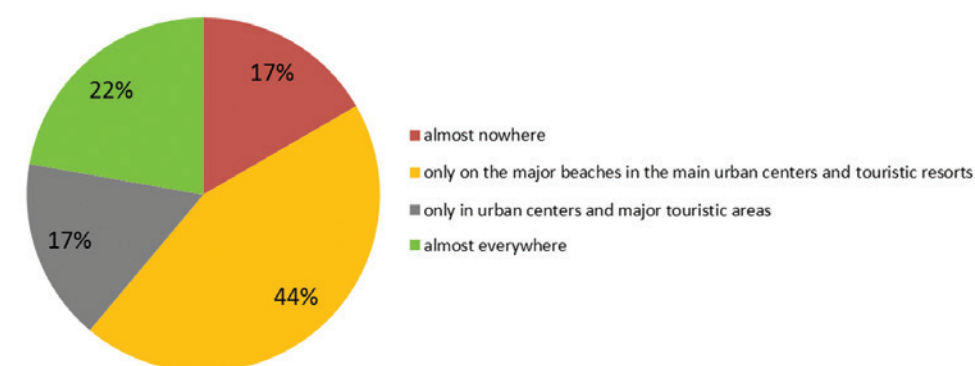
The NGO representatives were asked to identify the main source of marine litter in the areas they live and work. On an aggregated level, participants were of the opinion, that the most prominent reasons for marine litter occurrence are fishing activities, the irresponsible behaviour of tourists and local residents, of touristic facilities on beaches. (Fig. 3.7.2). Overseas sources (floating litter) and riverine inputs were perceived to be very important sources. Waste water outlets were also perceived as quite significant sources. The marine litter inputs from cruisers and maritime transport were not perceived as very significant.

### 3.7.3. Waste and marine litter management

NGO representatives were asked to assess the local municipal waste collection infrastructure in the survey areas. Only one fifth of the respondents (22%) reported that waste collecting infrastructure is found in all beaches within their area (Fig. 3.7.3). The big majority of respondents claimed that such infrastructure exists only in the major beaches of the main urban centres and touristic resorts (44%) or only in urban centres and major touristic areas (17%), while a considerable number of respondents (17%) said that such infrastructure isn't provided anywhere.

When asked to assess the adequacy of the waste collecting infrastructure where it exists, in terms of rubbish being outside of the bins or overflowing bins, half of the respondents (51%) reported that this is the image seen often and/or everywhere or that this is the prevailing image (14%). Some 29% claimed that this situation can be seen only on more distant beaches and on popular beaches during exceptional events, while only 6% claimed that the numbers of bins are adequate and that overloaded bins are never seen.

Last but not least, when it comes to signs promoting environmentally responsible behaviour at beaches within their territory, the majority of the respondents (83%) claimed that either they are almost nowhere to be found (55%) or they exist only on major beaches (28%).

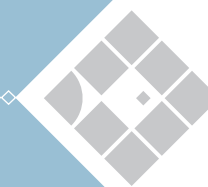


**Figure 3.7.3.** Respondent's assessment of the local waste collection infrastructure.

Regarding cleanup campaigns, the majority of the NGO respondents (72%) reported that they organize marine litter removal actions on beaches or at sea. 28% of the respondents didn't undertake any cleanup actions due to lack of financing, lack of support from the local and national authorities and lack of interest among the citizens. Yet, the big majority of NGOs, some 90%, would be interested to act as an organizer of public beach and/or sea floor cleanup campaigns in their area or to join a European Regional Seas-wide cleanup campaign.

It seems that cleanups are the main activities that NGOs from the Adriatic-Ionian macroregion undertake with regards to marine litter related measures. Only one third of the respondents (35%) claimed that they have implemented other marine litter related actions. It was very encouraging to see that a considerable number of NGOs, around 43% are interested in data collection activities and are planning to perform litter surveys in the near future. 89% of the respondents, if provided the necessary technical and financial support, would be willing to participate in marine litter monitoring activities that would apply a harmonized methodology, potentially using the Marine LitterWatch ICT platform developed by the European Environmental Agency to share the collected data.





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# CONCLUSIONS

4



## CONCLUSIONS

Although marine litter has received increasing attention in recent years, few studies have explored its socio-economic impacts. Measuring the full economic cost of marine litter is challenging due to a wide range of economic, social and environmental impacts, the range of sectors impacted and the geographic spread of those affected, the wide variety of approaches available for valuing the environment and detrimental anthropogenic impacts (Scoullou, 2014; Newman et al., 2015).

This DeFishGear study had to deal with each and every one of these challenges in its attempt to investigate in a coordinated, consistent and comprehensive way the socio-economic implications of marine litter in the Adriatic-Ionian macroregion. It is in fact unique in the whole of the Mediterranean. Despite the inherent limitations of the study (it didn't take into account the indirect costs nor the intangible costs such as inhibition of the proper functioning of marine ecosystems), it clearly demonstrates that the increased costs and potential losses of revenue associated with marine litter for vital economic sectors such as tourism, fisheries, aquaculture and navigation are considerable, and that they negatively affect individuals, enterprises and local communities.

For the fisheries sector the average annual cost of marine litter per vessel reaches € 5,378 (cost of repairs of damages, loss of revenue due to the smaller catch, loss of time spent on clearing and repairing nets, etc., reported by fishermen per fishing vessel per year), an amount much higher than the one reported for EU vessels. Given this, the total losses to the fisheries sector in the Adriatic-Ionian macroregion were calculated to be € 18.19 million per year, which represents one third of the marine litter costs to the EU fishing fleet (€ 61.7 million per annum). On average, the annual direct and indirect marine litter related costs for the aquaculture sector were assessed to be € 3,228 per aquaculture farm unit. The total annual cost of managing marine litter reported by 38 harbours and marinas in the Adriatic-Ionian macroregion was € 323,550 with an average annual cost of € 8,518 per harbour. The average annual amount per tourism related business of varying size and type was calculated to be € 5,685 per year, which can be considered as a substantial expense. The total cost of removing beach litter reported by the 32 municipalities was € 6,724,530 per year, with an average of € 216,920 per year per municipality. On average, the municipalities spent some 5% of their budget for marine litter cleanup operations.

The recognition by all stakeholder groups of marine litter being a problem indicated by the survey results and the significant number of the survey participants expressing their willingness to contribute to the implementation of wide ranging measures provide renewed impetus for coordinated and multi-sectorial action, key to combating marine litter and ensuring litter-free Adriatic and Ionian Seas.

More specifically, marine litter is acknowledged as a problem by all stakeholder groups, with 86% of the respondents considering marine litter as a serious or moderate problem. Close to half of the fishermen interviewed (45%) are willing to be pioneers and implement the 'fishing for litter' measure and an additional 25% will implement it if everybody does it. In the aquaculture sector, more than half of the respondents claim that they participate in marine litter removal actions and some 46% try to reduce the amount of packaging taken to sea. More than half of the interviewees (65%) from the tourism sector stated that there are joint efforts in their area to address the issue of marine litter, while 68% of them claimed that their enterprises participate actively in these actions. Regarding cleanup campaigns, the majority of the NGO respondents (72%) reported that they organize marine litter removal actions on beaches or at sea. Furthermore, a considerable number of NGOs (43%) are interested in data collection activities and they are planning to perform litter surveys in the near future, while 89% of the respondents would be willing to participate in marine litter monitoring activities, if provided with the necessary technical and financial support. Similarly, the majority of the municipalities (68%) reported that there are public campaigns organized to remove marine litter from the marine environment and almost all municipalities (except one) claimed that they are supporting them.

Last but not least, this report illustrates the added value of stakeholders in providing valuable insights and inputs with regards to marine litter accumulation areas. Stakeholders from the fisheries sector identified hotspots of ghost nets where targeted removal actions could be directed and performed in a sound environmental way if assessed to be cost-effective.

The study's results substantially add to the sketchy yet growing body of knowledge on the economic effects of marine litter. This knowledge is essential for establishing a clear and holistic understanding about the severity and scale of the harmful effects (social, economic, ecological) of marine litter in order to assist the countries of the Adriatic-Ionian macroregion in the next cycle of the EU MSFD (Member States will have to update their initial marine litter assessments by 2018) and the implementation of the Barcelona Convention Regional Plan for Marine Litter Management in the Mediterranean. Furthermore, these results feed directly into the implementation process of the EU Strategy for the Adriatic and Ionian Region that addresses a number of pressing socio-economic and environmental challenges facing the region, among which marine litter. In addition, the results can be of use to the EU Common Fisheries Policy in its role to ensure that fishing and aquaculture are environmentally, economically and socially sustainable.



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# ACRONYMS

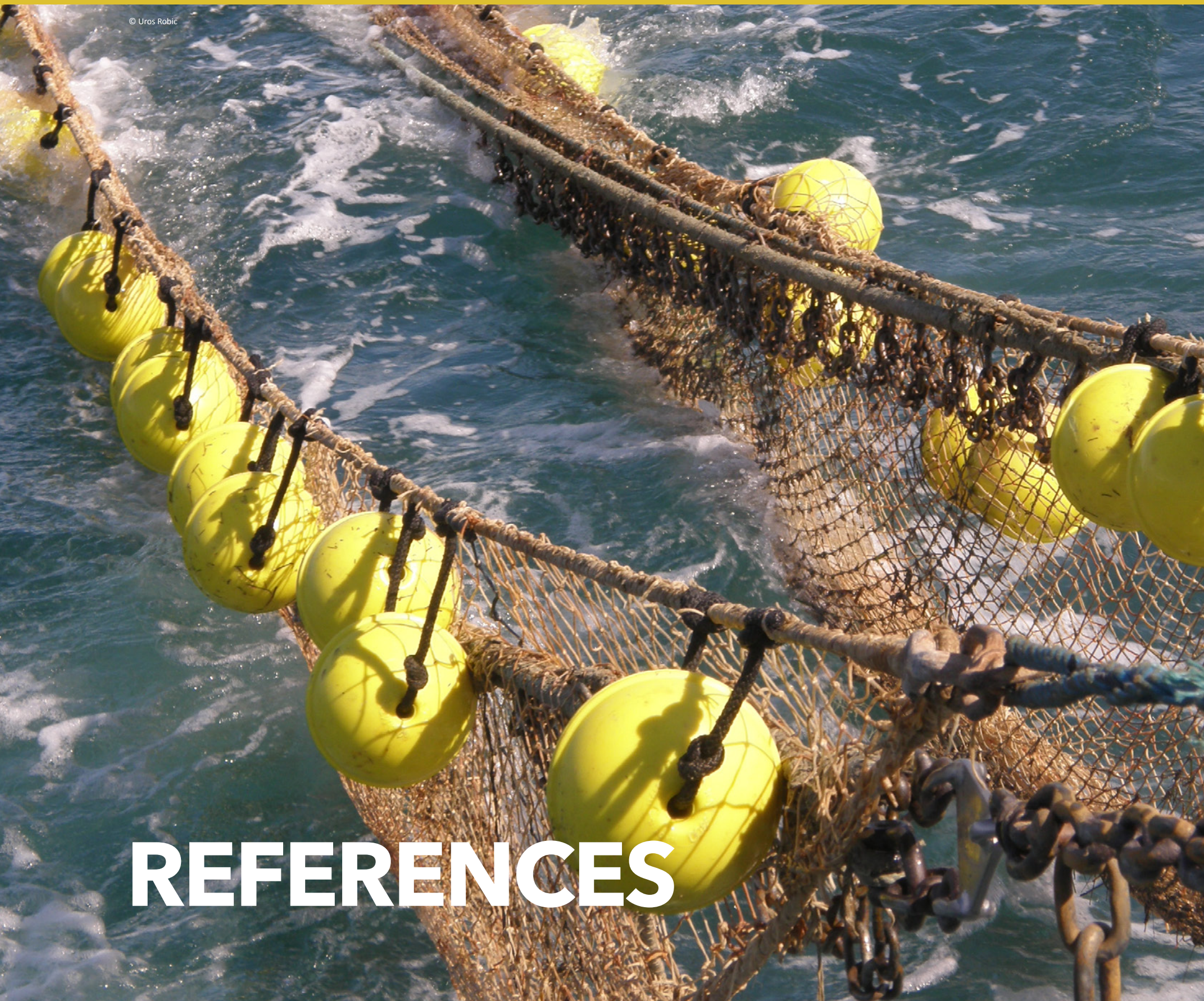
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<b>ALDFG</b>	Abandoned, lost, discarded fishing gear
<b>ARPAE</b>	Regional Agency for Environmental Protection in the Emilia-Romagna region
<b>AUT</b>	Agricultural University of Tirana
<b>DeFishGear</b>	Derelict Fishing Gear Management System in the Adriatic Region
<b>DFG</b>	Discarded fishing gear
<b>EC</b>	European Commission
<b>EcAp</b>	Ecosystem Approach
<b>EU</b>	European Union
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FFL</b>	Fishing for Litter
<b>GDP</b>	Gross Domestic Product
<b>GES</b>	Good Environmental Status
<b>HCMR</b>	Hellenic Centre for Marine Research
<b>HEIS</b>	Hydro-Engineering Institute of the Faculty of Civil Engineering
<b>IBM</b>	Institute of Marine Biology
<b>IOF</b>	Institute of Oceanography and Fisheries
<b>IPA</b>	Instrument for Pre-accession Assistance

<b>ISO</b>	International Organization for Standardization
<b>ISPRA</b>	Italian National Institute for Environmental Protection and Research
<b>IWRS</b>	Institute for Water of the Republic of Slovenia
<b>KIMO</b>	Local Authorities International Environmental Organisation
<b>MAP</b>	Mediterranean Action Plan
<b>MEDPOL</b>	Mediterranean Pollution Monitoring Programme
<b>MIO-ECSDE</b>	Mediterranean Information Office for Environment, Culture and Sustainable Development
<b>MSs</b>	Member States
<b>NGO</b>	Non-Governmental Organisation
<b>PAHs</b>	Polycyclic aromatic hydrocarbons
<b>PBDEs</b>	Polybrominated diphenyl ethers
<b>POPs</b>	Persistent organic pollutants
<b>STEF</b>	Scientific, Technical and Economic Committee for Fisheries
<b>UNEP/MAP</b>	United Nations Environment Programme
<b>Med-IAMER</b>	Integrated Actions to Mitigate Environmental Risks in the Mediterranean Sea
<b>MEDPOL</b>	Mediterranean Pollution Assessment and Control Programme





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*The DeFishGear partners involved in the assessment of the socio-economic implications of Marine Litter in the Adriatic and Ionian Seas:*

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for Water of  
the Republic  
of Slovenia*







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