

## MARINE LITTER IN SEAS AND OCEANS - DO WE COMMUNICATE THE PROBLEM ENOUGH?

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**Abstract:** *Marine litter is one of the fastest growing threats to the marine ecosystem with ecological and economic consequences. Litter is released into the sea exclusively by human activity on land or sea. Regardless of numerous political initiatives (action plans, programs and projects) related to the need to reduce marine litter at the global, European and national levels, this problem is not recognized by the general public and is not sufficiently, clearly and continuously presented to all relevant stakeholders.*

*Therefore, the paper briefly explains the problem of marine litter, lists some of the globally recognized communication campaigns and educational initiatives, and points to existing practices in the Republic of Croatia. In conclusion, based on the presented good practices, measures are proposed for more active communication of this issue with the wider public, which would enable the reduction of marine litter in the Adriatic Sea in the future.*

**Keywords:** *marine litter management, Republic of Croatia, communication strategy*

### 1. INTRODUCTION

The term marine litter includes all permanent, produced or processed solid materials that are not of natural origin, but have been produced, used or discarded by humans directly into the sea, or have reached the sea from land-based sources via rivers, wastewater or wind (Ministry of Economy and Sustainable Development - Directorate of Water Management and Sea Protection, n.d.). The main land-based sources of litter in the sea are coastal activities, i.e. unregulated landfills of urban areas on the coast of the sea or rivers, drainage systems, litter washed into storm drains and waterways and wind-blown litter from the coast and tourist activities (Lebreton et al., 2018). The increase in the population on the coast and intensive economic activities, especially tourism, maritime transport as well as fishing and aquaculture, have resulted in an increased input of litter into the coastal and marine environment of the Adriatic Sea (Santoro, et al., 2018).

Global research indicates increasing and significant amounts of marine litter and their continuous growth over the last ten years. It is estimated that about 6.5 million tons of different litter reach the world's seas and oceans annually. About three-quarters of the marine litter in the world's seas is plastic, and the majority comes from land-based sources. In addition to posing a major threat to marine and coastal biodiversity, marine litter also has a negative socioeconomic impact with costs for the European Union economy estimated at 259 and 695 million euros per year. A 2024 Eurobarometer survey showed that over 80% of Europeans worry about the impact of harmful chemicals in everyday products on their health and the environment. Specific concerns about plastic waste remain significant, with many respondents advocating for stricter EU measures to reduce waste and promote sustainability.

The Adriatic Sea, given its exceptional biological diversity, is particularly threatened by the increase in the amount of marine litter (Bule et. al., 2020). The sea abounds in diverse ecosystems, providing a habitat for numerous species of fish, crabs, molluscs and other marine organisms. It is estimated that between 7,000 and 8,000 marine species and subspecies live in this sea, but recent research suggests that this number could be even higher, reaching as many as 12,000.

The latest research points to increasing pollution of marine habitats. It has been shown that in the Adriatic Sea, as many as 70 percent of Adriatic fish species are in danger. Among them, 21 species are classified as critically endangered, while eight species are designated as endangered and 10 species as vulnerable (Soldo et al., 2022). The danger arises for marine animals that often mistake marine litter for food and thus introduce it into their bodies, which harms them, but also for humans who will consume such fish and other marine organisms. In addition, marine litter results in the reduction of biodiversity, suffocation/entanglement of animals, damage to vessels.

The tourism sector has been identified as a special problem related to the increase in marine litter in the Adriatic Sea. In Croatia, tourism is a significant generator of economic growth with a share of 18% in the GDP structure (year 2022). The continuous growth of tourism leads to an increase in the amount of marine litter and a decrease in the tourist experience due to the polluted sea.

The insufficiency of legal framework related to marine litter has been partially alleviated through initiatives and continuous activities of civil society. Recent research indicates that stakeholders in the Republic of Croatia have a moderate level of interest in the marine litter issues and that there is a lack of scientific research on the amount, distribution and composition of marine litter (Funduk et al., 2021). Therefore, identifying and involving all relevant stakeholders in the marine litter management process and their continuous information and communication are key to successfully preventing the entry of litter into the marine environment and reducing the amount of marine litter. Carefully planned and continuous implementation of communication activities and campaigns enables all participants in the process - local population, nature and environmental protection sectors, public authorities, the business sector and the general public - to gain a sense of ownership and responsibility for the preservation of rich natural heritage and human health.

## **2. METHODOLOGY**

The basic methods used for gathering and processing information included document analysis, which enables a review of domestic and international literature (studies, research, projects financed by the European Union, scientific and professional papers and books) related to the topic of marine litter and activities to inform the public about this issue. Data on current communication campaigns related to the issue on a global scale and in the Republic of Croatia were collected using the internet and social network search method in order to evaluate the availability of key information to the general public. Based on the synthesis of the analysis of the situation and collected examples of good practice in communicating topics about litter in the sea, suggestions were prepared for decision makers for more successful substantive communication of these topics and clearer formulation of communication messages.

## **3. ANALYSIS OF THE PROBLEM**

In the Republic of Croatia, marine litter management is regulated by the umbrella Act on Sustainable Waste Management (Official Gazette 94/13, 73/17, 14/19), according to which this type of litter is considered a special category and is defined as "litter in the marine environment and coastal areas in direct contact with the sea, which is created by human activities on land or sea, and is located on the surface of the sea, in the water column, on the seabed or washed ashore". According to the corresponding Law, the management of marine litter is prescribed by the Minister responsible for environmental protection by ordinance (Art. 16). Given that an appropriate marine litter management system has not yet been fully developed in Croatia, such a by-law has not yet been adopted.

In the area of the Croatian coast, the majority of marine litter items found are anthropogenic polymeric materials, i.e. plastic with a share of 92%. These data are not surprising considering the large amounts of plastic that reach the Adriatic-Ionian area every year. Potential sources of litter in the Adriatic relate to litter from coastal activities and transboundary litter, and to a lesser extent from urban and industrial areas, maritime transport, fishing and aquaculture. The results of research on litter washed up on beaches according to Vlachogianni et al. (2018) showed that in relation to those eight defined sources of origin, in the Republic of Croatia the largest percentage (57.7%) originates from sources that cannot be precisely identified. These results are understandable since the largest percentage of found litter is represented by pieces of plastic of 2.5-50 cm (G79) whose sources are very difficult to determine. At the same time, this indicates that plastic remains in the sea for a long time, and over time, due to strong hydrodynamic effects along with UV radiation, it is being crushed and shredded into smaller fragments that can remain in this area for years. After that, of the total amount of litter collected, 28% originates from coastal activities, including poor litter management practices, as well as from tourist and recreational activities. Furthermore, 12.33% of the found litter originates from sanitary (personal hygiene) and medical activities (e.g. ear sticks, tampons, syringes, etc.), a significant part of which is of cross-border origin. A percentage of 1.23% of litter originates

from illegal dumping, 0.6% from shipping, 0.10% from fishing and aquaculture, and only 0.04% from agriculture.


There are several key global initiatives, such as the Marpol Convention, the UN Convention on the Law of the Sea, also known as the Law of the Sea, and the Basel Convention, which was adopted in 1989, aimed at reducing sea pollution by marine litter from land and ships. The European Union additionally strives to regulate the protection of the sea from marine litter through a series of guidelines and initiatives, such as the Plastic bag ban initiative from 2021, which prohibits the use of disposable plastic bags, cups, cotton buds, cutlery, plates, straws, balloon sticks etc. What are all the products that often end up in the sea.




In addition to these prohibition measures, steps have been taken in efforts to raise public awareness of litter in general. Some of the recent steps forward in European Union legislation are, for example, the necessity of sorting litter at the source, attaching caps to bottles, promotional campaigns to reduce plastic packaging, bans on the use of plastic bags, etc. According to the Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment, the goal is to separate 77% of plastic bottles by 2025, and even 90% by 2029. Another goal is to include 25% of recycled plastic in PET drinking bottles by 2025, and 30% by 2030.

The key goals of public policies related to the reduction of marine litter in Croatia are (1) to establish a marine litter management system, (2) to improve the information system of litter management, (3) to continuously carry out education and information activities and (4) to strengthen international cooperation in solving the problem of marine litter (Ministry of Economy and Sustainable Development, 2020).

To date, in Croatia, occasional organized volunteer actions to clean the coasts, beaches and the seabed have proven to be very successful, as well as activities that are undertaken through various research projects and are regularly monitored by organizations. Some of the recent notable initiatives involving the topic are shown in Table 1.

**Table 1. Overview of recent communication campaigns related to the topic of marine litter in the Republic of Croatia**

Campaign	Web page
	<p><a href="https://zaljepsunasu.hr/">https://zaljepsunasu.hr/</a></p> <p>“For our more beautiful one” is a campaign that has been implemented by the Fund for Environmental Protection and Energy Efficiency in cooperation with the Ministry of Environmental Protection and Energy of the Republic of Croatia since 2019. The goal of the campaign is to increase awareness of the importance of sustainable litter management and to encourage all citizens not</p>

	<p>to treat litter as waste, but to treat it correctly and responsibly. As part of the mentioned campaign, a Facebook page was designed, with almost 12,000 followers.</p>
<p><b>“Together against marine litter” - Society of 20,000 Mile Sea Explorers, Zadar</b></p>	<p><a href="http://www.drustvo20000milja.hr/">http://www.drustvo20000milja.hr/</a></p>
	<p>The campaign "Together against marine litter" is a significant contribution to the protection of the Adriatic Sea. This project started in 2018. Through continuous clean-up campaigns, educational programs and cooperation with various active participants, the campaign helps to reduce plastic pollution and to protect the marine environment. The goal of the campaign is to reduce plastic and other litter in the sea and to protect marine ecosystems.</p>
<p><b>WWF (World Organization for Nature Protection)</b></p>	<p><a href="https://wwf.panda.org/discover/our_focus/markets/no_plastic_in_nature_new/">https://wwf.panda.org/discover/our focus/markets/no_plastic_in_nature new/</a></p>
	<p>The "No Plastic in Nature" campaign was launched in 2019 as a global driver of the fight against plastic pollution. The goal of the campaign is to eliminate plastic from nature by 2030. The campaign addresses a wide audience calling on them to action. We can create a world without plastic in nature by reducing the use of plastic, reusing, recycling and replacing plastic with sustainable materials.</p>
<p><b>WWF, Stop the flood of plastic</b></p>	<p><a href="https://www.worldwildlife.org/initiatives/plastics">https://www.worldwildlife.org/initiatives/plastics</a></p>
	<p>WWF's campaign "Stop the Flood of Plastic" is a global driver of the fight against plastic pollution in the oceans. The campaign was launched in 2019. The goal of the campaign is to reduce plastic pollution and protect marine ecosystems. Besides policy-makers the campaign addresses a wide audience and calls them to action. Through reducing the use of plastic, reusing, recycling, replacing</p>



	<p>plastic with sustainable materials, as well as through cleaning the oceans of plastic litter, we can save our oceans from being "flooded" by plastic.</p>
<p><b>Green Cleanup and Blue Cleanup! World Cleanup Day!</b></p>	<p><a href="http://www.zelena-cistka.org/pridruzi-se/">http://www.zelena-cistka.org/pridruzi-se/</a>  <a href="https://www.worldcleanupday.org/">https://www.worldcleanupday.org/</a></p>
	<p>Green Cleanup, Blue Cleanup and World Cleanup Day are inspiring actions bringing together people from all walks of life in their fight against pollution. The green clean-up is held every year since 2012, usually in September, aiming at cleaning illegal landfills, forests, fields and rural areas throughout Croatia. The Blue Cleanup is part of the Green Cleanup and focuses on cleaning up marine and coastal areas, usually held at the same time as the Green Cleanup. World Cleanup Day is a global cleanup action that, since 2018, takes place every year on September 18.</p>
<p><b>Volunteer in the Parks campaign</b></p>	<p><a href="https://www.parkovihrvatske.hr/volonteri">https://www.parkovihrvatske.hr/volonteri</a></p>
	<p>Program "Volunteer in the Parks of Croatia!" offers a unique opportunity to actively participate in the preservation of Croatia's natural beauty while at the same time enjoying unforgettable experiences. With 31 different programs in 19 national and nature parks "Volunteer in the Parks of Croatia!" offers a wide range of activities, from well tending of educational paths and the restoration of dry walls to the monitoring of dolphin populations and participation in actions to clean up marine litter.</p>

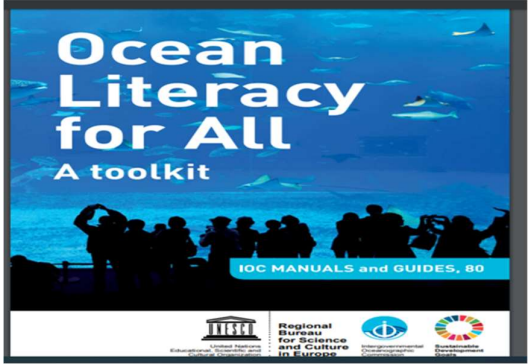


Table 1 shows that all the mentioned campaigns deal with the protection of nature from plastic and other litter pollution. The aim of the campaigns is to reduce the amount of litter in the environment, protect marine and terrestrial ecosystems as well as encourage responsible behaviour towards nature. Campaigns use a variety of methods to achieve their goals, including clean-ups, education of and collaboration with local communities, businesses, government institutions and other organizations to combat plastic pollution. All of these campaigns address a wide audience, including individuals, families, schools, businesses and governments.

Furthermore, it is evident from Table 1 that the mentioned campaigns differ in terms of geographic focus, as some campaigns are focused on specific geographic regions, while others are of a global nature. Then, they differ according to the type of litter, because some campaigns focus on plastic, while others deal with other types of litter. Regarding the working methods, some campaigns focus on cleaning actions, while others focus more on education and promotion of sustainable behaviour. Campaigns are organized by various organizations, including NGOs, government agencies and private companies. All of the mentioned campaigns are important initiatives that contribute to the protection of nature. It is important that everyone is informed about the problem of plastic pollution and that they actively participate in the fight against it.

Examples of several globally significant communication campaigns related to the problem of marine litter are described further in the text. Unlike communication campaigns in the Republic of Croatia, which in most cases cover broader topics related to litter management in general, there are a number of important initiatives focused exclusively on the preservation of seas and oceans and the need to reduce in these ecosystems. It should be pointed out that some of these communication activities are aiming at children and young people as a target group. An overview of recent international initiatives is listed in Table 2, and it is significant that some of them are recognized and active in Croatia.

**Table 2. Overview of recent global communication campaigns related to the topic of marine litter**

Campaign	web page
<p><b>“Ocean Conservancy, Trash Free Seas”</b></p>	<p><a href="https://oceanconservancy.org/trash-free-seas/">https://oceanconservancy.org/trash-free-seas/</a></p>
	<p>The "Ocean Conservancy, Trash Free Seas" campaign started in 2012. The goal of the campaign is to solve the problem of ocean pollution with plastic and other litter. Through its various activities, the campaign helps to reduce plastic pollution, raise awareness and promote responsible behaviour towards the ocean.</p>
<p><b>“Ocean Literacy for All: A Toolkit (UNESCO)”</b></p>	<p><a href="https://www.researchgate.net/publication/321780367_Ocean_Literacy_for_all_-_A_toolkit">https://www.researchgate.net/publication/321780367 Ocean Literacy for all - A toolkit</a></p>

 <p>The cover of the 'Ocean Literacy for All' toolkit features a blue background with silhouettes of people looking out at the ocean. The title 'Ocean Literacy for All' is in large white letters, with 'A toolkit' below it. At the bottom, it says 'IOC MANUALS and GUIDES, 80' and lists logos for UNESCO, the Regional Bureau for Science and Culture in Europe, and other organizations.</p>	<p>The "Ocean Literacy for All" campaign is a significant contribution to ocean conservation. The campaign was launched in 2017 at the International Ocean Conference in New York. Through its resources, tools and activities, the campaign helps raise the level of oceanographic education around the world and inspires people to get actively involved in protecting the planet. The goal of the campaign is to raise the level of oceanographic education ("ocean literacy") among people worldwide.</p>
<p><b>“Clean Seas” (UN)</b></p>	<p><a href="https://www.cleanseas.org/about">https://www.cleanseas.org/about</a></p>
 <p>The image shows a beach with a large wave made of blue plastic bottles. The text 'clean seas' is written in blue, with 'Turn the tide on plastic' in red below it.</p>	<p>The UN "Clean Seas" campaign is a significant contribution to ocean protection. Through its various activities, the campaign helps to reduce plastic pollution, raise awareness and promote responsible behaviour towards the ocean. It was launched in 2017 at the World Oceanographic Summit in New York. The goal of the campaign is to solve the problem of ocean pollution with plastic and other litter.</p>
<p><b>“Sea Shepherd”</b></p>	<p><a href="https://www.seashepherdglobal.org/">https://www.seashepherdglobal.org/</a></p>
 <p>The poster for a Sea Shepherd event in Croatia features a close-up of a sea turtle's head with a piece of plastic trash in its mouth. The text reads: 'PREDSTAVLJANJE SEA SHEPHERD HRVATSKA', 'ORIS KUĆA ARHITEKTURE', 'ULICA KRALJA DRŽISLAVA 3, ZAGREB', '28.11.2019. U 19H'. It also lists guests: 'GOSTI: Captain Alex Cornelissen, CEO Sea Shepherd Global; Andrea Morello, CEO Sea Shepherd Italia; Dr. Sc. Davor Vukic, Institut Rudjer Boskovic; GLAZBENI GOST THE BLONDES'.</p>	<p>“Sea Shepherd” was founded in 1977 by Canadian American environmental activist Captain Paul Watson. Through its direct actions, research and educational programs, Sea Shepherd raises awareness of the problems facing marine ecosystems and inspires people to become actively involved in protecting our planet. Sea Shepherd's goal is to protect marine ecosystems and their inhabitants through direct action.</p>
<p><b>“Plastic Oceans”</b></p>	<p><a href="https://plasticoceans.org/">https://plasticoceans.org/</a></p>





“Plastic Oceans International” has launched not one, but a series of campaigns focused on solving the problem of plastic pollution in the ocean. The activities of the organization have been extended since 2009 to date, with continuous work on various campaigns and projects. Through its various activities, campaigns and projects, the organization helps to reduce plastic pollution, raise awareness and promote responsible behaviour towards the ocean.

Table 2 shows that all campaigns deal with the protection of oceans and their living resources, raise awareness of the problems facing marine ecosystems, encourage people to become actively involved in ocean protection, and use various strategies to achieve their goals, including education, advocacy, research and direct actions.

#### 4. DISCUSSION AND CONCLUSION

Marine litter management is one of the key environmental challenges today, given the growing amount of litter released into the marine ecosystem, especially plastic litter. This problem not only harms marine flora and fauna, but also has long-term adverse effects on human health and sustainable development.

Due to the lack of a previous systematic database as well as the short period of the systematic monitoring program, the knowledge on marine litter in Croatia is still insufficient and, as a result, the general public is not sufficiently informed about this problem.

Although there are occasional initiatives, campaigns, educational programs and clean-ups that focus on the problem of marine litter, there is a strong need to increase awareness and engage the general public in solving this problem.

Croatia as a maritime, coastal and tourist country has a problem with marine litter. Until now, several occasional communication activities have been carried out to raise awareness about marine litter, such as the campaign *For Our More Beautiful One*, the WWF campaign on marine litter, the *Green Cleanup*, the *Blue Cleanup*, etc. Analysis of the campaigns carried out, especially in comparison with current global level campaigns such as the *Ocean Conservancy Campaign: Trash Free Seas* campaign organized by Clean Seas and *Sea Shepherd* and the like, indicates that there is additional room for improvement in communication of the marine litter problem in the Republic of Croatia.

Following the example of international communication campaigns, informational and educational campaigns for the local population, local interest groups, economic entities (hospitality and accommodation services, tourism, transport, fishing, etc.) as well as for civil

society should be intensified and continuously implemented at the local level in the coastal area. Particularly strong breakthroughs need to be designed and implemented by involving educational institutions, starting from kindergartens to primary and secondary schools. At the national level, a key step forward would be to design a communication strategy and to support its continuous implementation. At the same time, it should be intended for both the general public, i.e. citizens of the Republic of Croatia and tourists visiting Croatia.

Based on the previous insights into existing global initiatives and existing practices, some of the key measures that should be implemented in Croatia regarding the communication of the marine litter problem to the general public are as follows:

- establish a central contact point in Croatia with the task of continuous official communication of information to all relevant stakeholders,
- ensure the availability of information about marine litter and litter management methods to all target groups, especially through social networks,
- develop internal communication and coordination of stakeholders (written and oral communication and coordination, consulting, field trips) for the sake of information efficiency,
- organize public events with the aim to raise awareness about marine litter through various campaigns,
- organize conferences for the media as well as preparation, publication and dissemination of informative and educational materials,
- ensure media visibility of content related to marine litter in order to accelerate the flow of information to the wider public,
- prepare and present to the public continuous reports on the implementation of activities related to marine litter communication.

Through the intensification and systematic implementation of communication activities, Croatia can better inform the public, encourage changes in behaviour and work to preserve marine ecosystems from the negative impact of marine litter.

The involvement of the scientific community and educational institutions in gathering information, informing and communicating the harmful effects of marine litter on marine ecosystems, animals and people to the wider community is the key element for encouraging positive changes in the behaviour and habits of people in relation to the environment.

Continuing and strengthening communication about marine litter through various channels such as the media, social networks, educational programs, volunteer actions and cooperation with civil society organizations and government institutions can contribute to greater public engagement in solving this problem.

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