

SECOND JOINT REPORT ON BEACH CLEAN-UPS AND GARBAGE MANAGEMENT REPORT

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Project Partners

N°	Participant name	Short name	Country
LP	National Interuniversity Consortium for Marine Sciences	CoNISMa	Italy
PP2	Municipality of Lecce	ML	Italy
PP3	National Coastal Agency	NCA	Albania
PP4	Polytechnic University of Tirana	F.GJ.M.	Albania
PP5	Public enterprise for coastal zone management of Montenegro	JMDCG	Montenegro
PP6	University of Montenegro	UNIME	Montenegro

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SECOND JOINT REPORT ON BEACH CLEAN-UPS AND GARBAGE MANAGEMENT

Beach clean-ups and garbage management activities were devoted to the removal of marine litter from the selected beaches of the Italian, Albanian and Montenegrin areas. Alongside the selected beaches, the marine litter was collected separately so that materials like wood, glass, aluminium and plastic can be recycled. The marine litter collection mainly was done manually, limiting, as much as possible, the use of vehicles and their passage on the beaches. After the beach cleaning operations, the collected material was then sent to an authorized and licensed disposal centre where the woody material was separated in order to be reused for consolidation and restauration of sand dunes (anti-erosion barriers) by artists and architects.

At the beginning of project "WELCOME" partners from Italy, Albania and Montenegro selected 3 beaches in all three countries along the cross-border coasts for the marine litter removal and research activities. These activities were carried out on the following beaches:

Italy:

-**Torre Chianca** in
Lecce municipality

-**Frigole** in Lecce
municipality

-**San Cataldo** in
Lecce municipality

Albania:

-**Spille** in Durres
municipality

-**Adriatik** in Shkoder
municipality

-**Velipoja** in Shkoder
municipality

Montenegro:

-**Velika plaža** in Ulcinj
municipality

-**Bečićka beach** in
Budva municipality

-**Igalo beach** in Herceg
Novi municipality

Marine litter collection and selection activities were carried out according to pre-defined transects in accordance with the adopted methodology – “Metodology for monitoring marine litter on beaches” which is developed within the IPA ADRIATIC “DeFishGear” project. The following methodology has been prepared based on the EU MSFD TG10 “Guidance on Monitoring of Marine Litter in European Seas (2013)”, the OSPAR “Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (2010)” and the NOAA “Marine Debris Monitoring and

Assessment: Recommendations for Monitoring Debris Trends in the Marine Environment (2013), taking into consideration the draft “UNEP/MAP MEDPOL Monitoring Guidance Document on Ecological Objective 10: Marine Litter (2014)”.

In detail, these criteria include the conditions that selected beaches should be situated in the vicinity of coastal urban areas and of tourism destinations. Moreover, the selected beaches should: have a minimum length of 100 m; be characterized by a low slope (1.5 – 4.5 °); have clear access to the sea; be accessible to survey operators throughout the year. A further required condition is that the beaches should not be subject to cleaning activities, otherwise the timing of non-survey must be known so that litter flux rates can be determined. This methodology was adopted and used within the Interreg IPA CBC project "WELCOME" for the activities T1 - Marine litter study and removal from the coasts. After the first monitoring the existing methodology has been partially improved and more data has been collected compared to the first monitoring activities, that is, a more detailed measurement of the weight of the collected waste has been carried out.

The fixed sampling unit was transect of 100 m of sandy beach. So, two different transects of 100 m was determine on all three selected beaches of the Italian, Albanian and Montenegrin areas. Two contiguous transects are separated at least by 50 m.

The use of the same methodology by all project partners has enabled more efficient implementation of marine litter removal and research activities, easier comparison of the obtained data and obtaining more complete information on marine litter along the Italian, Albanian and Montenegrin coasts.

Beach clean-ups and marine litter research activities were performed each four months during the project implementation – three times per year during a period of 2 years on 3 selected beaches along the three cross-border coasts. The first field activities on beach clean-ups and garbage management which included collection, assessment of the quantity, type and distribution of marine litter on the selected beaches along the coast, within the Interreg IPA CBC project "WELCOME", were carried out during the May 2018 and the last beach clean-ups activities were done during December 2019. The marine litter was collected in a total of six transects on three selected beaches in Italian, Albanian and Montenegrin coasts and classified into eight main classification groups: artificial polymer materials, rubber, cloth/textile, paper/cardboard, processed/worked wood, metal,

glass/ceramics, unidentified and/or chemicals. Natural wood is also collected separately and reused for consolidation and restoration of sand dunes.



Figure 1: Picture from field activities

Together with activities of sampling, categorization and monitoring of marine litter on selected beaches, a raising awareness campaigns of the importance of marine litter clean up actions and the impact of marine litter on the environment were conducted through participation of volunteers in beach cleaning activities, publication and announcement, brochures, workshops, lessons at schools etc. In addition to the project staff, volunteers and general public were also involved and had a chance to participate in beach cleaning activities since all beach clean-ups activities are announced on web portals and local media as well as research results. Researchers, external expertise from public authorities and fishery cooperatives was directly involved in the cleaning operations while schools and other training and education centres was informed about the initiative mainly through the local media, workshops organized under work package Communication as well as through publications, lessons at schools and brochures.

Implementation of the beach clean-ups and garbage management activities and the results of the survey has enabled the monitoring of marine litter in the period of 2 years as well as the comparison of data and identification of the type and origin of marine litter that comes to the beaches from the sea and the mouth of the river.

1. FIELD ACTIVITIES CONDUCTED IN ITALY

1.1. Sampling methods, the guidelines followed and the selected beaches

The Local Research Unit of CoNISMa in Lecce together with the Municipality of Lecce indicated the beaches to be monitored in the framework of the WELCOME Project. All the beaches belong to the municipality of Lecce and they firstly included the marinas of Torre Rinalda, Spiaggiabella, Torre Chianca, Frigole and San Cataldo as indicated in the Part A of the project summary. By following agreements with municipality of Lecce the final selection of the three beaches to be monitored indicated the marinas of **Torre Chianca**, **Frigole** and **San Cataldo** with two transects for each beach. Overall, the coast of the ‘Welcome Project’ is about 12 km long (Figure 2). Each transect was parallel to the coast line, 100 meters long and stretched from the shore to the dune vegetation.

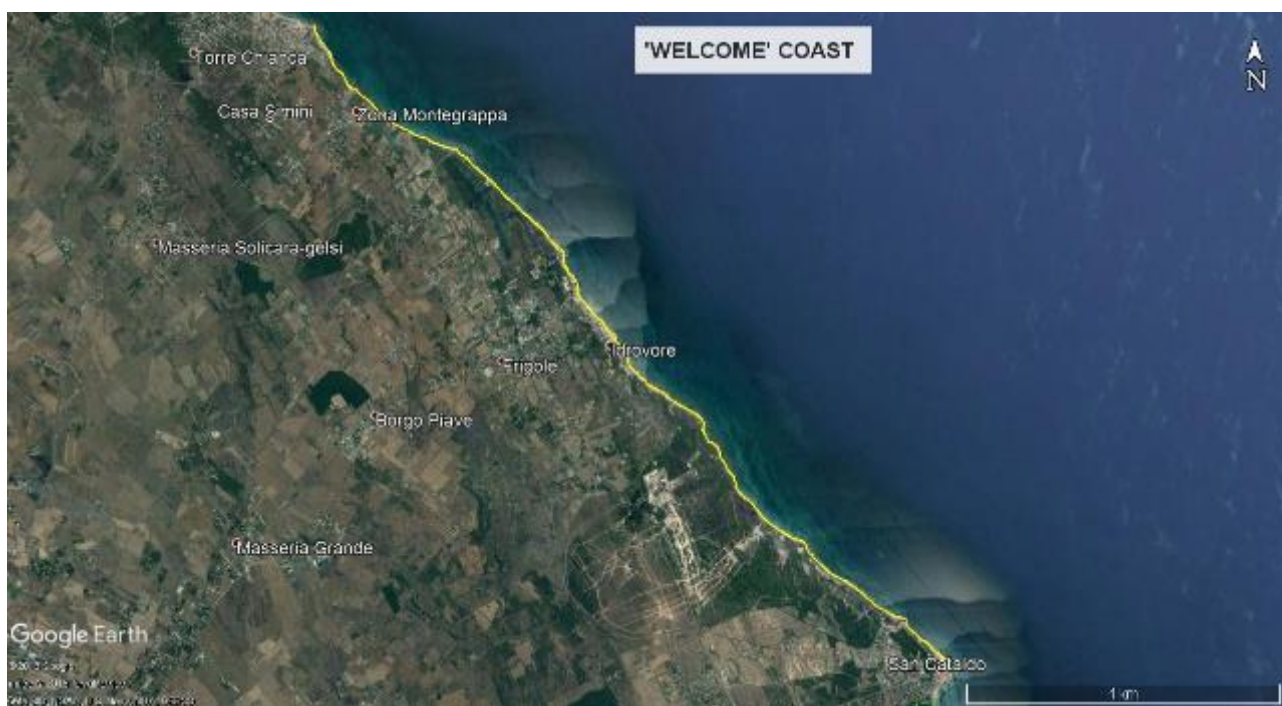


Figure 2: The trait of Adriatic coast of the Welcome Project in Italy

The followed methodology is largely based on the **DeFishGear Methodology for Monitoring Marine Litter on Beaches (macro-debris > 2.5 cm)**. This methodology include reference to the EU MSFD TG10 “Guidance on Monitoring of Marine Litter in European Seas (2013)”, the OSPAR “Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (2010)” and the NOAA “Marine Debris Monitoring and Assessment: Recommendations for Monitoring Debris Trends in the Marine Environment (2013)”.

In detail, these criteria include the conditions that the selected beaches should be situated in the vicinity of coastal urban areas and of tourism destinations. Moreover, the selected beaches should: have a minimum length of 100 m; be characterized by a low slope (1.5 – 4.5 °); have clear access to the sea; be accessible to survey operators throughout the year. A further required condition is that the beaches should not be subject to cleaning activities, otherwise the timing of non-survey must be known so that litter flux rates can be determined.

The field operations were carried out every four months for two years and the marine litter was collected preferably manually in order to not compromise the natural shape of the beaches and to not destroy possible nests of marine birds (e.g. *Charadrius alexandrinus*) or of the sea turtles (*Caretta caretta*). The fixed sampling unit was a transect of 100 m of sandy beach. Each one of the three marinas (Torre Chianca, Frigole and San Cataldo) is represented by two different transects of 100 m. Two contiguous transects are separated at least by 50 m.

Finally, the selected transects with the respective coordinates are reported below:

site	code	START North		END South	
		Latitude N	Longitude E	Latitude N	Longitude E
Torre Chianca 1	TC_1	40°27'21.71"	18°13'02.18"	40°27'20.55"	18°13'06.16"
Torre Chianca 2	TC_2	40°27'19.03"	18°13'07.78"	40°27'16.98"	18°13'11.04"
Frigole 1	FR_1	40°25'21.80"	18°15'42.00"	40°25'19.62"	18°15'45.27"
Frigole 2 (old)	FR_2	40°25'18.90"	18°15'47.60"	40°25'16.93"	18°15'51.10"
Frigole 2 (new)	FR_2	40°25'24.72"	18°15'37.18"	40°25'22.44"	18°15'40.23"
San Cataldo 1	SC_1	40°23'54.20"	18°17'39.90"	40°23'51.7"	18°17'42.60"
San Cataldo 2	SC_2	40°23'49.80"	18°17'46.80"	40°23'47.80"	18°17'50.10"

Table 1: Coordinates of the extremities of the transects in Italy

In particular, the location of both transects for each selected beach (Torre Chianca, Frigole and San Cataldo) is showed in the figures 3, 4 and 5 respectively.



Figure 3: Location of the two transects of Torre Chianca

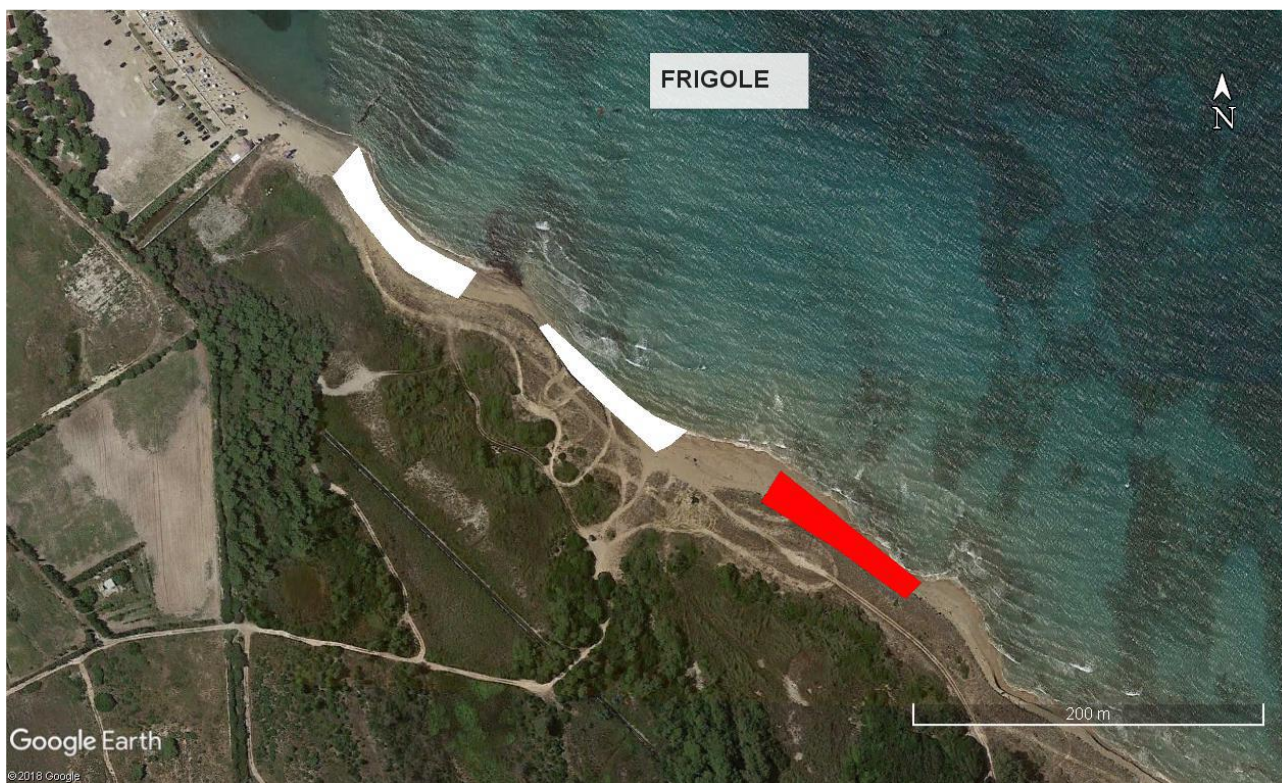


Figure 4: Location of the two transects of Frigole



Figure 5: Location of the two transects of San Cataldo

1.2. Field activities

The field interventions were anticipated by a first inspection. Prior to each monitoring a careful assessment of the weather conditions was carried out. The staff of Salento university provided its own posters. With executive management municipality determination n. 890/2019 (march, the 15th) was entrusted to the company Cento18ambiente S.r.l., an economic operator expert in both beach cleaning up activities and dunes restoration setting biomass material. The selected operator has been informed about the working modes through a summary document in addition to the indications mentioned in the international protocols TSG_ML.

The Municipality of Lecce regularly cleans up the beaches during the spring-summer period, although with different frequencies (usually it starts in April and ends in early October); However, in the 20 days prior to field operations, the transects were not cleaned. It is interesting to note that this department also provided monitoring and regimenting cleaning up activities of volunteer organisations to not alter the situation on the transects.

A **preliminary survey** on the selected beaches has been carried out on **14 may 2018** in order to verify the standard conditions required from the international protocols of the marine litter monitoring while the last beach cleaning operation were carried out during November 2019. Moreover, a better choice of the transects was performed in order to promote the restoration of traits of the nearby dunes consumed by the coastal erosion. Also for these reasons, the transects preliminarily identified on the maps have been better identified *in situ*.

The samples were taken in six different periods:

TIME I	28/05/2018
TIME II	06/11/2018
TIME III	19/03/2019
TIME IV	22/05/2019
TIME V	09/10/2019
TIME VI	28/11/2019

The field operations were aimed at the complete removal of waste, they were carried out according to the international protocols TSG_ML. The collection was carried out strictly with manual mode and machinery were left behind the dunes.

The operating modes required about no. 4 operators, which, in addition to collecting waste, also supported the staff of the LP, responsible for cataloguing operations. Two transects a day were cleaned up, for a total of six transects. All collected and catalogued waste has been sent for disposal. The beached uneven wood was collected separately and kept for the following operations of dune restoration.

Consumable materials: The contractor company supplied waste bags and work gloves.



Figure 6: Transept before operations (example)



Figure 7: Transept before operations (example)



Figure 8: Field operations



Figure 9: Field operations



Figure 10: Field operations



Figure 11: Field operations

1.3. Marine litter amount and classification in Italy

All the items (> 2.5 cm) inside the selected transects were collected, classified according their respective codes, and finally weighted based on the material group. Overall, 14712 items were collected and a total amount of 529.81 kg of litter removed from beaches along the Italian coasts of the municipality of Lecce in the beaches of Torre Chianca, Frigole and San Cataldo. In detail, 122.51 kg of marine litter were collected at Torre Chianca, 262.46 kg at Frigole and 144.84 kg at San Cataldo.

The natural wood estimated on the three beaches during surveys was about 5200 kg in total. In detail, about 1000 at Torre Chianca, about 2000 at Frigole kg and more than 2000 kg at San Cataldo.

The ‘artificial polymers’ resulted the most abundant material both in terms of weight (83.06% in total on six surveys) and number of items (95.84%). Contribution of ‘Rubber’ was 4.07% (weight) and 0.91% (items); ‘glass’ was 3.54% (weight) and 1.58% (items); ‘metals’ 1.18% (weight) and 0.89% (items); ‘worked wood’ 7.16% (weight) and 0.38% (items); ‘clothes’ 0.79% (weight) and 0.11% (items), ‘other’ 0.12% (weight) and 0.07% (items).

The top 20 items with their description and code are reported in the **Figure 12**. They belong all to the group of the ‘artificial polymers’ with the only exception of the code G125, the rubber balloons. The first 5 are: ‘Plastic pieces 2.5 cm > < 50cm’ with 4453 items, ‘Plastic caps/lids from drinks’ 1550 items, ‘Cotton bud sticks’ 1476 items; ‘Polystyrene pieces 2.5 cm > < 50cm’ 1039 items; ‘Mussels nets’ 983 items in total.

The top 20 most abundant categories in terms of weight, with their description and code, are reported in the **Figure 13**. The heaviest categories recorded were: G49_Rope (diameter more than 1cm), 203 kg; G79_Plastic pieces 2.5 cm > < 50cm, 32,45 kg; G8_Drink bottles >0.5l, 24.95 kg; G68_Fiberglass/fragments, 22,77 kg; G172_Other wood > 50 cm, 16.9 kg.

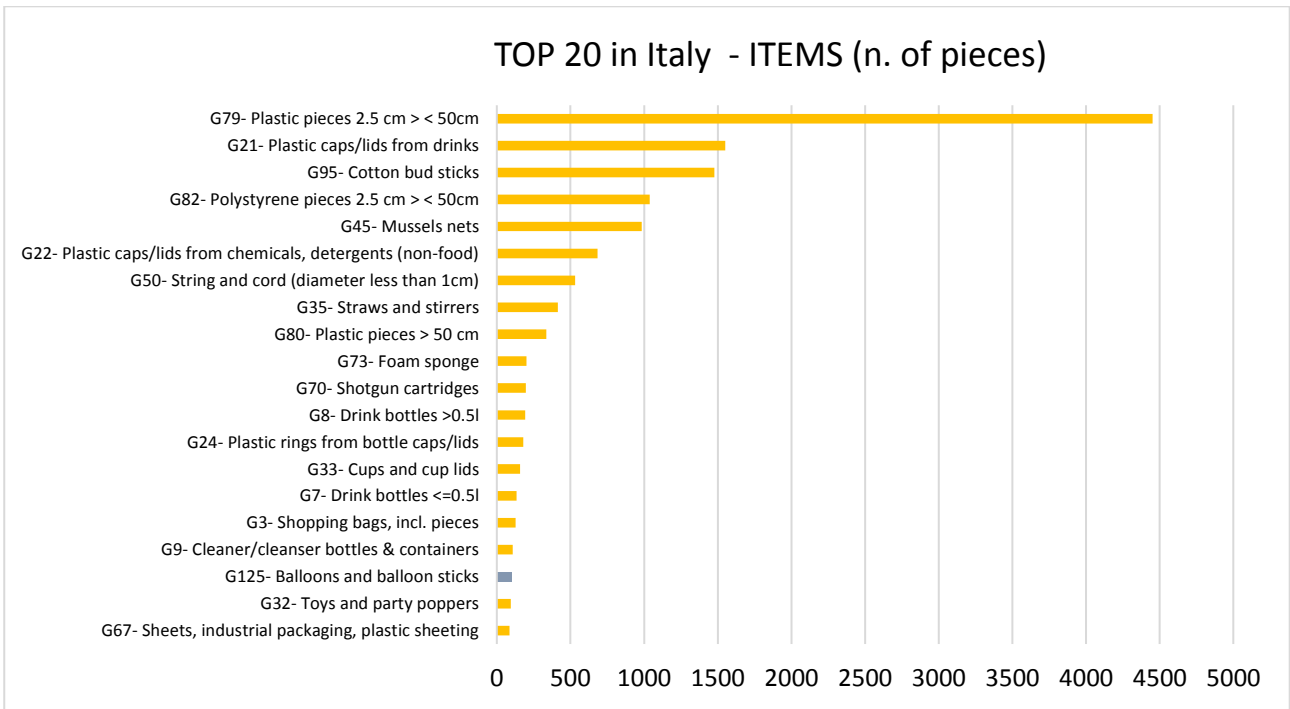


Figure 12: Top 20 items collected during all the six surveys in Italy

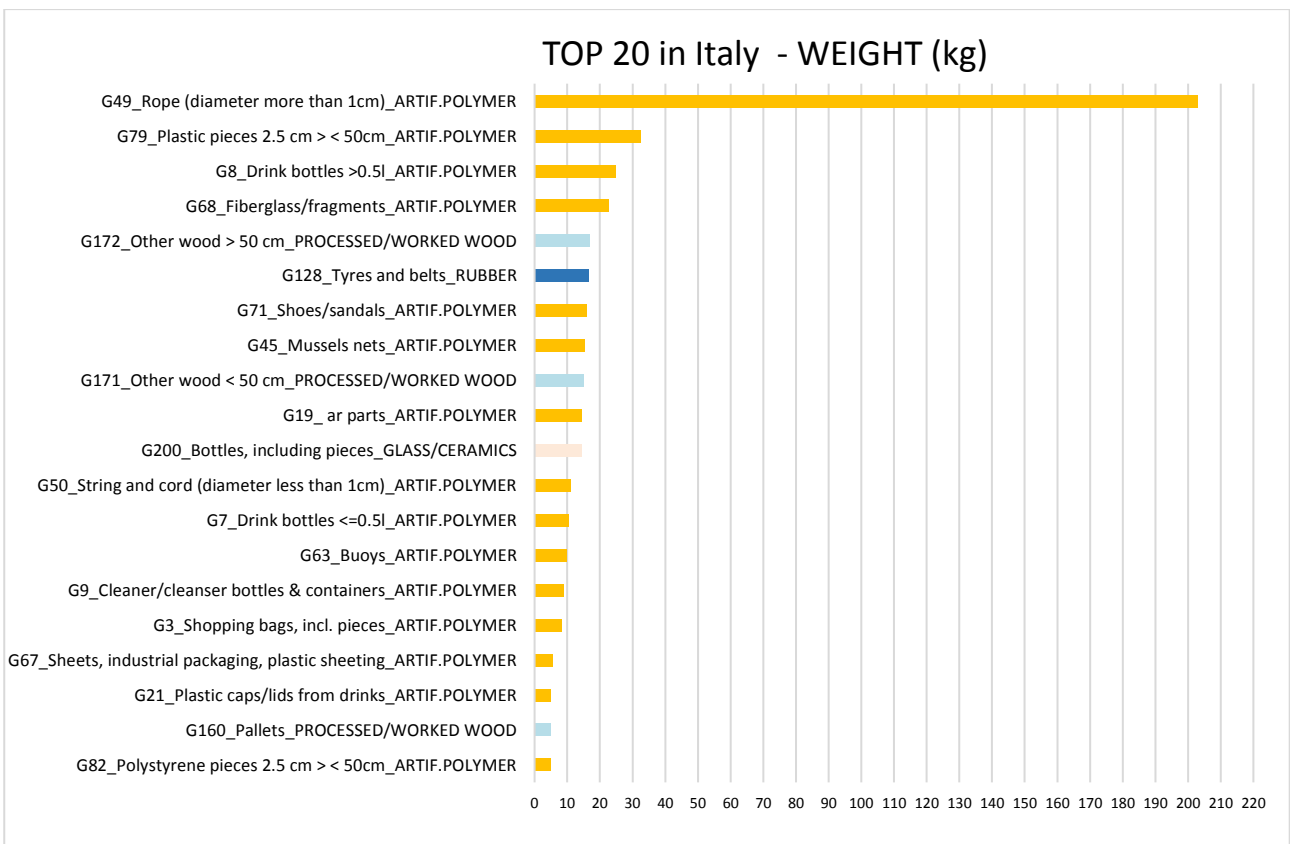


Figure 13: Top 20 categories (in terms of weight) collected during all the six surveys in Italy

2. FIELD ACTIVITIES CONDUCTED IN MONTENEGRO

2.1. Sampling methods, selected beaches and followed guidelines

In the framework of the WELCOME project Public Enterprise for Coastal Zone Management, together with Institute of Marine Biology, at the beginning of the project selected three beaches for the marine litter removal and research activities. These activities were carried out on the following beaches in Montenegro:

- **beach Velika plaža** in Ulcinj municipality,
- **Bečićka beach** in Budva municipality and
- **Igalo beach** in Herceg Novi municipality.

In Ulcinj municipality one transect was selected under the hotel “Otrant“ and other one in area of Kite-Surfe zone (Z4) on the beach Velika plaža. In Budva municipality „St. Toma“ and “Samsara” are selected on the beach Bečićka plaža, while in Herceg Novi municipality two transect on Igalo beach are selected – “Igalo I” and “Igalo II” (*Figure 14*).

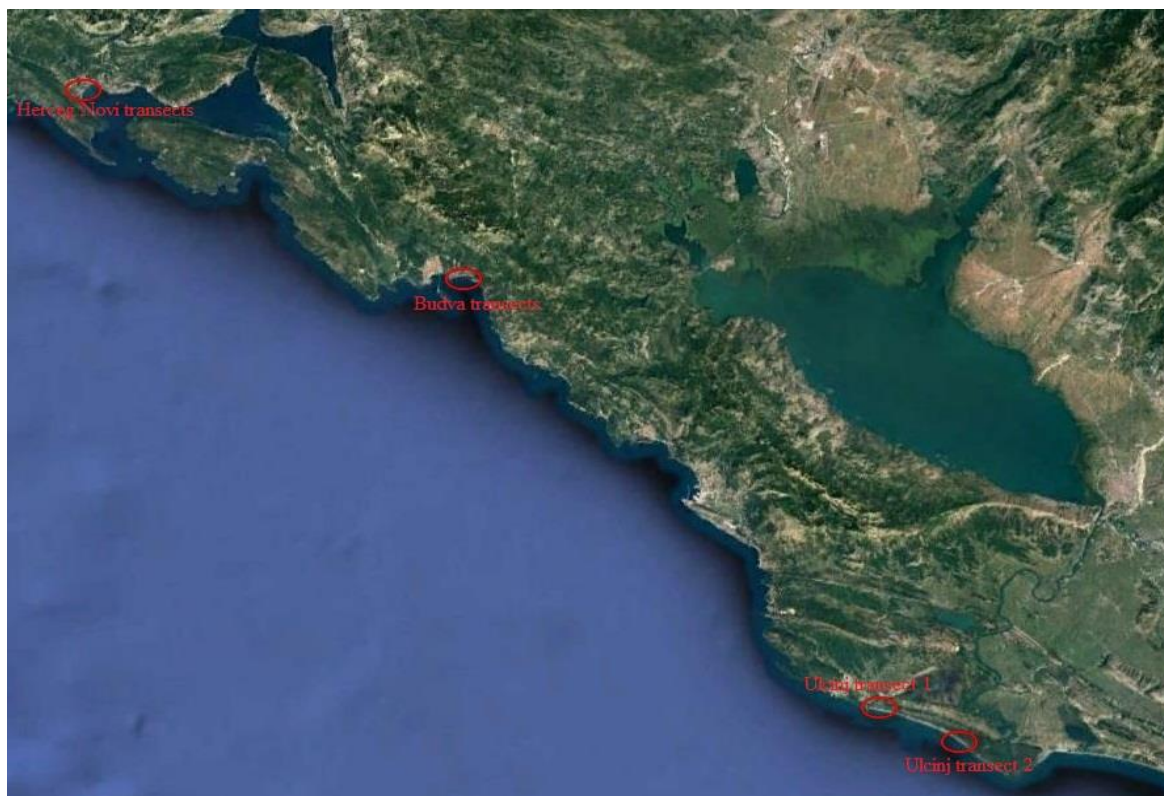


Figure 14: Selected transects on Montenegrin coast according to the WELCOME project

Marine litter collection and selection activities were carried out according to pre-defined transects in accordance with the adopted methodology – “Metodology for Monitoring Marine Litter on Beaches” which is developed within the IPA ADRIATIC “DeFishGear” project. The followed methodology has been prepared based on the EU MSFD TG10 “Guidance on Monitoring of Marine Litter in European Seas (2013)”, the OSPAR “Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (2010)” and the NOAA “Marine Debris Monitoring and Assessment: Recommendations for Monitoring Debris Trends in the Marine Environment (2013), taking into consideration the draft “UNEP/MAP MEDPOL Monitoring Guidance Document on Ecological Objective 10: Marine Litter (2014)”.

In detail, these criteria include the conditions that selected beaches should be situated in the vicinity of coastal urban areas and of tourism destinations. Moreover, the selected beaches should: have a minimum length of 100 m; be characterized by a low slope (1.5 – 4.5 °); have clear access to the sea; be accessible to survey operators throughout the year. A further required condition is that the beaches should not be subject to cleaning activities, otherwise the timing of non-survey must be known so that litter flux rates can be determined. After the first monitoring the existing methodology has been partially improved and more data has been collected compared to the first monitoring activities, that is, a more detailed measurement of the weight of the collected waste has been carried out.

Table 2: Coordinates of selected transects in Montenegro

Beach	Code	Starting point	Ending point
Herceg Novi, Igalo I	HN1	42°27'15.45"N	42°27'13.65"N
		18°30'28.57"W	18°30'26.30"W
Herceg Novi, Igalo II	HN2	42°27'13.65"N	42°27'10.60"N
		18°30'26.30"W	18°30'22.65"W
Budva, St. Toma	BD1	42°16'50.99"N	42°16'51.12"N
		18°52'11.77"W	18°52'16.18"W
Budva, Samsara	BD2	42°16'51.13"N	42°16'51.04"N
		18°52'23.36"W	18°52'27.66"W
Ulcinj, Otrant	UL1	41°54'32.96"N	41°54'33.02"N
		19°14'09.68"W	19°14'13.86"W
Ulcinj, Z4	UL2	41°52'41.28"N	41°52'39.32"N
		19°19'21.60"W	19°19'24.99"W

The fixed sampling unit was transect of 100 m of sandy beach. So, two different transects of 100 m was determine on all three selected beaches on Montenegrin coast. Two contiguous transects are separated at least by 50 m, except in Herceg Novi where transects were next to each other because selected beaches are only sandy beaches in this municipality which meet all requirements according to the protocol. In Table 2 starting and ending points of each transect are given.

Locations of transects on the selected beaches (Igalo beach, beach Bečićka plaža and Velika plaža) on the Montenegrin coast are showed in Figures 15, 16, 17 and 18.

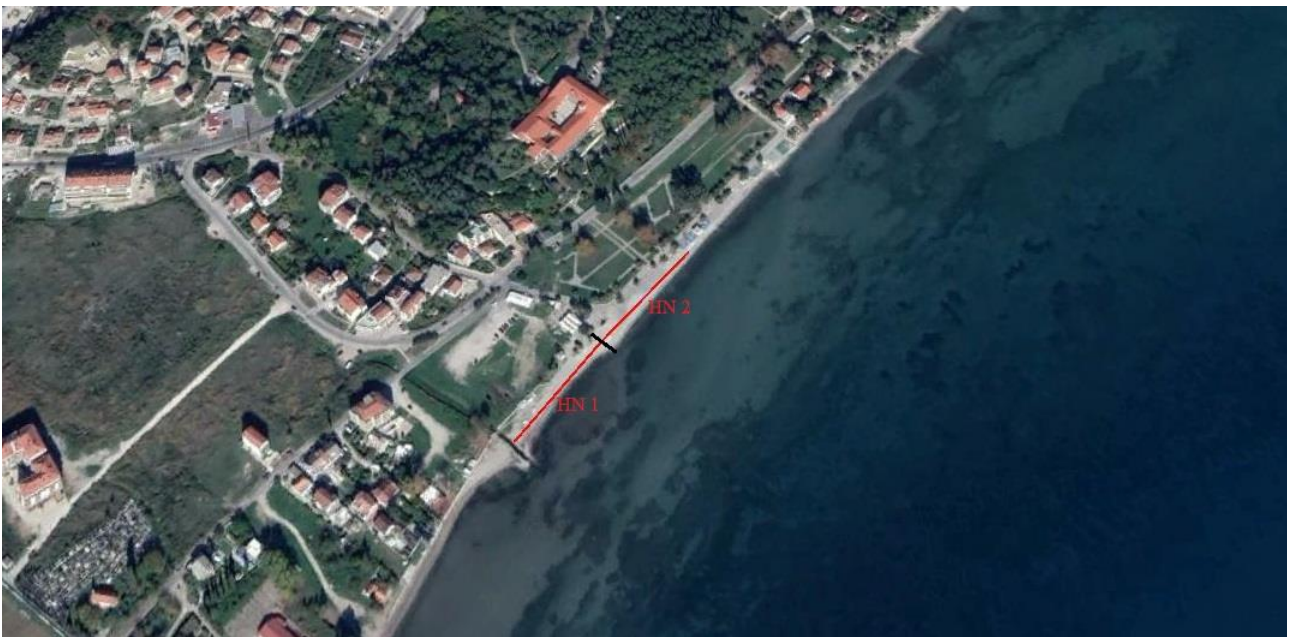


Figure 15: Location of the two transects in Herceg Novi Municipality



Figure 16: Location of the two transects in Budva Municipality



Figure 17: Location of transect 1 in Ulcinj Municipality



Figure 18: Location of transect 2 in Ulcinj Municipality

Beach clean-ups and marine litter research activities in Montenegro were performed three times per year during a period of 2 years on 3 selected beaches - 3 times during the 2018 and 3 times during 2019. First survey on the selected beaches began in mid- May 2018 in order to verify the standard conditions required from the international protocols of the marine litter monitoring. Moreover, a better choice of transects was performed in order to promote the restoration of traits of the nearby dunes consumed by the coastal erosion.

2.2. Field activities

The field activities on beach clean-ups and garbage management on selected beaches in Montenegro were carried out in the following dates:

- | | | |
|---------------------------|----------------|----------|
| • First field activities | May 2018 | TIME I |
| • Second field activities | October 2018 | TIME II |
| • Third field activities | December 2018 | TIME III |
| • Fourth field activities | March 2019 | TIME IV |
| • Fifth field activities | September 2019 | TIME V |
| • Sixth field activities | December 2019 | TIME VI |

The first field activities on beach clean-ups and garbage management within the Interreg IPA CBC project "WELCOME", which included collection, assessment of the quantity, type and distribution of marine litter on the selected beaches along the Montenegrin coast, were carried out during the May 2018 and the last beach clean-ups activities were done during December 2019. In order to collect relevant information and present the real situation the transects were not cleaned in the 20 days prior to field operations.

The first field activities on the selected Montenegrin beaches were conducted by Public enterprise for coastal zone management (JPMDCG) and Institute of Marine Biology (IBM) project staff. In all other field activities in Montenegro, besides the Public enterprise for coastal zone management (JPMDCG) and Institute of Marine Biology (IBM) project staff, participated Non-government

organization “Zelena mreža – Green net” from Budva – hired for organization and conduction of beach clean-ups activities as well as volunteers.

At the beginning of each beach cleaning activity participants were introduced with the rules of marine litter collection and selection, defined and marked transects in accordance with the adopted methodology, divided into teams and collected marine litter from the selected Montenegrin beaches. The marine litter was collected in a total of six transects on three beaches of the Montenegrin coast and classified into eight main classification groups: plastics, rubber, textiles, paper, natural wood, processed wood, metal, glass/ceramics and unidentified waste. Natural wood is also collected separately and reused for consolidation and restauration of sand dunes and for construction of artistic installation. The marine litter collection was done manually, limiting, as much as possible, the use of vehicles and their passage on the beaches. In beach cleaning activities participated about 10-15 operators together with project staff and volunteers and two transects per a day were cleaned.

The beach cleaning action lasted several hours after which the marine litter collected from these beaches was transferred to the Institute of Marine Biology where they analysed and categorized these marine litter, in accordance with internationally standardized protocols and methodology based on the Marine Strategy Framework Directive (MSDF). In the laboratory of the Institute of Marine Biology marine litter was classified in detail according to their respective codes and items were counted and weighted.

2.2.1 Field activities in Herceg Novi municipality

The field activities on beach clean-ups and garbage management on two transect on Igalo beach - “Igalo I” and “Igalo II” in Herceg Novi municipality were carried out in the following dates:

- | | | |
|---------------------------|------------|----------|
| • First field activities | 18/05/2018 | TIME I |
| • Second field activities | 25/10/2018 | TIME II |
| • Third field activities | 24/12/2018 | TIME III |
| • Fourth field activities | 17/03/2019 | TIME IV |
| • Fifth field activities | 20/09/2019 | TIME V |
| • Sixth field activities | 22/12/2019 | TIME VI |



Figure 19, 20 and 21: Field activities in Herceg Novi - Montenegro

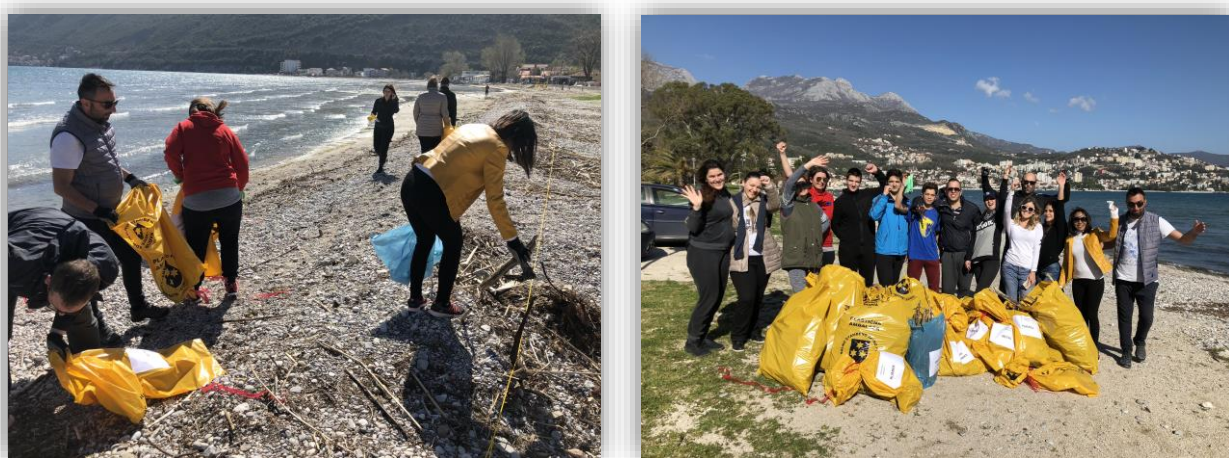


Figure 22 and 23: Field activities in Herceg Novi – Montenegro

2.2.2 Field activities in Budva municipality

The field activities on beach clean-ups and garbage management on two transect on the beach Bečićka plaža – “St. Toma” and “Samsara” in Budva municipality were carried out in the following dates:

- First field activities 25/05/2018 TIME I
- Second field activities 27/10/2018 TIME II
- Third field activities 22/12/2018 TIME III
- Fourth field activities 15/03/2019 TIME IV
- Fifth field activities 22/09/2019 TIME V
- Sixth field activities 20/12/2019 TIME VI

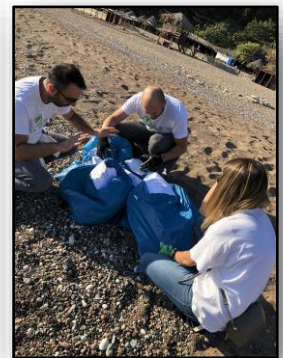
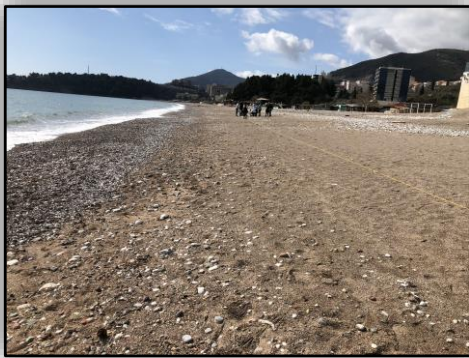


Figure 24, 25 and 26: Field activities in Budva - Montenegro



Figure 27, 28 and 29: Field activities in Budva - Montenegro

2.2.3 Field activities in Ulcinj municipality

The field activities on beach clean-ups and garbage management on two transect on the beach Velika plaža – under the hotel “Otrant“ and other one in area of Kite-Surfe zone (Z4) in Ulcinj municipality were carried out in the following dates:

- | | | |
|---------------------------|------------|----------|
| • First field activities | 24/05/2018 | TIME I |
| • Second field activities | 26/10/2018 | TIME II |
| • Third field activities | 23/12/2018 | TIME III |
| • Fourth field activities | 16/03/2019 | TIME IV |
| • Fifth field activities | 21/09/2019 | TIME V |
| • Sixth field activities | 21/12/2019 | TIME VI |



Figure 30, 31 and 32: Field activities in Ulcinj - Montenegro



Figure 33, 34 and 35: Field activities in Ulcinj - Montenegro

2.2.4. Raising awareness campaigns

Together with activities of sampling, categorization and monitoring of marine litter on selected beaches, a raising awareness campaigns of the importance of marine litter clean up actions and the impact of marine litter on the environment were conducted through participation of volunteers in beach cleaning activities, publication and announcement, brochures, workshops, lessons at schools etc. In addition to the project staff, volunteers and general public were also involved and had a chance to participate in beach cleaning activities since all beach clean-ups activities are announced on web portals and local media as well as research results.

➤ Marine Litter Coastal Clean up Event

On the occasion of the International Coastal Clean up Day, Public enterprise for coastal zone management of Montenegro in cooperation with Institute of Marine Biology, within the Interreg IPA CBC Italy-Albania-Montenegro project “WELCOME”, organized “Marine Litter Coastal Clean up Event”. This event was held on Saturday - September 21st, 2019 at the location – “Giovanni beach” on the Velika plaža in Ulcinj – Montenegro. More than 100 children’s and volunteers from JU OŠ "MARŠAL TITO" – ULCINJ, NGO “Književna omladina Tivta”, NGO “Dramski studio Budva”, Izviđački Odred “24. novembar” iz Bara, NGO “GreenNet – ZelenaMreža” from Budva, Giovanni’s Beach Montenegro and volunteers registered at Zero Waste Montenegro participated in this action.

Before the clean-up, the participants were instructed on selective marine litter collection by categories, and divided in 3 teams (blue, green, yellow) to compete in collection of litter. After the clean-up, the workshop on creative marine litter recycling was organized, followed by the performance "The sea and plastic". At the end, the results were announced, and the prizes were given for first, second and third place in the marine litter collection competition. During this action, participants had the opportunity to socialize, compete, entertain and educate about marine litter, which has become increasingly prevalent in recent years, as well as cleaning, selective collection and recycling of marine litter collected from the beaches.

During this action, a total of 279.5 kg of waste was collected, of which - 96 kg of wood, 78 kg of plastic, 39 kg of glass, 26.5 kg of metal and 40 kg of other waste.



Figure 36, 37, 38, 39, 40, 41, 42 and 43: Marine Litter Coastal Clean up Event – Montenegro

2.3. Marine litter amount and classification in Montenegro

On the field, all the items (> 2.5 cm) inside the selected transects were collected and classified in eight main litter groups (artificial polymer materials, rubber, cloth/textile, paper/cardboard, processed/worked wood, metal, glass/ceramics, unidentified and/or chemicals). In the laboratory of the Institute of Marine Biology marine litter was classified in detail according to their respective codes and finally items were counted and weighted based on the material group. Natural wood was also collected and selected as small pieces (diameter less than 10 cm) and large pieces (diameter more than 10 cm).

Overall, 11152 items were collected and a total amount of 257.03 kg of litter removed from beaches along the Montenegrin coasts of the municipality of Herceg Novi, Budva and Ulcinj. In detail, 112.46 kg of marine litter were collected at Herceg Novi beach, 42.84 kg at Budva beach and 101.73 kg at Ulcinj beach. The natural wood estimated on the three beaches during surveys was about 178.79 kg in total. In detail, about 89 kg at Herceg Novi beach, 28 kg at Budva beach and 60 kg at Ulcinj beach.

Analyses of beach transects in **Herceg Novi** transects during all six surveys resulted the most abundant material the ‘artificial polymers’ both in terms of weight (51.26%) and number of items (81.66%). Contribution of ‘Rubber’ was 16.63% (weight) and 0.85% (items); ‘Processed/worked wood’ was 15.39% (weight) and 3.88% (items); ‘Glass/ceramics’ 7.81% (weight) and 3.45% (items); ‘Metal’ 3.68% (weight) and 4.32% (items); ‘Clothes’ 3.07% (weight) and 1.23% (items), ‘Other’ 0.30% (weight) and 0.19% (items).

Beach transects monitored in **Budva**, during all six surveys showed that the ‘artificial polymers’ resulted the most abundant material both in terms of weight (36.76%) and number of items (69.40%). Contribution of ‘Glass/ceramics’ 18.12% (weight) and 9.78% (items); ‘Processed/worked wood’ was 17.89% (weight) and 4.37% (items); ‘Rubber’ was 10.49% (weight) and 2.48% (items); ‘Clothes’ 8.19% (weight) and 2.64% (items); ‘Metal’ 7.87% (weight) and 6.55% (items);, ‘Other’ 0.00% (weight) and 0.00% (items).

The ‘artificial polymers’ in **Ulcinj** transects during all six surveys also resulted the most abundant material both in terms of weight (56.44%) and number of items (72.69%). Contribution of

‘Processed/worked wood’ was 21.19% (weight) and 2.92% (items); ‘Clothes’ 8.71% (weight) and 1.5% (items), ‘Metal’ 6.28% (weight) and 18.08% (items); ‘Glass/ceramics’ 3.43% (weight) and 1.12% (items); ‘Rubber’ was 3.29% (weight) and 1.85% (items); ‘Other’ 0.19% (weight) and 0.21% (items).

The top 20 items with their description and codes are reported in the **Figure 44**. Majority of top 20 items belongs to the group of the ‘artificial polymers’. The first 5 of “top 20” are: G-27 Cigarette butts and filters with 1416 items, “G-79 Plastic pieces 2.5 cm > < 50cm” with 1199 items, “G-67 Sheets, industrial packaging, plastic sheeting” with 735 items, “G-30 Crisps packets/sweets wrappers “ with 606 items and “G-178 Bottle caps, lids & pull tabs” with 518 items in total.

The top 20 most abundant categories in terms of weight, with their description and code, are reported in the **Figure 45**. The heaviest categories recorded were: “G-172 Other wood > 50 cm” with 15.8 kg, “G-160 Pallets” with 12.7 kg, “G-29 Combs/hair brushes/sunglasses” with 8.1 kg, “G-67 Sheets, industrial packaging, plastic sheeting” with 7.1 kg and “G-138 Shoes and sandals (e.g. leather, cloth)” with 7 kg in total.

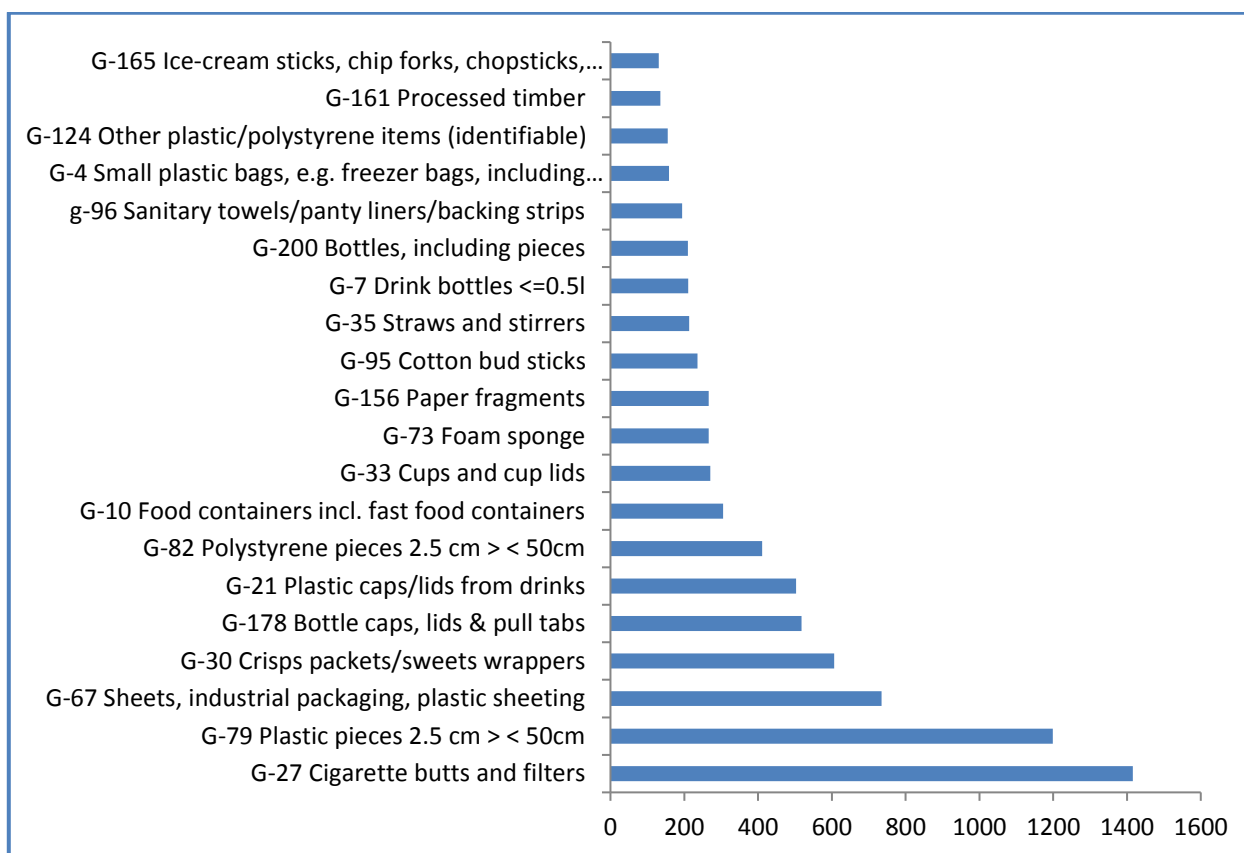


Figure 44: Top 20 items collected during all the six surveys in Montenegro

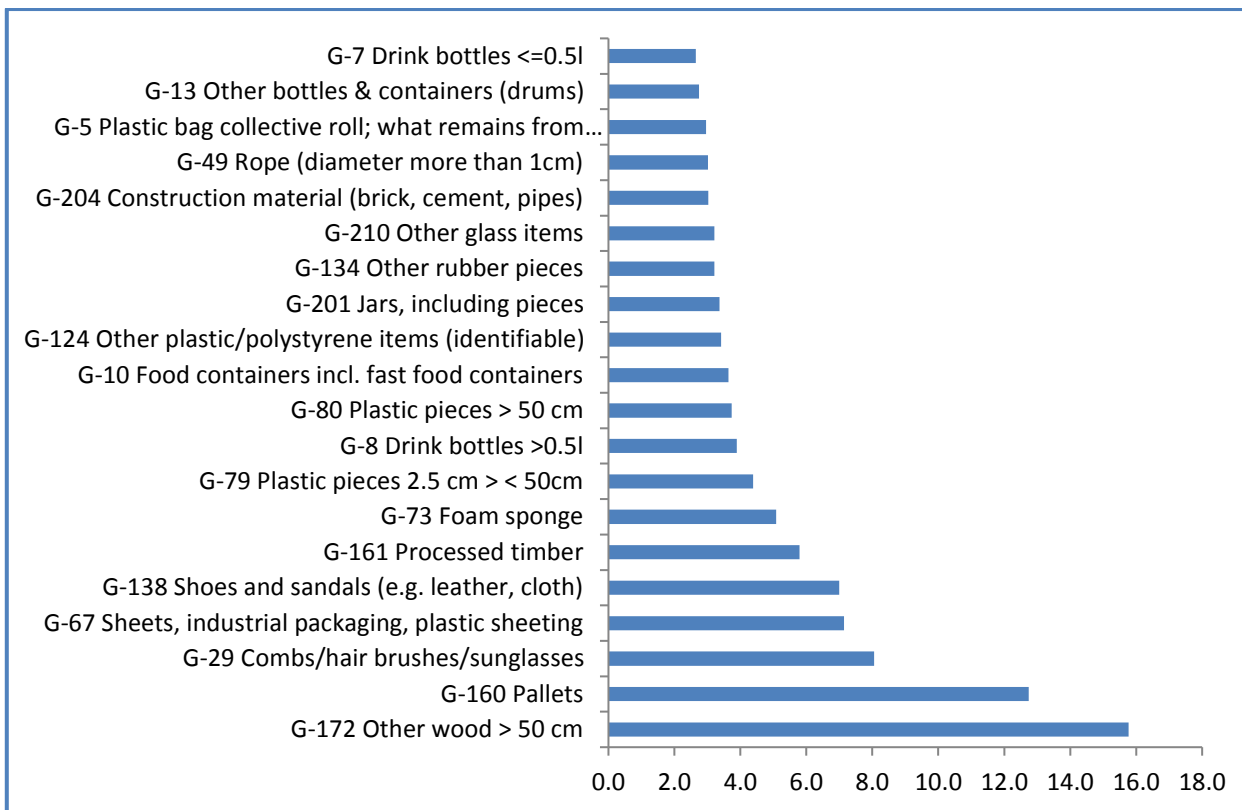


Figure 45: Top 20 categories (in terms of weight) collected during all the six surveys in Montenegro

Analyses of beach transects in Montenegro during all six surveys resulted the most abundant material the ‘artificial polymers’ both in terms of weight (50,89%) and number of items (77,17%). Contribution of ‘Processed/worked wood’ was 18,1% (weight) and 3,78% (items); ‘Rubber’ was 10,32% (weight) and 1,4% (items); ‘Glass/ceramics’ 7,8% (weight) and 4,31% (items); ‘Clothes’ 6,15% (weight) and 1,59% (items); ‘Metal’ 5,4% (weight) and 7,66% (items); ‘Paper/cardboard’ 1,1% (weight) and 3,91% (items); ‘Other’ 0,2% (weight) and 0,15% (items).

3. FIELD ACTIVITIES CONDUCTED IN ALBANIA

3.1. Sampling methods, the guidelines followed and the selected beaches

Albania is a typical coastal country. The entire costal line, with a length of 476 km, borders two seas – the Adriatic and Ionian Sea – which are part of the Mediterranean Sea. Despite the efforts in the last years, the urban waste management in Albania constitutes a big challenge for the country. Characterized by a dense hydrographic network, with rivers passing through important residential areas, and with urban landfills located near the rivers, a considerable amount of urban waste reaches the Adriatic and Ionian Seas. The main rivers of Albania from the North to the South are: Buna River, Mati River, Ishmi River, Erzeni River, Shkumbini River, Semani River and Vjosa River. In the last years, Coastal Erosion phenomenon is accentuated, in some cases reaching in certain areas a rate of a dozen meters per year. This is evident especially in sandy beaches of the Adriatic Sea.

The main aim of the WELCOME project is to develop a soft method based on an art-driven reuse of wood ML to make anti-erosion coastal systems in a sustainable, circular economy based approach, converging with the Albanian needs.

The methodology used in the study is largely based on the **DeFishGear Methodology for Monitoring Marine Litter on Beaches (macro-debris > 2.5 cm)**. This methodology include reference to the EU MSFD TG10 “Guidance on Monitoring of Marine Litter in European Seas (2013)”, the OSPAR “Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (2010)” and the NOAA “Marine Debris Monitoring and Assessment: Recommendations for Monitoring Debris Trends in the Marine Environment (2013)”.

In order to finally define the sites for the beach cleanup and the ML classification, several field surveys were conducted, covering the entire Adriatic coastline from Vlora in the South to the Buna River mouth (border with Montenegro) during April – May 2018. The objective of these surveys was the suitability of the priorly selected sites with the criteria described in the selected methodology. Some of which did not comply with one or several criteria and consequently, non

significant displacements from previously selected areas have been performed. The coastal erosion phenomenon was also taken into consideration.

Finally the selected sites are: Spille, Adriatik and Velipoja. Their locations are given in the table below.

Table 3: Geographic location of the selected study sites in Albania

Site	Code	START North		END South	
		Easting	Northing	Easting	Northing
Velipoje	V1	365696	4634314	365799	4634372
Velipoje	V2	366188	4634537	366286	4634566
Adriatik	A1	381459	4606314	381434	4606269
Adriatik	A2	381405	4606189	381379	4606143
Spille	S1	370398	4548400	370386	4548297
Spille	S2	370368	4548147	370355	4548046

3.1.1. Spille transects

At the beginning the study site in the central part of the Albanian coastline was foreseen in the Durrës and Lalezi Bays. Due to the high human activities and the presence of protective works the study site was shifted to the South in the Spille area, which complies with all the criteria of the accepted methodology.

The selected site of Spille is located in the central part of the Adriatic coastline, about 4 km north of the Shkumbin River mouth. The location of the beach is given in Figure 1. The Shkumbini River passes through important residential centers such as Elbasan, Peqin, Rogozhina and other small villages transporting to the sea important quantity of urban waste. In this river, a waste collection system is built, but at the moment it is damaged. The dominant wind direction is from the southwest and consequently the ML is transported towards the northeast.

Two transects having a length of 100 m each, separated by 152 m were selected. The transects areas are as follows 1682 m² for S1, and 2182 m² for S2 (Figure 46). This part of the Albanian coast is also suitable for dune restoration activities.

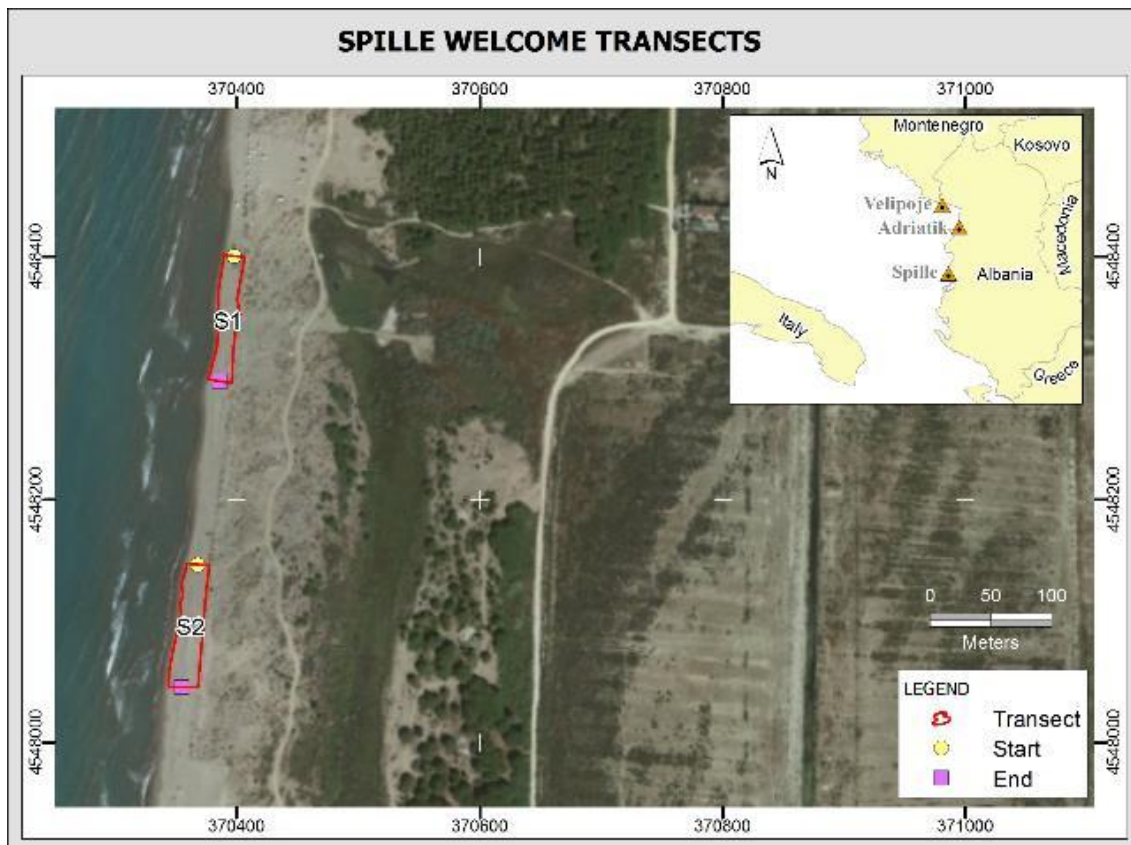


Figure 46: Geographic location of SPILLE transects

3.1.2. Adriatik transects

The foreseen study area in Rodon Bay is shifted northwards in the Nord of Ishmi River mouth. This shift is motivated by the fact that this River is the main contributor of ML in the Adriatic Sea because it passes through important urban centers such as Tirana, Kamza, Fushe Kruje and other small inhabited areas. Since the dominant wind and wave direction is from the southwest the ML is transported towards the northeast.

The location of the beach is given in the Figure 47.

This site is located within the Protected Area, classified as Managed Nature Reserve, Category IV according to IUCN (International Union for Conservation of Nature) classification.

Due to the huge amount of ML (Figure 48) and according to the DeFishGear Methodology, two 50-metre stretches were selected. The distance between the transects is 85 m. The respective areas are 688 m² and 787 m².



Figure 47: Geographic location of the Adriatik Transects



Figure 48: Heavily littered beach of Adriatik

3.1.3. Velipoja transects

This site is located in the south of the Buna River mouth, which is the border between Albania and Montenegro. Even this site is located inside a Protected Landscape, Category V, Wetland of International Importance (Ramsar site N0: 781) according to IUCN (International Union for Conservation of Nature) classification.

Two transits of 100 m each were selected. The distance between them is 424 m. The location of the beach is given in Figure 49. The respective areas are 8474 m² and 6221 m².

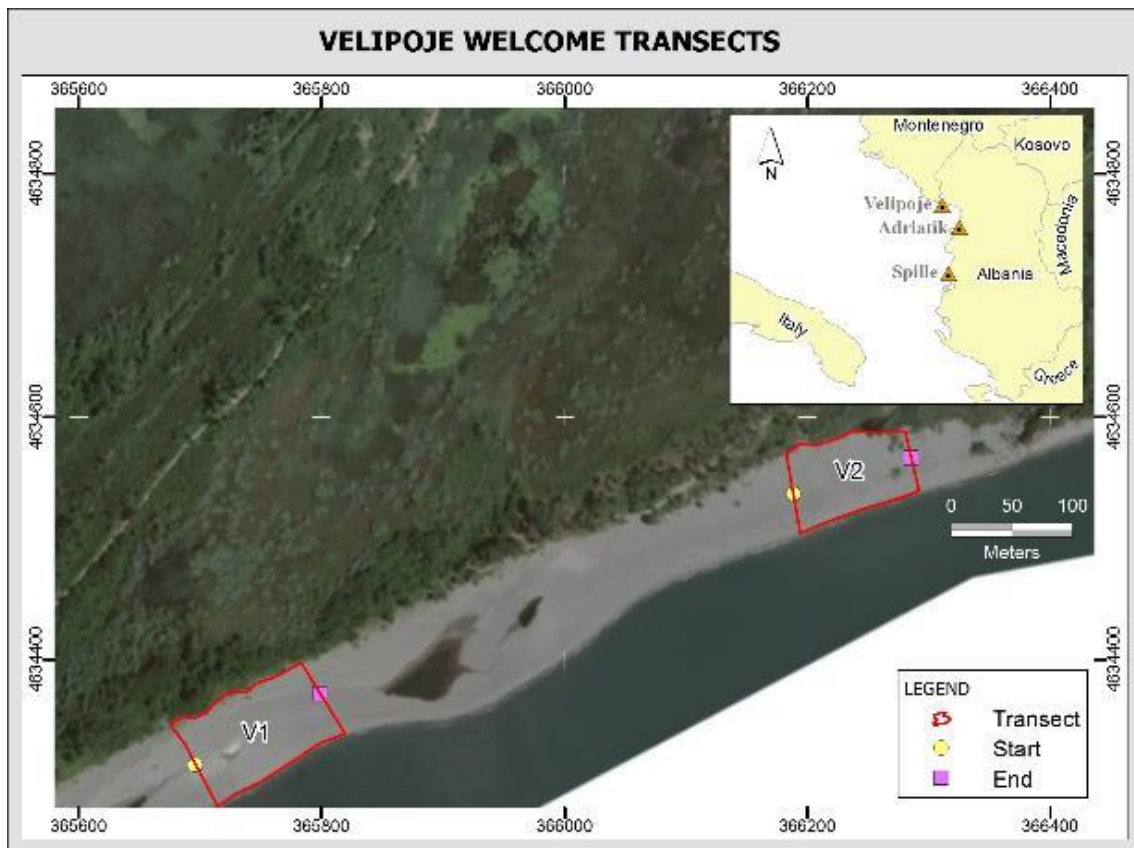


Figure 49: Geographic location of Velipoja Transects



Figure 50: View of the Protected Landscape of Velipoja

3.2. Field activities

First survey on the selected beaches has been carried out during may 2018 while the last beach cleaning operation were carried out during December 2019.

Six beach clean-up operation and ML classification were carried out. The beach clean-ups operations in the selected study sites in Albania were carried out by the staff of the Faculty of Geology and Mining (FGJM) with the kind contribution of it's students.

The surveys were carried out as scheduled in the approved project. Due to the geographic locations, distance from Tirana, site conditions (distances to do by walk, site access), quantity of ML, distances from the selected sites to the garbage bins in the study areas, especially in the sites of Adriatik and Velipoja, the operations took more than 1 week each. As examples in Velipoja and Adriatik sites more than one hour of walk is needed to reach the selected transects.

It should be noted that in the Adriatik study site the third survey did not occur due to the inaccessibility of the site. In the period corresponding to the third survey it was not possible to access the Adriatik transects due to the weather conditions. The selected study site is separated from the land by a wetland having a width of about 1.6 km as shown in the Google Earth image below. During January-March period of the year 2019, this wetland was completely covered by water reaching depths of about 1 m. Three site inspections were conducted in order to assess the accessibility to the study site, and the inaccessibility was verified.



Figure 51: View of the wetland in Adriatik study site

In all six surveys the ML was counted, weighted and classified in the field. Only ML of small dimensions were taken away and the counting and classification were carried out in the laboratory of the Faculty of Geology and Mining.

The field surveys were carried out in the following periods:

I survey	June 2018	TIME I
II survey	mid-September – mid-October 2018	TIME II
III survey	mid-January – mid-February 2019	TIME III
IV survey	mid-June – mid-July 2019	TIME IV
V survey	mid-September – mid-October 2019	TIME V
VI survey	December 2019	TIME VI

The followed pictures show part of the undertaken activities in the frame of the activity beach cleanups and garbage management in Albania.

First beach cleaning operation



Figure 52: View of the Spille Transect 1 before (left) and after beach cleaning operation (right)



Figure 53: Beach cleaning operations in Adriatik site



Figure 54: View of beach cleaning operation (left) and Cleaned beach (right)

Second beach cleaning operation



Figure 55: Beach cleaning operations

Third beach cleaning operation



Figure 56: Photos from the third data collection in Spille



Figure 57: Photos from the third data collection in Velipoja

Fourth beach cleaning operation



Figure 58: Beach cleaning operations -Spille



Figure 59: Beach cleaning operations - Velipoje



Figure 60: Beach cleaning operations - Adriatic

Fifth beach cleaning operation



Figure 61: Beach cleaning operations - Spille



Figure 62: Beach cleaning operations - Adriatic



Figure 63: Beach cleaning operations - Velipoje

Sixth beach cleaning operation



Figure 64: Beach cleaning operations - Spille

3.3. Marine litter amount and classification in Albania

Overall, about 52 000-items were collected and a total amount of 1629,84 kg of litter removed from beaches along the Albanian coasts, respectively 11577 items for a weight 228.34 kg in Spille, 23265 items for a weight 766.72 kg in Adriatik and 17173 items for a weight 634.88 kg in Velipoje.

The natural wood estimated on the three beaches during surveys was about 2560 kg in total, respectively 79 kg, 675.3 kg and 1808.66 kg in Spille, Adriatik and Velipoje. It should be highlighted that the quantity in terms of weight in Velipoje is probably underestimated due to the impossibility of weighting the entire trees found in this area. It should be also noted that the woody material in the beaches is removed for domestic use by local people.

In terms of weight, the ‘artificial polymers’ resulted the most abundant material representing 69.5% of the total, followed by “glass/ceramics” (10.09 %), “processed/ worked wood “ (8.36%), “cloth/textile” (6.34%), “metal” (3.00%), “rubber” (1.64%), “paper/cardboard” (1.05%) and finally the “unidentified items” (0.05%).

In terms of number of ITEMS, the ‘artificial polymers’ resulted the most abundant material representing 90.77% of the total, followed by “metal” (3.11%) “glass/ceramics” (2.12 %), “cloth/textile” (1.35 %) “paper/cardboard” (1.17 %), “processed/ worked wood “ (0.94 %), “rubber” (0.35 %), and finally the “unidentified items” (0.20 %).

The top 20 items with their description and code are reported in the Figure 65, and belong all to the category of the ‘artificial polymers’ excluding “G175 - Cans (beverage)” belonging to “Metal” group. The first 5 are: G21 - Plastic caps/lids from drinks with 6841 pieces; G30 - Crisps packets/sweets wrappers, 4948 pieces; ‘G 82 - Polystyrene pieces 2.5 cm > = 50cm, 4839 pieces; G8 - Drink bottles >0.5l, 4016 pieces and G79 - Plastic pieces 2.5 cm > = 50cm, 3884 pieces.

The top 20 most abundant categories in terms of weight, are reported in the Figure 66. The heaviest categories recorded were: G8 - Drink bottles >0.5l 242.6 kg; G200 - Bottles, including pieces 96.06 kg, G7 - Drink bottles <=0.5l 93.11 kg; G79 - Plastic pieces 2.5 cm > = 50cm 78.03 kg and G161 - Processed timber 63.9 kg.

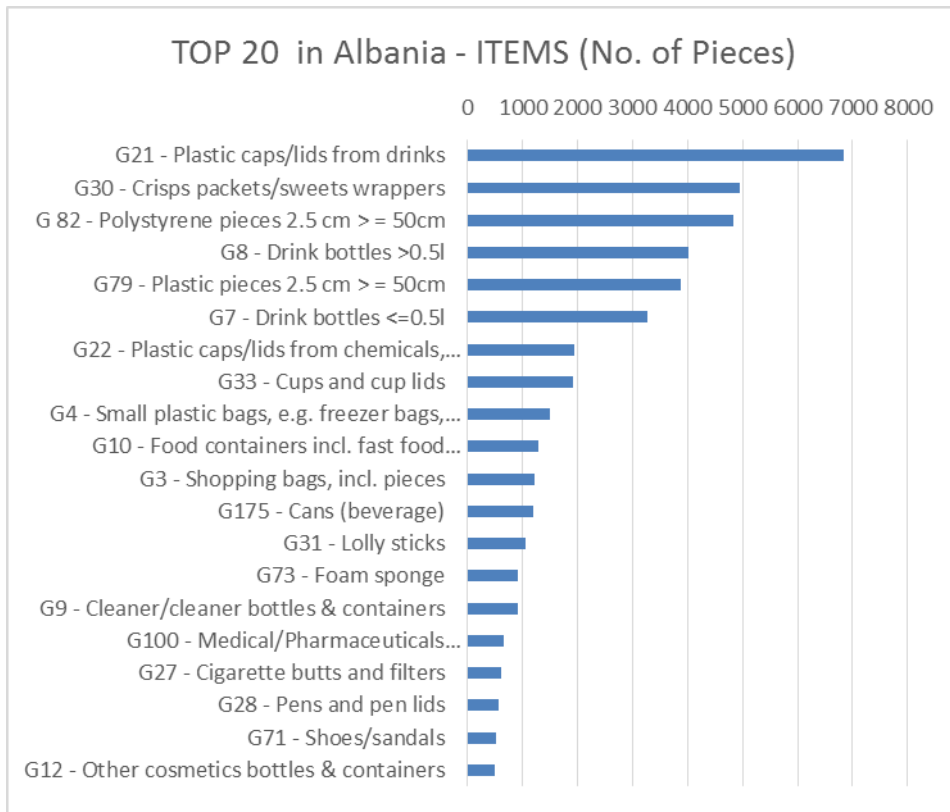


Figure 65: Top 20 ITEMS collected during all the six surveys in the Albanian study sites



Figure 66: Top 20 categories (in terms of weight) collected during all the six surveys in the Albanian study sites

4. MARINE LITTER AMOUNT AND CLASSIFICATION IN ITALY, ALBANIA AND MONTENEGRO

Beach clean-ups and garbage management activities were devoted to the removal of marine litter from the selected beaches of the Italian, Albanian and Montenegrin areas. After the beach cleaning operations, the collected material was then sent to an authorized and licensed disposal centre where the woody material was separated in order to be reused for consolidation and restauration of sand dunes (anti-erosion barriers) by artists and architects.

Marine litter collection and selection activities were carried out according to pre-defined transects in accordance with the adopted methodology – “Metodology for monitoring marine litter on beaches” which is developed within the IPA ADRIATIC “DeFishGear” project. The following methodology has been prepared based on the EU MSFD TG10 “Guidance on Monitoring of Marine Litter in European Seas (2013)”, the OSPAR “Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area (2010)” and the NOAA “Marine Debris Monitoring and Assessment: Recommendations for Monitoring Debris Trends in the Marine Environment (2013), taking into consideration the draft “UNEP/MAP MEDPOL Monitoring Guidance Document on Ecological Objective 10: Marine Litter (2014)”. The use of the same methodology by all project partners has enabled more efficient implementation of marine litter removal and research activities, easier comparison of the obtained data and obtaining more complete information on marine litter along the Italian, Albanian and Montenegrin coasts.

Beach clean-ups and marine litter research activities were performed each four months during the project implementation – three times per year during a period of 2 years on 3 selected beaches along the three cross-border coasts. The first field activities on beach clean-ups and garbage management which included collection, assessment of the quantity, type and distribution of marine litter on the selected beaches along the coast, within the Interreg IPA CBC project "WELCOME", were carried out during the May 2018 and the last beach clean-ups activities were done during December 2019. The marine litter was collected in a total of six transects on three selected beaches in Italian, Albanian and Montenegrin coasts and classified into eight main classification groups: artificial polymer materials, rubber, cloth/textile, paper/cardboard, processed/worked wood, metal,

glass/ceramics, unidentified and/or chemicals. Natural wood is also collected separately and reused for consolidation and restoration of sand dunes.

- Overall, 14712 items were collected and a total amount of 529.81 kg of litter removed from beaches along the **Italian coasts** of the municipality of Lecce in the beaches of Torre Chianca, Frigole and San Cataldo. In detail, 122.51 kg of marine litter were collected at Torre Chianca, 262.46 kg at Frigole and 144.84 kg at San Cataldo. The natural wood estimated on the three beaches during surveys was about 5200 kg in total. In detail, about 1000 at Torre Chianca, about 2000 at Frigole kg and more than 2000 kg at San Cataldo.

In Italy the ‘artificial polymers’ resulted the most abundant material both in terms of weight (83.06% in total on six surveys) and number of items (95.84%). Contribution of ‘Rubber’ was 4.07% (weight) and 0.91% (items); ‘glass’ was 3.54% (weight) and 1.58% (items); ‘metals’ 1.18% (weight) and 0.89% (items); ‘worked wood’ 7.16% (weight) and 0.38% (items); ‘clothes’ 0.79% (weight) and 0.11% (items), ‘other’ 0.12% (weight) and 0.07% (items).

- Overall, 11152 items were collected and a total amount of 257.03 kg of litter removed from beaches along the **Montenegrin coasts** of the municipality of Herceg Novi, Budva and Ulcinj. In detail, 112.46 kg of marine litter were collected at Herceg Novi beach, 42.84 kg at Budva beach and 101.73 kg at Ulcinj beach. The natural wood estimated on the three beaches during surveys was about 178.79 kg in total. In detail, about 89 kg at Herceg Novi beach, 28 kg at Budva beach and 60 kg at Ulcinj beach.

Analyses of beach transects in Montenegro during all six surveys resulted the most abundant material the ‘artificial polymers’ both in terms of weight (50,89%) and number of items (77,17%). Contribution of ‘Processed/worked wood’ was 18,1% (weight) and 3,78% (items); ‘Rubber’ was 10,32% (weight) and 1,4% (items); ‘Glass/ceramics’ 7,8% (weight) and 4,31% (items); ‘Clothes’ 6,15% (weight) and 1,59% (items); ‘Metal’ 5,4% (weight) and 7,66% (items); ‘Paper/cardboard’ 1,1% (weight) and 3,91% (items); ‘Other’ 0,2% (weight) and 0,15% (items).

- Overall, about 52000-items were collected and a total amount of 1629,84 kg of litter removed from beaches along the **Albanian coasts**, respectively 11577 items for a weight 228.34 kg in Spille, 23265 items for a weight 766.72 kg in Adriatik and 17173 items for a weight 634.88 kg in Velipoje. The natural wood estimated on the three beaches during surveys was about 2560 kg in total, respectively 79 kg, 675.3 kg and 1808.66 kg in Spille, Adriatik and Velipoje. It should be highlighted that the quantity in terms of weight in Velipoje is probably underestimated due to the impossibility of weighting the entire trees found in this area. It should be also noted that the woody material in the beaches is removed for domestic use by local people.

In terms of weight, the ‘artificial polymers’ resulted the most abundant material representing 69.5% of the total, followed by “glass/ceramics” (10.09 %), “processed/ worked wood“ (8.36%), “cloth/textile” (6.34%), “metal” (3.00%), “rubber” (1.64%), “paper/cardboard” (1.05%) and finally the “unidentified items” (0.05%).

In terms of number of ITEMS, the ‘artificial polymers’ resulted the most abundant material representing 90.77% of the total, followed by “metal” (3.11%) “glass/ceramics” (2.12 %), “cloth/textile” (1.35 %) “paper/cardboard” (1.17 %), “processed/ worked wood “ (0.94 %), “rubber” (0.35 %), and finally the “unidentified items” (0.20 %).

The main results of the research of marine litter collected on the selected beaches show that the quantities and types of marine litter are different in each country. Overall, 77 864 items were collected and a total amount of 2 416,68 kg of litter removed from the selected beaches along the Italian, Albanian and Montenegrin coasts. In detail, 14712 items and a total amount of 529.81 kg were collected in Italy, 11152 items and a total amount of 257.03 in Montenegro and about 52000 items and a total amount of 1629,84 kg in Albania (*Figure 67, Figure 68*).

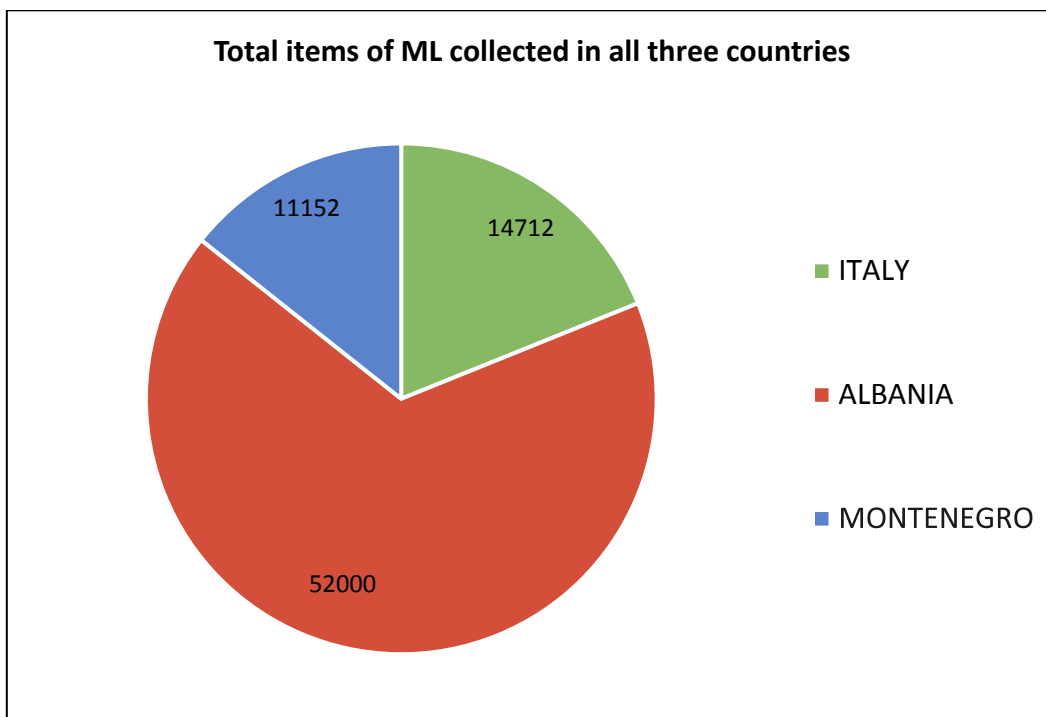


Figure 67: Total items of ML collected in Italy, Albania and Montenegro

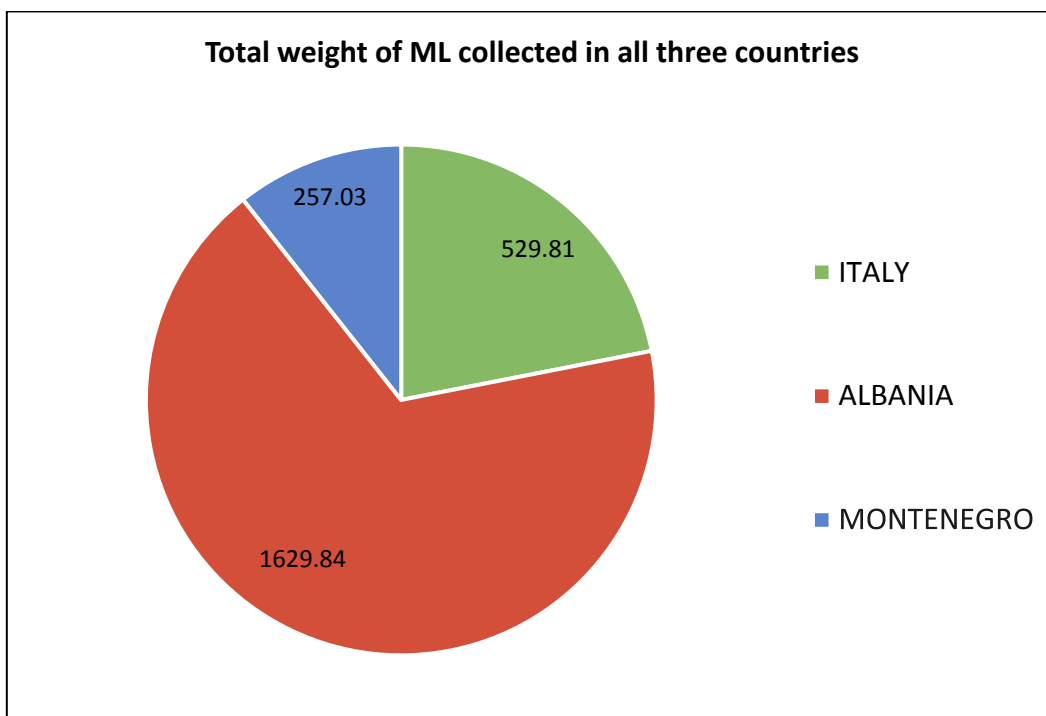


Figure 68: Total weight of ML collected in Italy, Albania and Montenegro

The main results of the research of marine litter collected on the selected beaches show that the quantities and types of marine litter are different in each country. The largest amounts of marine litter were collected on beaches in Albania, both in terms of weight and number of items while on the beaches in Italy and Montenegro the significantly less amounts of marine litter were collected. The results of the research of marine litter in the period of 2 years shows that various types of marine litter were collected in Italy, Albania and Montenegro but the most dominant marine litter in each country are Artificial Polymer Materials.

Implementation of the beach clean-ups and garbage management as well as marine litter research activities and the results of the survey has enabled the monitoring of marine litter in the period of 2 years as well as the comparison of data and identification of the type and origin of marine litter that comes to the beaches from the sea and the mouth of the river.



JAVNO PREDUZEĆE ZA UPRAVLJANJE MORSKIM DOBROM CRNE GORE

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