

The background image is an aerial photograph of a coastal city, likely Split, Croatia. It shows a dense urban area with numerous buildings of varying heights and architectural styles, many with red roofs. In the foreground, a large body of water is visible, with several boats and a small dredging vessel. The city is built on a hillside, with mountains visible in the background under a cloudy sky.

BEYOND
PLASTIC
MED

INTERDISCIPLINARY CONFERENCE ON WASTE MANAGEMENT PRIORITIES – REDUCE, REUSE AND RECYCLE

sunce

IMPRESSUM

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INTERDISCIPLINARY CONFERENCE ON WASTE MANAGEMENT
PRIORITIES – REDUCE, REUSE AND RECYCLE

Beyond Plastic Hrvatska BOOK OF ABSTRACTS

Partners:

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Association for Nature, Environment and Sustainable Development Sunce
Split, November 2022

TABLE OF CONTENTS

INTRODUCTORY WORD.....	6
ABOUT THE CONFERENCE.....	7
CONFERENCE PROGRAM.....	8
BOOK OF ABSTRACTS.....	12
SESSION: MARINELITTER.....	13
Marine Waste; Global Problem - Local Solutions?.....	14
Accumulation of Plastic Waste in Seaweed Banquettes.....	15
Does Settlement Correspond to (Marine) Pollution?.....	16
Microplastics in Beach Sediment and From the Sea Surface of the Central and Southern Adriatic.....	17
Identifying Microplastic Hotspots Around the Maltese Islands: A Preliminary Overview.....	18
Monitoring the Amount and Composition of Marine Waste within the LIFE Artina Project.....	19
A Capitalisation Process for BeMed Projects Supported in Islands: Results and Lessons Learnt.....	20
Amount, Composition and Sources of Washed-Up Waste on Sakarun Beach (Dugi otok) During 2022.....	21
Marine Litter - the Number One Global Environmental Problem.....	22
The Role of Civil Society Organizations and the Fishing Sector in the Issue of Marine Waste in the Republic of Croatia.....	23
SESSION: PUBLIC POLICIES AND WASTE MANAGEMENT.....	24
Analysis of the Implementation of the SUP Directive in the Croatian National Legislation and Examples of Good Practice Within the EU.....	26
SESSION: CIRCULAR ECONOMY AND WASTE TREATMENT TECHNOLOGIES.....	28
The Way Waste is Collected Makes a Difference.....	30
Development of the UniCompoST Device for Improving Environmental Education and Sustainable Development in Educational Institutions.....	31
SESSION: BUSINESS SECTOR AND WASTE MANAGEMENT.....	32
Reuse as One of the Key Factors in Reducing Waste Generation.....	33
SESSION: SOCIETY, INDIVIDUALS AND WASTE	34
Green Office.....	36
Swap Fair.....	37
THE MAIN CONCLUSIONS OF THE CONFERENCE.....	38

INTRODUCTORY WORD

The Association for Nature, Environment and Sustainable Development Sunce has been protecting the public's interest and right to a healthy environment since its inception, encouraging the application and creating solutions for the preservation of nature and the environment and the reasonable use of natural resources for the benefit of all citizens. Precisely because of this, the focus of this conference was the topic Marine waste and waste management. Observing the research, marine waste has become one of the leading threats to the marine environment, especially in countries that do not have an adequate waste management system on land, specifically considering that almost 80% of waste from the sea originates from land, and only a small part is generated on the sea itself. The problem manifests itself on several levels, both ecological and health, economic and aesthetic, and is present globally without exception. This naturally resulted in the growing interest of the scientific and general public in researching the impact that marine waste has on the marine ecosystem and is reflected in numerous private and public initiatives. Globally, the problem of marine litter stands out as one of the three biggest threats to marine ecosystems (along with overfishing and climate change), so it is not surprising that it is recognized by the UN, various international conventions, and the EU, of which Croatia is a legal follower. Marine waste is slowly finding its way into legislation (some international conventions related to marine waste were taken over 20 years ago). During the two days of the conference, we heard lectures by experts from the domestic and international academic and research community, panel discussions and debates on the topics of marine waste and waste management. We exchanged knowledge and information on the topics of marine debris and waste management, built partnerships and strengthened capacities and, in the end, received conclusions and recommendations to influence decision makers in creating policies related to the conference topics.



ABOUT THE CONFERENCE

The Beyond Plastic Croatia Conference was held on September 15 and 16, 2022 in the Spinit Incubator (Antun Gustav Matoš Street 56, 21000 Split) as part of the For Plastic-Free Islands project financed by The Beyond Med Association.

The Beyond Plastic Croatia conference is organized as part of the For Plastic-Free Croatian Islands project. The project started on October 1st, 2020, and lasted until September 31st 2022. The project is funded by The Beyond Med Association (www.beyondplasticmed.org). The project holder is the Association for Nature, Environment and Sustainable Development Sunce, and the partners are the City of Stari Grad (island of Hvar), the Municipality of Sali (island of Dugi Otok) and the Green Action. The collaborators on the project are SMILO, the Zlarin Initiative without plastic, and the project is supported by the WWF.

Conference goals:

- exchange of knowledge and available information on waste management, use of disposable plastics and level of plastic pollution
- building partnerships and capacity building participants to implement sustainable waste management, reduce the use of disposable plastics and plastic pollution in the Mediterranean
- encourage the application of the principles of reduce, reuse, recycle in waste management
- implementation of recommendations and measures for shaping and improving legislative frameworks in sustainable waste management.

ORGANIZATIONAL COMMITTEE:

- Gabrijela Medunić-Orlić, M.Sc. in Chemistry, B.Sc. in Environmental Science and Technology, executive director of Association Sunce Split
- Tea Kuzmić-Rosandić, M.Sc. in Marine Biology and Ecology, project manager
- Maja Jurić, M.A. in Journalism, head of communications and public relations
- Blanka Rakuljić, M.Sc. in Chemistry, associate in the Program of Environmental Protection and Sustainable Development
- Tihana Arapović, M.Sc. in Biology, expert associate educator
- Maja Golem, M.Ed. in Croatian Language and Literature and M.Sc. in Pedagogy, expert associate educator.

PROGRAM / SCIENTIFIC COMMITTEE:

- Ivana Carev, Ph.D., Mediterranean Institute for Life Research MedILS
- Sladana Pavlinović Mrsić, Ph.D., Faculty of Economics, University of Split
- Pero Tutman, Ph.D., Institute of Oceanography and Fisheries Split
- Dubravka Bojanić Varezić, Ph.D., Institute of Oceanography and Fisheries Split
- Ivanka Buzov, Associate Professor, Ph.D., Faculty of Humanities and Social Sciences, University of Split
- Tijana Trako Poljak, Ph.D., Faculty of Humanities and Social Sciences, University of Zagreb
- Anka Kekez Krišto, Ph.D., Faculty of Humanities and Social Sciences, University of Zagreb.

CONFERENCE PROGRAM

Thursday, September 15, 2022

SPINIT incubator, Antun Gustav Matoš Street 56, 21000, Split

Facilitator: Tihana Arapović, Association for Nature, Environment and Sustainable Development Sunce

09:45 - 10:30	registration, coffee, and press conference
10:30 - 11:00	introductory word Gabrijela Medunić-Orlić, executive director Association for Nature, Environment and Sustainable Development Sunce, Split, Croatia opening of the conference Blaženko Boban, Prefect of Split-Dalmatia County presentation of the project <i>For Plastic-Free Croatian Islands</i> Tea Kuzmić Rosandić Association for Nature, Environment and Sustainable Development Sunce, Split, Croatia
11:00 - 11:15	introductory speech Marine Litter at the EU Level Frédérique Mongodin, Seas at Risk, Brussels, Belgium
	SESSION: MARINE LITTER
11:15- 11:30	Marine Waste: Global Problem - Local Solutions? Ph.D. Pero Tutman Institute of Oceanography and Fisheries, Split, Croatia
11:30 - 11:45	Accumulation of Plastic Waste in Seaweed Banquettes Assoc. Ph.D. Kristina Pikelj Faculty of Science, Zagreb, Croatia
11:45 - 12:00	short discussion Ph.D. Dubravka Bojanić Varezić Institute of Oceanography and Fisheries, Split, Croatia
12:00 - 12:30	coffee break
12:30 - 12:45	Does Settlement Correspond to (Marine) Pollution? Assoc. Ph.D. Natalija Špeh, assistant professor Ph.D. Robert Lončarić Faculty of Environmental Protection, Velenje, Slovenia
12:45 - 13:00	Microplastics in Beach Sediment and From the Sea Surface of the Central and Southern Adriatic Ph.D. Dubravka Bojanić Varezić and Ph.D. Pero Tutman Institute of Oceanography and Fisheries, Split, Croatia
13:00 - 13:15	Identifying Microplastic Hotspots Around the Maltese Islands: A Preliminary Overview Manya Russo Zibel, St. Julian's, Malta
13:15 - 13:30	short discussion
13:30 - 14:30	lunch break
14:30 - 15:00	poster session
15:00 - 15:15	Monitoring the Amount and Composition of Marine Waste within the LIFE Artina Project Fedra Dokoza Association for Nature, Environment and Sustainable Development Sunce, Split, Croatia

15:15 - 15:30	A Capitalisation Process for BeMed Projects Supported in Islands: Results and Lessons Learnt Pedro Fernandez Bautista, Sylvain Petit MedWaves, Barcelona, Spain
15:30 - 15:45	Evaluation of Current Practices and Futuristic Options of Plastic Waste Management in Djerba Island Through Plastistop Project (Bemed Initiative) Aida Ben Hassen Trabelsi AJEM, Association Jlij pour l'Environnement Marin, Tunisia
15:45 - 16:00	short discussion
16:00 - 16:15	conclusion on the first day
16:15 - 17:15	cocktail party for all participants

POSTERS:

Amount, Composition and Sources of Washed-Up Waste on Sakarun Beach (Dugi otok) During 2022

Assoc. Ph.D. Melita Mokos, Dora Lovrić, Department of Ecology, Agronomy and Aquaculture, University of Zadar, Croatia

Marine Litter - the Number One Global Environmental Problem

Ph.D. Pero Tutman, Institute of Oceanography and Fisheries, Split, Croatia

The Role of Civil Society Organizations and the Fishing Sector in the Issue of Marine Waste in the Republic of Croatia

Ph.D. Pero Tutman and Ph.D. Dubravka Bojanić Varezić, Institute of Oceanography and Fisheries, Split, Croatia

Friday, September 16, 2022

SPINIT incubator, Antun Gustav Matoš Street 56, 21000, Split

Facilitator: Tihana Arapović, Association for Nature, Environment and Sustainable Development Sunce

13:30 – 13:45	conclusion of the conference
13:45 – 15:00	lunch for all participants

09:00 – 09:30	welcome and coffee
09:30 – 10:00	introductory speech on the topic Legislative Framework of Waste Management in the Republic of Croatia and an Overview of the Current Situation Nela Palarić Ministry of Economy and Sustainable Development, Zagreb, Croatia
SESSION 1: PUBLIC POLICIES AND WASTE MANAGEMENT	
10:00 – 10:15	Overview of Waste Management in Split-Dalmatia County, Opportunities and Challenges Ph.D. Mladen Perišić Split-Dalmatia County, Split, Croatia
10:15 – 10:30	Public Call for Plastic-Free Zones Tomislav Vidović The Environmental Protection and Energy Efficiency Fund, Zagreb, Croatia
10:30 – 10:45	Single Use Plastics (SUP) Directive Frédérique Mongodin Seas At Risk, Brussels, Belgium
10:45 – 11:00	Analysis of the Implementation of the SUP Directive in the Croatian National Legislation and Examples of Good Practice Within the EU Marko Košak Zelena akcija, Zagreb, Croatia
11:00 – 11:45	panel discussion
11:45 – 12:15	coffee break
SESSION 2: CIRCULAR ECONOMY AND WASTE TREATMENT TECHNOLOGIES	
12:15 – 12:30	The Way Waste is Collected Makes a Difference bacc. Agronomy Engineer Marijan Galović, B.Sc. Biology and Ecology Engineer Marko Ružić VG Čistoća, Velika Gorica, Croatia
12:30 – 12:45	Development of the UniCompoST Device for Improving Environmental Education and Sustainable Development in Educational Institutions Zvonimir Jukić, Tina Slatina, Katarina Bunoza, Ana Goleš UniCompoST, Split, Croatia
SESSION 3: BUSINESS SECTOR AND WASTE MANAGEMENT	
12:45 – 13:00	Reuse as One of the Key Factors in Reducing Waste Generation Eduard Kalčić Cupup System d.o.o., Pazin, Croatia
SESSION 4: DRUŠTVO, POJEDINAC I OTPAD	
13:00 – 13:15	Green Office Maja Golem Association for Nature, Environment and Sustainable Development Sunce, Split, Croatia
13:15 – 13:30	Swap fair Olena Pidleteichuk Association for Nature, Environment and Sustainable Development Sunce, Split, Croatia



BOOK OF ABSTRACTS

The abstracts of the papers are arranged according to the conference program and thematic sessions. The editors of the book of abstracts only intervened exceptionally in the content of the abstracts, in cases where they needed to be adapted to the required format.

SESSION MARINE LITTER

Marine litter is one of the fastest growing global threats to marine ecosystems with a major environmental, cultural, health and economic impacts and consequences. A large proportion of quantities relate to plastics, which due to their longevity poses the greatest danger to the marine environment and human health. It enters the sea exclusively due to human activities on land or sea, i.e., due to deficiencies and omissions in the waste management system. It is estimated that about 80% of waste in the sea comes from land sources and land activities, like illegal landfills, wind and leaching into the sea by rainwater, as a by-product of tourism activities, etc. About 20% of waste ends up in irresponsible activities, maritime transport, and fisheries. It is estimated that as much as 70-80% of the total waste in the Mediterranean Sea is microplastic, which is formed by the decomposition of plastic waste already present in the sea. The problem of marine litter is increasingly visible and obvious in the Republic of Croatia, but we are faced with a lack of appropriate data from systematic research, which is the main problem related to this issue. Marine litter is not an environmental problem that can only be solved by law enforcement, beach cleaning and technical solutions. It is also a cultural issue and significant efforts are needed to change behaviour, approach to management, and the involvement of all sectors and interests is needed.



Marine Waste: Global Problem - Local Solutions?

Ph.D. Pero Tutman
Institute of Oceanography and Fisheries, Split, Croatia

Marine litter is a worldwide environmental problem with significant socioeconomic, health and aesthetic consequences. It is present in all the world's seas, not only in densely populated areas, but also far from obvious sources and human influence. It is a multidimensional challenge with significant global consequences for the marine and coastal environment and human activities. These impacts are cultural and multisectoral, and are the result of poor waste management practices, lack of adequate infrastructure, harmful impacts of human activities and inappropriate behaviour of the public. To this should be added the lack of implementation of appropriate legal regulations at all levels and the lack of funds for removal. One of the first steps towards suppression is a regional approach, as marine litter problems transcend national borders. The countries of the Adriatic region are faced with a lack of appropriate measures to reduce the impact of marine waste pollution. Also, the existing international and national legislation is not applied at a satisfactory level. The Institute of Oceanography and Fisheries from Split participated in two important projects: DeFishGear (IPA Adriatic CBC program; 2013–2016) and ML-REPAIR (INTERREG Ita-Cro; 2018–2019) which dealt with the wider context of the issue of marine debris and ultimately resulted in a regional strategic assessment. The important goals of the project are raising the level of environmental awareness and educating target groups by adopting examples of "good practice", reducing the amount of waste on beaches and the seabed by actively involving the civil and fishing sectors, and monitoring and removing waste from the bottom in selected Natura 2000 areas. With the completion of the projects, an assessment of the state of the sea and the coastal zone was obtained regarding pollution with waste washed up on the coast, floating, as well as from the seabed collected in trawling and lost fishing tools, as well as better knowledge about the burden of microplastics and its effects on marine organisms. The aforementioned activities made an important contribution to the problem of marine waste, and special value comes from the active involvement of the civil and fishing sectors. Also, the national legislation was positively influenced, given that marine waste management is still at an insufficient level.

KEYWORDS:

marine litter on beaches, floating marine litter, microplastics, discarded fishing gear, marine litter from trawling.

Accumulation of Plastic Waste in Seaweed Banquettes

Assoc. Ph.D. Kristina Pikelj
Faculty of Science, Zagreb, Croatia

Plastic marine litter is a worldwide problem in environmental protection of today. Due to its accumulation on the coasts, beaches, as the most interesting coastal environment for humans, represent the places where the scale of plastic waste load is most visible. Beaches and other parts of the coast oriented to the southern waves in Croatia are particularly susceptible to a significant accumulation of plastic. An example of such a beach is Sakarun on Dugi otok. This pebble beach is only partially covered with sand, which, from a tourist point of view, is its most valuable part. The beach currently shows a significant loss of sand, which is attributed to the long-term practice of permanent removal of significant deposits (so-called banquets) of *Posidonia oceanica* sea-grass plant remains. Banquets are common throughout the Mediterranean coast, while in Croatia their occurrence is less common. The emergence of the banquet is related to the period of weakening of the effect of the waves on the coast during the calm of the storms. Such events contribute to a significant accumulation of plastic (and other) waste on the beaches. Given that they are compactly layered structures, banquets often contain pieces of waste in their composition, which in their shape and hydraulic behavior resemble fallen leaves of sea grass. These are usually flat objects, such as plastic bags, discoidal and ribbon pieces of plastic, shoe soles, etc. Banks, in addition to incorporating plastic waste, form a natural trap for sediment and cover sediment deposited on the beach, and both of these mechanisms reduce beach erosion. For this reason, recent management measures for seaweed banquets in the Mediterranean are aimed at leaving a significant part of the banquets on the beaches. In this way, plastic waste remains trapped in them and eventually becomes a secondary source of plastic waste. The scale of the mentioned processes needs to be further investigated in the future.

KEYWORDS:

Sakarun beach, southern waves, secondary sources of marine plastic.

Does Settlement Correspond to (Marine) Pollution?

Assoc. Ph.D. Natalija Špeh, assistant professor Ph.D. Robert Lončarić
Faculty of Environmental Protection, Velenje, Slovenia

Population density correlates with pollution, but in the opposite direction in our research case. A survey of two archipelagos' marine ecosystems yielded an unusual data. We recorded coastal litter pollution at the Kornati National Park and Elaphiti islands. Both study sites are attractive for tourists and are exposed to the open sea. Regarding natural settings and pollution of the researched coastal areas, we found that they mainly depend on a) the sea currents, namely the East Adriatic Sea Current (EAC) which influences the Dalmatian coasts, b) wind and c) openness of the coast to the sea. We assumed the inhabitants' impact is a predominant social factor for distribution of marine litter. The results determined a situation which was reversed from what was expected. The settlement as a permanent feature did not prove to be the dominant social determinant of pollution. The data on marine litter characteristics showed another driving force, tourism, with its seasonal impact, that disturbs the marine ecosystem more prominently. We tried to establish that from the origin of litter accumulated on the islands' coasts by reading the label 'Made in' on the deposited products, which could also be misleading. We also focused on the plastic share of the coastal litter. As a research approach, we integrated an environmental geography perspective into the indicator method to check every coastal site and the litter deposition there. Depending on the country of production, the Elafiti coastal litter displays globally dispersed origins (Australia, India, China in 25% of sites). In addition, the litter produced in Albania was also recorded. Of course, country of production does not indicate the true origin of the litter as most of the marine litter comes from illegal dumping sites along south Adriatic coast. Marine litter deposited on the coast of Kornati islands came mainly from European production. The average percentage of plastic litter was lower on Elafiti (51.54%) than on Kornati islands (65.4%).

KEYWORDS:

marine litter, litter origin, Kornati, Elafiti, Croatia.

Microplastics in Beach Sediment and From the Sea Surface of the Central and Southern Adriatic

Ph.D. Dubravka Bojanic Varezić and Ph.D. Pero Tutman
Institute of Oceanography and Fisheries, Split, Croatia

The eastern Adriatic coast is morphologically highly indented with numerous islands, islets, and rocks extending parallel to the coastline. The prevailing surface circulation consists of a northerly flow along the coast (EAC) with several cyclonic gyres, such as in the southern and central Adriatic. The water circulation is triggered and regulated by seasonal winds, Mistral (NW) in summer and Bora (NE) and Sirocco (SE) in winter and is highly influenced by the Buna-Bojana shed and Neretva River, both in terms of freshwater inflow and land-based litter washed up from landfills along the riverbanks. The sites for sampling microplastics at the sea surface and in the beach sediment were selected taking into account the possible accumulation of microplastic particles due to prevailing winds and currents and proximity to the river mouths. Microplastics in beach sediment were sampled at Duće and Zaglav beach (Island of Vis) in the central Adriatic, and Prapratno and Komin estuary beach in the southern Adriatic. Close to these sites, samples of microplastics at the sea surface were taken; in the Brač and Hvar Channels in the central Adriatic and in the Neretva Channel, and along the SW side of the island of Mljet in the southern Adriatic. Sampling was conducted from May 2019 to October 2021 using the standard MSFD methodology, developed and tested in the Adriatic within the DeFishGear project. Higher concentrations of microplastics were found at stations with no land-based sources of pollution nearby, both at the sea surface and in sediment. This suggests that the amount and distribution of litter and microplastics in this area are mainly due to litter brought by sea currents and southerly winds from distant areas. Contrary to expectations, lower concentrations of microplastics were found both in the sediment and sea surface at the stations near the river mouths.

KEYWORDS:

marine litter, accumulation, pollution sources, river mouths, sea currents.

Identifying Microplastic Hotspots Around the Maltese Islands: A Preliminary Overview

Manya Russo

Zibel, St. Julian's, Malta

The ubiquitous presence of plastic litter in our marine environment reflects the prevalence and dependence that people currently have on plastic. The Mediterranean Sea is considered to be a hotspot for pollution, including microplastics (MPs) due to a wide range of characteristics. This study aims to evaluate concentrations of MPs around the Maltese Islands as well as identify the most common polymers found by applying a standardised monitoring protocol. The mean microplastic concentration within the Maltese coastal waters was 0.58 (± 0.72) MPs/m³. The concentration ranged from 0.20 (± 0.09) MPs/m³ to 3.35 (± 1.28) MPs/m³. Whilst possible associations with different anthropogenic activities are presented, the heterogeneity of the MPs' distribution and of their concentration levels could be related to several factors.

KEYWORDS:

microplastics, hotspots, characterisation.



Monitoring the Amount and Composition of Marine Waste within the LIFE Artina Project

Fedra Dokozla

Association for Nature, Environment and Sustainable Development Sunce, Split, Croatia

As part of the LIFE Artina project - a network for the conservation of seabirds in the Adriatic, monitoring of marine litter on the beaches and the surface of the sea in the area of the Lastovo Islands Nature Park was carried out. Monitoring of marine waste provides data on quantities, composition, and sources of waste, which are a necessary part of assessing the impact on the marine ecosystem. Due to the danger of consumption and entanglement, marine litter is a particular threat to seabirds: the kaukala (*Calonectris diomedea*) and gregula (*Puffinus yelkouan*) and the Mediterranean gull (*Larus audouinii*). Waste monitoring and collection was carried out in October 2019, May and October 2020 and May 2021, on the beaches of Kremena, Saplun and Sito and on the surface of the sea on 5 transects within 2 locations. All the collected waste was classified into 8 basic categories (artificial polymer materials - plastic, rubber, textiles, paper, treated wood, metal, glass and ceramics and unidentified materials and chemicals), supplemented by examples of the most common items (plastic bags, glass bottles...).

A total of 42,047 different items of waste, weighing 745.70 kg, were recorded, classified, and removed, with the largest share in the category artificial polymer materials with 55.54% (414.23 kg) and processed wood with 33.17% (251.43 kg). The largest number of items was recorded on Sito beach (20,468), followed by Saplun beach (10,901) and Kremena beach (10,678). The total amount of

collected and recorded waste on all beaches and transects was analysed in detail on a qualitative-quantitative level, which showed anthropogenic polymer material, i.e., plastic, as the most prevalent category of waste on beaches with a frequency of 94.94%, while on the sea surface with 95.93%. The highest density of waste was recorded on Sito beach with 5,116 pieces/m², followed by Saplun beach with 1,816 pieces/m² and Kremena beach with 0.889 pieces/m². The average density of floating waste is 415.53 N/km².

The obtained results provide a clearer picture of the quantities, composition and potential sources of marine waste and can be linked to fishing and mariculture, tourism and recreational activities, poor management of municipal waste disposal sites, sewage, and shipping.

KEYWORDS:

LIFE Artina, marine waste, waste monitoring.

A Capitalisation Process for BeMed Projects Supported in Islands: Results and Lessons Learnt

Pedro Fernandez Bautista, Sylvain Petit
MedWaves, Barcelona, Spain

Beyond Plastic Med (BeMed) supports projects in Mediterranean islands, particularly through a specific call for islands where five projects were selected. A total of 26 initiatives have been supported in islands. Through the capitalisation process, a community has been built and animated, with an active participation of 11 projects. Whereas each of them has its own approach and fields of action, commonalities can be found. The joint effort hence provides for interesting results of the community as a whole. Projects comprising clean up actions, both at beaches and sea, collected around 8.700 kg of waste, out of which 3.700 kg was plastic. For example, the Skopelos Dive Center collected nearly 1.500 kg of plastic waste through dedicated immersions in Sporades islands, Greece, which have been later recycled.

Thus, the projects engaged with nearly 200 businesses to advance in the abatement of plastic pollution, particularly with the hospitality sector and cruises. In the case of Plastic Free Balearics, 67 businesses have been certified as "plastic-free".

In relation to single-use plastic products, 6 projects have researched potential alternatives in their territories. 150 alternatives have been found and promoted throughout the activities, and it is estimated that the work with businesses has prevented nearly 13.000 kg of plastic waste. For example, SMILO researched alternatives using local giant reed, and distributed 35,000 cutlery items to shopkeepers in Hyères islands, south France.

Some projects have also worked closely with public authorities, especially municipalities. In Tunisia, Albania and Croatia city councils adopted 9 legal texts limiting the use of disposable plastics and enhancing waste management. The Municipalities of Stari Grad and Sali (Croatia) have proven great commitment and ambition. After the adoption of municipal decisions, public events under municipal licence are required to include important limitations on single-use plastics and waste management.

Through the capitalisation process, projects have gained visibility and their results shared in 7 capitalisation events and other communication means. Concerning impact on policies, a policy brief was produced at the occasion of the COP22 of the Barcelona Convention, highlighting the contribution of the community to the achievements of targets set in the updated Regional Marine Litter Regional Plan.

KEYWORDS:

capitalisation, islands, community, businesses, policy.

Amount, Composition and Sources of Washed-Up Waste on Sakarun Beach (Dugi otok) During 2022

Assoc. Ph.D. Melita Mokos, Dora Lovrić
Department of Ecology, Agronomy and Aquaculture, University of Zadar, Croatia

Waste represents a major environmental problem today, which negatively affects the living world, ecosystems, and their functions, and, ultimately, human health and life. Marine litter is described as any persistent, manufactured or processed solid material produced and used by man, which is ultimately dumped directly into the sea or enters the sea from land (rivers, drainage, wind, sewage). Human activities, such as tourism, agriculture, fishing, maritime transport and aquaculture; and due to poor waste management and inappropriate disposal, waste often ends up in the seas or accumulates on the coasts. One such bay is Sakarun on Dugi otok. The aim of this research is to determine the amount, composition, and sources of washed-up macro waste (> 2.5 cm) on Sakarun beach on Dugi otok during 2022 (winter, spring, summer).

A total of 2,515 pieces of waste were collected during the research. 1405 pieces were collected in the first collection, 652 in the second and 458 in the third, and the mean value of all three collections is 838.3. The density of waste for the winter period was 1.405 pieces/m², for spring 0.652 and for summer 0.458, and the average value is 0.84 pieces/m². According to the Coastal Cleanliness Index (CCI), the beach is categorized as "Extremely dirty" for the winter period, "Dirty" for the spring and "Moderately clean" for the summer. Looking at the mean value of the CCI, which is 16.76, the Sakarun beach is classified as a "Dirty" beach.

Analysing the collected data, it was determined that the composition of the waste is dominated by artificial polymers with 97.50%. The remaining share of 2.50% consists of processed wood (0.87%), metal (0.68%), glass and ceramics (0.40%), rubber (0.32%), paper (0.16%) and clothing and textiles (0.08%).

The source of the largest share of waste is unknown (48.59%). In the part of waste whose source could be determined, the most common source of waste is the coast, specifically tourism and recreation (26.68%), fishing and aquaculture (10.6%), personal hygiene and sewage (9.98%), improper disposal of waste (2.66%), maritime transport (1.75%), medical waste (0.28%) and agriculture (0%).

The Protocol for waste monitoring on beaches of the DeFishGear project was used for the collection and processing of samples. The data collected through this research will contribute to a better understanding of the state of coastal pollution with washed-up waste and can serve for better waste management and prevention of its occurrence.

KEYWORDS:

waste in the sea, plastic, Adriatic Sea.

Marine Litter – the Number One Global Environmental Problem

Ph.D. Pero Tutman

Institute of Oceanography and Fisheries, Split, Croatia

Marine litter is the fastest growing threat to marine ecosystems with major environmental and economic consequences. It is defined as any manufactured or processed solid material that is not of natural origin but has been produced and used, and discarded, by man directly into the sea or has reached it from land via rivers, drainage and sewerage or wind. It ends up in the sea due to failures in waste management; appears floating on the surface of the sea, in the water column, on the seabed and washed up on the shore; the main categories are plastic, metal, glass, rubber, processed wood, fabric and paper. Annually, 8 million tons of plastic end up in the seas, and it is estimated that more than 150 million tons are there. The greatest impact on marine organisms is entanglement (lost fishing tools, plastic bags) and ingestion and ingestion into the digestive system, which particularly exposes marine mammals, turtles, and birds. It represents a risk to human health, disrupts traffic and reduces the quality of using the sea. Microplastics pose a potential threat to organisms, given that they can enter the food chain. Although the issue of marine waste in Croatia has been known for a long time, our knowledge is still quite scarce. The main shortcomings are insufficient knowledge about quantities, composition, and trends, as well as sources and input into the sea that affect distribution. Cross-border waste arriving from neighbouring countries is a particular problem. Civil society organizations have an important role in developing awareness and sensitizing the public, while scientific institutions deal with basic research on the issue started with the DeFishGear project. Systematic national monitoring has been carried out since 2017. In Croatia, marine waste prevention activities are carried out by applying existing legal frameworks related to waste management. Marine litter is not an environmental problem that can only be solved by enforcing laws and cleaning beaches; it is a cultural problem, and it is necessary to make great efforts to change habits, levels of awareness and management methods to achieve the active involvement of all sectors and interest groups.

KEYWORDS:

pressure on the environment, protection, Adriatic, education, legislative framework.

The Role of Civil Society Organizations and the Fishing Sector in the Issue of Marine Waste in the Republic of Croatia

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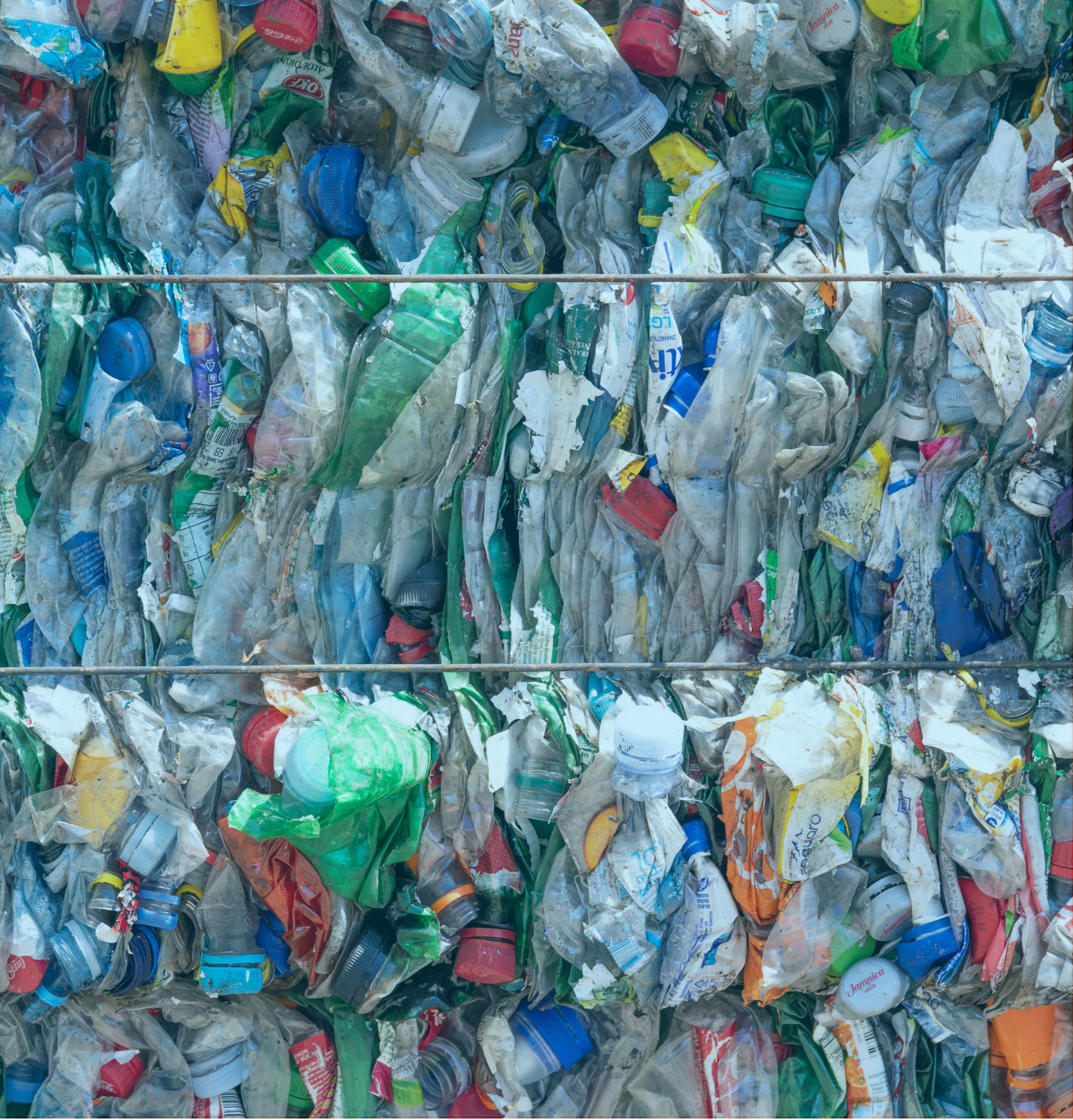
Although the problem of marine litter in the Croatian part of the Adriatic has been present for a long time, we still do not know the extent of the amount, distribution, and its composition. In addition, there is a lack of a sufficiently effective legislative and legal framework for its elimination, both globally, regionally, and nationally. In recent times, with the growth of personal responsibility and social influence, the role of civil society is gaining more and more importance. Civil society organizations can play an important role in the issue of marine litter by carrying out ecological coastal cleaning actions, while trying to influence the public in sensitizing and raising the level of environmental awareness by changing the way waste is handled on land. Non-governmental organizations, such as ecological associations and clubs of recreational divers, can significantly contribute to reducing the amount of marine waste by participating in its removal through ecological actions of coastal and shallow coastal cleaning. Also, fishing can contribute significantly by including the so-called Fishing for Litter practice, that is, the collection of waste found as by-catch in nets during trawl fishing and its disposal on the shore, where it is disposed of within the framework of existing waste management systems. This activity is a simple and very effective way of involving the fishing sector in reducing the amount of waste from the seabed. By applying appropriate protocols, methodology and training, these actors can significantly contribute to the collection of data on the amount, composition, and distribution of marine debris, thereby improving the national research program. Their importance is recognized as a measure to achieve good environmental status (GES) and is part of the EU Marine Strategy Framework Directive (MSFD, 2008/56/EK). Considering the number in the Republic of Croatia – about 270 environmental associations, 150 diving clubs and 480 trawlers, the mass of actions that are carried out every year, and the social benefits of their engagement, they have great potential in removing marine waste, as well as raising the level of environmental awareness more widely to the public. Therefore, there is a justified need for networking of the public sector, civil society associations and scientific institutions in the organized implementation of the aforementioned activities in order to realize their potential.

KEYWORDS:

ecological associations, diving clubs, fishing sector, waste washed up on the coast, waste on the seabed.

SESSION PUBLIC POLICIES AND WASTE MANAGEMENT

EU waste policy aims to contribute to the circular economy by extracting high-quality resources from waste as much as possible. The European Green Agenda aims to promote growth by moving to a modern, resource-efficient, and competitive economy. The Waste Framework Directive is the EU's legal framework for waste treatment and management in the EU. It introduces an order of preference for waste management called the "waste hierarchy". Certain categories of waste require special approaches. Therefore, as well as a comprehensive legal framework, the EU has many laws to deal with different types of waste. Nevertheless, the principles of reducing, reusing, recycling form the basis of the EU legislative framework. Modern policies rely on strategies such as extended producer responsibility, sustainable packaging and design, efficient separate collection and recycling, special disposal standards and the like. However, there is a certain inconsistency in national approaches among EU member states, and Croatia stands out. Also, the issue of marine litter has been identified as an extremely serious and worrying problem, but more concrete policies to prevent and mitigate this problem at the global and international levels are lacking. Therefore, the aim of this thematic unit is to bring together experts from various fields of natural, technical, and social sciences that primarily deal with the analysis, setting and evaluation of policies aimed at waste management and mitigation of pollution in the environment and nature.



Analysis of the Implementation of the SUP Directive in the Croatian National Legislation and Examples of Good Practice Within the EU

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Efforts invested in research and discussion on the most effective ways to establish a circular economy of plastic products resulted in the adoption of Directive (EU) 2019/904 of the European Parliament and the Council on June 5, 2019, on reducing the impact of certain plastic products on the environment (hereinafter: SUP Directive). The SUP Directive establishes a special legal framework that aims to effectively reduce the "significant negative impact on the environment and health, as well as the negative economic impact of certain plastic products" by promoting "circular approaches in which preference is given to sustainable and non-toxic products, which can reuse, and systems for re-use over single-use products, which primarily aims to reduce the amount of generated waste".

The SUP Directive prescribes various measures to reduce the impact on the environment and human health. But, on top of that, the directive is a strong signal to the legislators of the member states that it is necessary to use all available means, including market restrictions, to effectively prevent the generation of waste, especially the waste that can often be found in our immediate environment.

On July 16, 2021, on the occasion of harmonization with the SUP Directive and other waste directives, Croatia adopted a new Waste Management Act (Official Gazette 84/2021), which entered into force on July 31, 2021. With the entry into force of the WMA, the previous Law on Sustainable Waste Management (OG 94/13, OG 73/17, OG 14/19, OG 98/19) applies. However, the new Law did not manage to fully implement the SUP Directive, but a significant part of this matter is planned to be implemented by passing by-laws, i.e., regulations. Also, neither the adopted nor the planned measures correspond to the level of ambition that Croatia needs as a coastal country and a popular tourist destination. In terms of ambition, we can compare ourselves with Hungary, Romania, Bulgaria, and Slovakia - countries with minimal aspirations that ignore some of the key measures, such as reducing consumption, expanding producer responsibility and raising awareness.

KEYWORDS:

law on waste management, waste, single-use plastic, waste reduction, reuse.





SESSION CIRCULAR ECONOMY AND WASTE TREATMENT TECHNOLOGIES

The circular economy is a model of production and consumption that includes the exchange, lease, reuse, repair, restoration and recycling of existing materials and products for as long as possible to extend the life cycle of the product. Waste treatment technologies are a set of techniques, skills and advanced engineering tools applied in environmental engineering in accordance with the principles of sustainable development and environmental protection. The aim of the thematic unit is to bring together experts and stakeholders to exchange ideas and examples of good practice and discuss the link between the principles of the circular economy and modern waste treatment technologies.

The Way Waste is Collected Makes a Difference

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On March 1st, VG Čistoća launched a long-prepared system of separate door-to-door waste collection in the entire administrative area of the city of Velika Gorica. The analysis of the results of the implementation of the system, for the first five months, reveals and confirms several characteristic advantages of the new system. With the previous eight removals in the urban part and four removals in the rural part of the city, the total number of user handovers of containers in the first five months amounted to 53 %, that is, only slightly more than two removals per household out of the four removals offered. For the purposes of creating a comparative analysis, data on the amount of waste for the period from March 1st, 2022, to August 1st, 2022 and the same period in 2021 were used. The most important conclusions about the collected amounts of waste tell us that in the first five months the system reached a result of 28 % of separately collected waste. However, the stated result needs to be further confirmed by other observations. The total amount of waste in 2022 was reduced by 566 tons, while the amount of disposed mixed municipal waste was reduced by 1282 tons, which represents a total of 210 less trucks of disposed waste (two trucks of waste per day). As for the amount of separately collected waste, the amount of separately collected paper increases by 35 %, plastic by 217 %, biodegradable waste by 100 %, and with the introduction of a new billing system and creation of a new price list of services, an increase in the amount of other types of waste (bulky, construction and problematic). This result was accompanied by an increase in costs of over HRK 600,000 required for waste disposal. Therefore, a calculation was made that shows how this system is profitable only with a reduction in the cost of processing biowaste.

KEYWORDS:

door to door, separate collection, waste disposal, composting, plastic.

Development of the UniCompoST Device for Improving Environmental Education and Sustainable Development in Educational Institutions

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Working with students and educational institutions, we saw a low level of information and education in the field of waste management and circular economy. The very setting of education for the environment and sustainable development is based on a theoretical approach, without elements of practical work that would raise the interest of students and facilitate the acquisition of knowledge. Thus, students do not become responsible stakeholders in the waste management system, which directly affects the low level of sustainability of our communities and the high level of negative impacts on all environmental components. Therefore, at UniCompoST we develop devices, practical educational models that combine biowaste processing and plant cultivation. These devices are used in several teaching areas in primary and secondary schools, simultaneously satisfying a wide range of educational outcomes. In addition to the device, the starter package includes accompanying tools for working with students, supplies of microorganisms, substrate, and seeds for growing plants, and methodologies and teaching materials have been prepared for teachers for easy application in teaching processes. Our desire is to improve the processes of education for the environment and sustainable development and make them more efficient.

KEYWORDS:

circular economy, biowaste processing, plant cultivation, practical education.

SESSION BUSINESS SECTOR AND WASTE MANAGEMENT

Industrialization, the development of science, urbanization and population growth have contributed to the growing production of various types of waste. The business sector is affected by high waste management prices but is also the focus of innovative waste management concepts. To prevent improper delays and enable the implementation of the circular economy concept, partnerships with the business sector are necessary. Waste, i.e., its disposal, is one of the key environmental problems of today that the business sector specifically faces. This thematic unit is designed to bring together companies and small businesses that exemplify environmentally sustainable business and business on the principles of reduce, reuse, and recycle, and with the aim of innovative solutions in environmental protection, to reduce their environmental footprint. In addition, the goal is to bring together those entrepreneurs engaged in, i.e., work in the field of waste management, waste collection, recycling and related.

Reuse as One of the Key Factors in Reducing Waste Generation

Eduard Kalčić

Cupup System d.o.o., Pazin, Croatia

CupUp is not just a product, but a concept that accompanies the user from the very beginning to the end of an event. Reusable cups are a responsible choice that, in the last few years, has been increasingly practiced in the world with the aim of reducing waste on planet Earth and achieving a strong marketing effect. In this concept, CupUp plays the eco-friendly role of a high-quality polypropylene cup, practical to use and a solution for organizers of events, festivals, sports events, concerts, and the beer industry as a worthy replacement for a disposable cup. By using reusable cups, you develop your business according to the principles of the circular economy to reduce the CO2 footprint.

KEYWORDS:

circular economy, reuse, waste reduction, reusable, zero waste.



SESSION SOCIETY, INDIVIDUALS AND WASTE

In March 2020, the European Commission adopted a New Action Plan for the Circular Economy. It is one of the main elements and the backbone of the European Green Deal, the new European program for sustainable development. The percentage of separate waste collection and recycling is growing across Europe and the world. New trends are emerging like green consumer and tourist, zero waste lifestyle, veganism, and vegetarianism, all due to the growing level of environmental concern and awareness regarding the problem of waste generation and disposal. However, the problem of waste generation and management, its disposal and increasing pollution of the environment, especially plastics in the sea, is becoming one of the biggest political and environmental problems in the world. Therefore, the aim of this thematic unit is to encourage discussion about the relationship between society, culture, education, our individual and collective action, consumer and other habits and generation, treatment, management and disposal of waste at local, national and international levels, encourage exchange of ideas, experiences and examples of good practice, especially between civil society, academia, the education system, public services and a number of other stakeholders who are actively involved in the problem.



Green Office

Maja Golem

Association for Nature, Environment and Sustainable Development Sunce, Split, Croatia

Green office, a service to promote environmentally responsible behaviour in the business sector, was designed by the Association for Nature, Environment and Sustainable Development Sunce as a response to the ever-growing aspiration and increasingly necessary need for ecologically fair business. Green office is the name for a set of activities that employees should practice regularly to reduce the consumption of energy and materials in daily office operations, and at the same time increase the efficiency of resource use and reduce the negative impact on the environment. Environmentally just business is a necessary tool for solving the pressing problem of climate change and other environmental challenges. However, in addition to offering guidelines for bridging environmental problems, the principles of the Green Office bring various ethical, cost and health benefits for all involved in this business model. Environmentally responsible business is closely related to business that cares for the common good and to business entities that have humanity at their core. Also, we should not forget the health benefits that an environmentally responsible office can bring to those involved in green business. Consequently, this service serves as an aid to all those who are motivated to make a change towards a more sustainable and ethical business. It aids in identifying types of waste and is a consultant on energy efficiency and green transport. The service can be used by entrepreneurs who are just embarking on a business venture, but also by well-established businesses.

KEYWORDS:

environmentally responsible business, business sector, sustainability, energy efficiency.

Swap Fair

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Consumerism - when the love of things becomes the love of buying the latest products on the market. The growth of consumerism has led to the fact that every year we create more and more waste, and the space for its disposal is decreasing. To respond to this growing and broad challenge of today, we started with a monthly swap fair of used items in Split. It is a project that has already taken off in Sunce after the implementation of similar events in Trogir and the school garden of the Elementary school Skalice in Split. Swap fairs are very popular in Europe, and they have only recently come to life in our country. They are like flea markets, but the difference is that the items at the barter fair are not charged for but are exchanged for other items. They are an ideal opportunity to exchange something we don't need for something else that will benefit us. The rules for participating in the exchange fair are simple: you bring up to five well-preserved, clean, working items that can be used by others (books, decorations, jewellery, fashion accessories, toys, clothes, etc.); you exchange items for vouchers at the entrance to the fair according to the principle - as many items, as many vouchers and then you choose the items you want to take home and exchange them for the vouchers obtained at the exit. The production of new items not only drains the Earth's limited resources, but also creates a huge amount of waste, which is most often associated with packaging. By exchanging items, we no longer use for some more necessary items, we reduce our own carbon footprint, save money, and directly participate in environmental protection. Monthly swap fairs are held every first Tuesday of the month in the premises of the Klub zona in Split. Their popularity is slowly growing, and citizens and tourists visit them in large numbers. For this reason, we hope that this kind of project, connected with the replacement and reuse of old objects, will come to life in other cities as well.

KEYWORDS:

swap fair, exchange, environmental protection, reuse, used items.

THE MAIN CONCLUSIONS OF THE CONFERENCE

This conference was a step towards the awareness of responsible people in order to preserve on of the most beautiful parts of the globe. These are some of the main conclusions derived from the exchange of knowledge and experiences of all participants.

- Until some ten years ago, marine pollution was not considered pollution. People didn't pay much attention to it, they didn't know what its consequences were. But, through various projects, conferences, educations, work on this problem intensified, people's awareness rose that this waste, in which plastic predominates, has a negative impact, that's not only visual.
- Influences of marine waste are much more complex and far-reaching. In fact, there is no part of our coast that is not threatened by marine litter. Vis, Lastovo, Mljet are even more loaded with marine litter than we originally thought, but the similar situation is on Malta and in Tunisia.
- It is very important to monitor, research, use an interdisciplinary approach and most importantly involve the local community in the problem of the accumulation of plastic waste in seaweed banquets.
- As a maritime, coastal and touristic country, Croatia has a problem with marine waste, which is one shortcoming in the chain of waste management on land. It is very important to start a separate waste collection system, a recycling industry and bio-waste composting, things that somehow "don't work" in this area.
- Great pressures on nature are the main reasons why marine litter is a topic in the EU parliament. The representatives therefore requested several measures to reduce marine litter in the sea, such as additional restrictions on the use of single-use plastics, strengthening the circular economy through collection, recycling and repurposing and therefore increasing the value of products, as well as designing fishing equipment in a more sustainable way.

- In addition, many more people, public institutions, and political segments need to be motivated to take their own step to reach the final goal together. The need for an international strategic document for the future good quality of the marine ecosystem was highlighted.
- Our next steps are the continuation of cooperation, finding funds for new projects and encouraging competent institutions to improve the legislative framework and its implementation, with the aim of preserving the Adriatic and the entire marine ecosystem.





OPĆINA SALI

KOMUNALNO
STARI GRAD d.o.o.

ZELENA AKCIJA
FRIENDS OF THE EARTH CROATIA