BEMED+ PROJECT

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Diagnostic report on plastic pollution in the Shkumbini River, Albania

Environmental and Territorial Management Institute

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Abbreviations

IUCN - International Union for Conservation of Nature
PP - Polypropylene
PET - Polyethylene terephthalate
PS - Polystyrene
PVC - Polyvinyl Chloride
HDPE - High-density polyethylene
LDPE – Low Density polyethylene
INSTAT - The Institute of Statistics
MSFD - Marine Strategy Framework Directive
GES – Good Environmental Status

1. Introduction

The waste management is a fundamental problem in Albania in particular plastic pollution in rivers. There are very few studies conducted in the country about the quantification of the debris (in particular to plastic items). According the IUCN study, Albania discharge annually in the Adriatic Sea around 8000 ton of plastic. [1] The main causes of the plastic come for mismanagement of waste and low awareness of the citizens. Moreover, another challenge for the country is the implementation of the policies and financing options to improve the waste management. Saying that, the rivers in Albania are quite exposed to plastic pollution and very few knowledge are in place to monitor and improve it. There is no any national unified methodology that might be used from the stakeholders in the country to assess the level of plastic pollution in rivers. Through this study, the project team, explored the most recent used methodologies in plastic waste quantification and applied it on the Shkumbini river. It is important to notice that there are many factors that influence the plastic leakage such as weather conditions, hydrology, topography that often make difficult the estimation of the plastic flux. [2] The baseline report developed from the team will be useful input for the national policy-makers and municipalities to design appropriate strategies and measures to reduce the plastic waste.

The Shkumbin river is one of the most important rivers located in central-southeast part of Albania, crossing it from the east, the Valamare mountain where it originates and passing by 7 municipalities before reaching on the Adriatic Sea. The total length of the river is 181.4 km and the surface of the catchment basin is 2445 km2 and the height of the basin is 753.2 m. [3] There are 5 municipalities that are considered from the study located across the river such as Prrenjas, Librazhd (in the upstream part of the river), Elbasan (midstream) and Peqin and Rrogozhina in the downstream part of the river. The Shkumbini river originates from Pogradec municipality and reach the final destination in Divjaka Municipality. The study did not consider the Pogradec municipality and Divjaka municipality because the time frame of the project. Nevertheless the 5 municipalities included are well representing the situation of the plastic pollution in the basin. The total population that lives along the Shkumbin River is estimated to be 257,280 inhabitants where 148 181 inhabitants are living in rural areas and 109,099 inhabitants are living in the urban areas. According to the other reference studies conducted to assess the water quality in the river basin has resulted that the water quality levels are not within the norms. [4]

Furthermore, Shkumbin river is highly impacted by plastic pollution, originating from various sectors, including hospitality (hotels, restaurants, cafes), waste management and less about sport activities. [5] In order to contribute with more additional insights about the current situation the project team with support of the local experts and partners has contributed in the development of the baseline report. The overall **aim of the assignment** is to develop detailed analyses of plastic pollution in and along the Shkumbin river, focusing on estimating the plastic leakage hotspots, plastic items and polymer types. This report represents the baseline report which aims to identify and analyze the amount of waste and the type of polymers. The methodology used to carry out the baseline data was based on the river litter monitoring along the riverbank and river body. The marine litter monitoring across the riverbanks, consisted in defining the locations (n=18) based on the potential leakage emissions, population density. Moreover, the project team, manage to estimate the plastic flux along the river by using the existing hydropower plants as a barrier to collect the waste.

The results of the baseline report will support the development of the plastic leakage hotspots by exploring more the main sectors, locations and sources which influence the accumulation of the plastic waste in line with the proposed methodology (presented chapter 2.2).

2. Methodology

2.1. Study area

Shkumbini river has a total length 181 km and the catchment area is estimated to be 2,444 m^2. [5] Its average flow is 61m^3/sec, with a floating modul from 25.211-27.310 s/km^2. [6] The river is located in the south part of the country. It has a rich biodiversity, becoming the house of threaten species as categorized by IUCN. [7] The Shkumbin River basin spans several municipalities in central Albania, including Rrogozhinë, Divjakë, Peqin, Elbasan, Prrenjas, Pogradec, and Librazhdi. [8] These municipalities are situated across the central and south-eastern parts of the country, with the Shkumbin River flowing through them, providing water resources that support both the local population and agriculture. The basin plays a vital role in the ecological and economic landscape of this region. Demographic movements and economic activities in the main cities (Elbasan, Librazhd) have affected the water quality of the river. The sewerage water and waste management are the main causes of the pollution. Shkumbin River is one of the most important rivers in Albania. Its waters are widely used for the irrigation of the field of Elbasani and other area. [9]

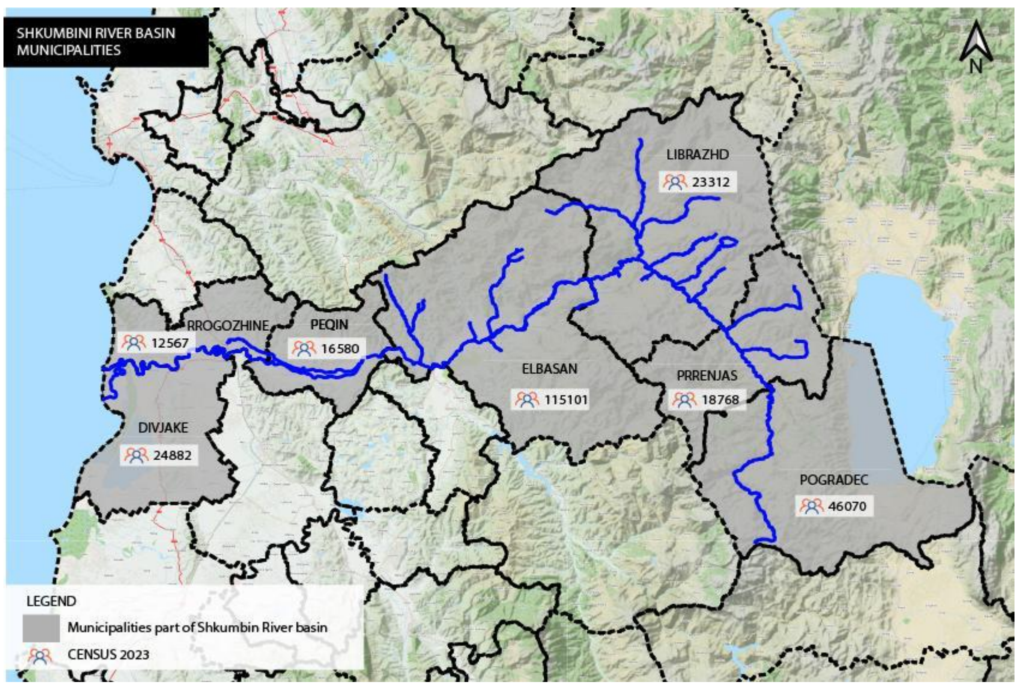


Figure 1: Municipalities along the Shkumbini River Basin (Source: INSTAT)

In the municipalities of Divjakë, Peqin, Elbasan, Prrenjas, Librazhdi, and Pogradec, rural populations dominate over urban ones. According to the 2023 Census the total number of populations living across the Shkumbini river is 257,280 inhabitants. The number of people living is estimated to be 148 181 in the rural areas and 109,099 in the urban area. According the table below, the municipality of Elbasan has the largest population with a total number estimated, 115,101 inhabitants. The municipality of Divjaka is ranked the second municipality with a total number of 24, 882 inhabitants followed by Librazhd (23,312 inh), Prrenjas (18, 768 inh) and Peqin municipality (16, 580 inh). The municipality of Pogradec is part of the river basin but it does not directly affect the quality. The population density, varies from the rural to urban areas and the population which is different.

Table 1 Number of populations in municipalities across Shkumbin River (INSTAT: 2023)

	Municipalities	Populations
1	Pogradec	46,070
2	Prrenjas	18,768
3	Librazhd	23,312
4	Elbasan	115,101
5	Peqin	16,580
6	Rrogozhina	12,567.
7	Divjaka	24,882
Total		**257,280**

While urban areas in these municipalities have seen some growth, the majority of the population in these regions resides in rural settings, reflecting the agricultural and less densely populated nature of the area.

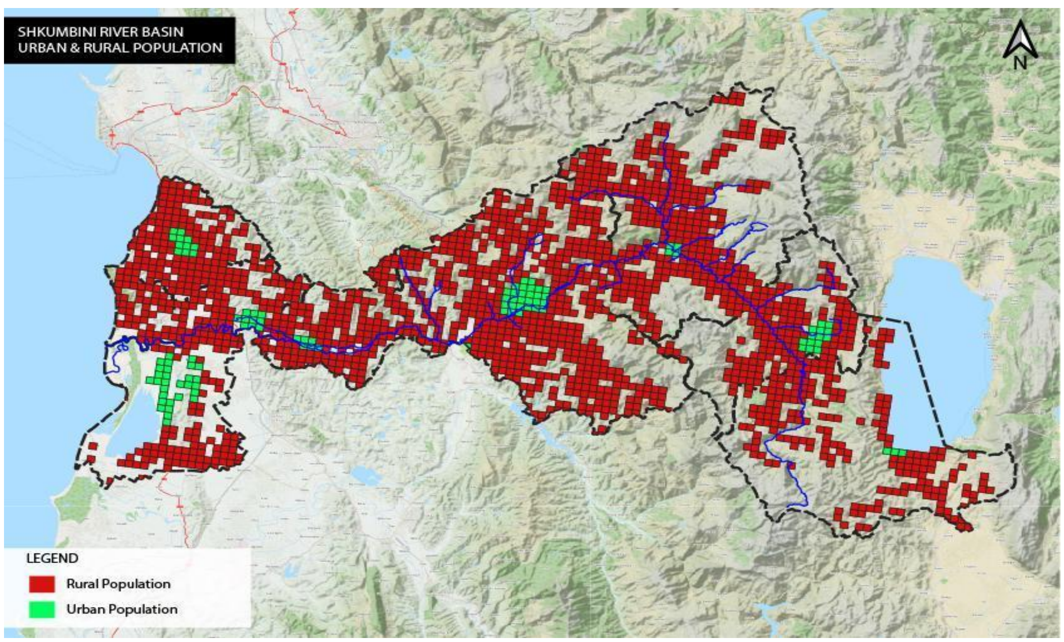


Figure 2 Urban and rural population distribution along the Shkumbini River Basin

In the map above, the distribution of the population in the Shkumbin River basin is shown using different colors. Red squares represent the rural population spread across the basin, while green squares indicate the urban population. This map is constructed based on the 2011 population data from INSTATGRID, which provides detailed information on population distribution at a local level. It visually highlights the predominance of rural communities in the basin, with urban centers shown in green and relatively smaller in comparison.

2.2. Data collection and analysis method

The project team has followed a very structured methodology for evaluating the hotspots, plastic leakage and the impact. Referring to the complexity of the assignment, the team is relied on the methodology 'National Guidance for Plastic Pollution Hot spotting and Shaping Action'' [10]. The proposed methodology contains three main components related to the location of the leaking (Where is leaking?), the factors that creates the leaking (Why is leaking) and the type of leaking (what is leaking). For the development of the baseline report, there will be explored only the information answering the question What is leaking? Such components will be further elaborated and explained on the methodology. According to the figure below (Fig.1) the approach consists in initially exploring the **What is leaking and its impact?** To answer this question the consultant has conducted the 1) Inventory of the plastic flux. The assessment (plastic flux) is based on the quantification of polymers along the river water body. According to the Riverine Litter Monitoring - Options and Recommendations, the main methods used are through regular observation (items/hour), by observing on the side of the river looking across half section and secondly is through riverbanks. In order to have validation of results, it is advised to have a combination of litter monitoring on riverbanks (items/m^2) and floating on the river water body to assess the plastic flux. Secondly, according to the methodology, there is required the 2) Characterization of the waste management. The main purpose of such assignment is to identify the types of polymers and other types of waste found in the riverbanks.

Table 2 The list of components in each hotspot category (Source: National Guidance Report)

Hotspot category	**Default list of components**
Polymers	PP, PET, PS, PVC, HDPE, LDPE, Polyester, Synthetic rubber, and Others
Applications	Bags, Bottles, Lids & caps, Crates & boxes, Cups, Cutlery, Straws, Food packaging, Film & packaging containing non-food products, Household/hygienic articles, Fishing nets.
Sectors	Packaging, Automotive & Transportation, Construction, Electrical & Electronics, Medical, Fishing, Agriculture, Textiles, Tourism, and Others

The waste characterization is conducted by waste collection and monitoring along the river banks. Following that, the consultant has conducted the 3) modelling of polymers/application hotspots and the sectors identification will be explored during the second part of the assignment. The information collected during the waster characterization will lead to identification of main polymer types (PP, PET, PS, PVC, HDPE, LDPE, polyester and synthetic rubber). The Application hotspots refer to the identification of a product or packaging or any other product made out of plastic. The common examples of such applications refer to straws, bottles, food packaging, grocery bags. Furthermore, the method applied explores the location/source of the leaking, recalling **''Where is leaking''?** Identification of the source of leaking is closely connected with the sectoral and regional hotspots. The outcome of the waste characterization leads to defining the main source of leaking referred to the type of waste collected. Defining the source of litter usually is quite complex and requires experience and knowledge. The consultants will identify the sectors and source of litter from the catalogue of waste referred to MSFD GES TG Marine Litter - Thematic

Report. Based on the litter found in the riverbanks and river water body will be realized the identification of the source and sectors. The main sectors that are the focus of the assignment are related to Tourism, Sport and Waste Management. The list of waste found during the assessment will be related with the type of waste that comes from such waste by using the experience and the reference studies. The main outcome of the analyses will lead in the 3 highest leakage contributors OR leakage intensity.

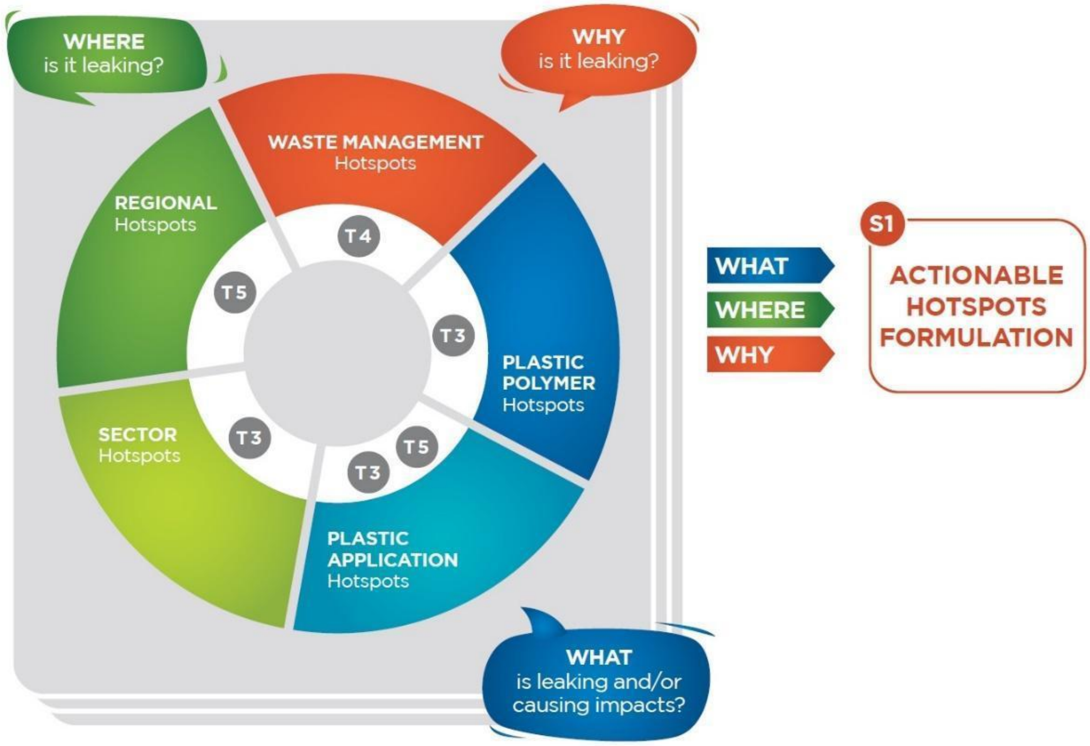


Figure 3 Hotspots categorization (Source: National Guidance Report

Moreover, there will be analyzed the regional hotspots category which aims to identify the highest leakage potential within the river basin This is the first activity that will occur before the plastic waste analyses. The consultant is relied on Geographic Information System (GIS) tools and other variables including population density, distance of population from the river, interviews with local experts to identify the potential location with the highest leakage potential. Based on such variables there is prepared a map which shows the plastic leakage hotspots. The consultant has further estimated the plastic flux in the identified locations and will end up with the regional hotspots' visualization during the second part of the assignment. The final component of the methodology is to evaluate the factors/reason for causing the plastic leakage, referred as **Why is leaking?** According to the assignment, the consultant will focus on the waste management hotspot representation. There will be analyses of every waste component (waste generation, waste segregation, waste collection, infrastructure, waste related behavior, waste-water treatment). The consultant will have an in-depth review of the waste management plans of every municipality to evaluate the issues that might create problems for the plastic leaking. Furthermore, there will be interviews with municipality staff and other waste specialist to give answer and provide inputs for every waste component.

3. Baseline assessment in plastic pollution (What is leaking?)

3.1. The sampling procedure

To gain a comprehensive understanding on the plastic waste pollution in the riverbanks it is essential to monitor and analyses the distribution patterns and plastic accumulation zones. Understanding the composition and distribution of plastic waste in rivers is fundamental for identifying priority areas for intervention and develop strategies for to reduce the plastic impact on the aquatic environment. [11] According to the ‘’Riverine Litter Monitoring - Options and Recommendations’’ guideline, there are two ways to monitor the plastic flux, along the **river body and riverbanks**. [12] The identification of the location to carry out the litter monitoring along the riverbank was based on the population density, potential litter discharge and sampling location opportunities. In the case of the river body, the monitoring consists usually by visual observations and use of existing structures such as nets. In the case of our work, the direct observation was not possible due to low water flow and in addition the use of nets was not very useful even-though it was used in several locations. Based on the literature, the riverbank monitoring consists in collection of litter items and categorization according the type.

The assessment of the plastic waste hotspots along the Shkumbin river was conducted mainly in the riverbanks. Additionally, the project team managed to estimate the plastic flux in certain areas through using the existing hydropower plants as a barrier to collect the waste and make the proper estimations. Moreover, the usage of nets in certain areas to collect the plastic and estimate the flux was used as well. The sampling period was realized from January to September 2025, where a comprehensive analysis was conducted on the riverbank’s debris mainly. The Riverbank survey sites (n=18) ranged to 100 m section and were situated parallel to the waterline. Data collection focused on collecting visible debris items found along the riverbanks. Moreover, during the plastic collected on the riverbank was further divided referring the applications (plastic items, textile, glass), type of polymer (PET, PE, PP, HDPE, LDPE, other). Regarding the composition or applications, the division was made into 4 categories/applications (Artificial polymer materials - bottles (of any type), Food related stuff, Fishing gear & fishing gear related stuff, Others with polymer type identification and 107 sub-categories in total. The project team conduced a total **18 locations** to collect the data. In the following table are shown the locations and the map.

3.2. Description of the locations

The riverbasin as it is shown in the photo is divided into three main catchments. The **upstream catchment** is considered the municipality of Prrenjas and Librazhd. The municipality of Prrenjas is composed of four administrative units as Prrenjas, Qukes, Rrajce and Stravaj. In municipality of Prrenjas are conducted 4 (four) litter monitoring. In total are conducted 4 (four) riverbank monitoring and 1 (one) litter monitoring in the water body through observations. The L1 (location 1) is located along the Lingajca stream located in Prrenjas village. The hydropower plant located along the stream was used as a ‘’net’’ to collect the waste and estimate the plastic flux annually. The monitoring on the L1 is excluded from the riverbank monitoring assessment. The L2 is located in Qukes-Shkumbin village. In the L2 are estimated the riverbank monitoring and litter monitoring through the net. The information collected through the net was not well representative so on the assessment is considered only the riverbank monitoring. The L3 (third location) is located in the Quken-Skenderbe village in the municipality of Prrenjas. The L4 (four location) is located to the called ‘’Bushtrica bridge’’ with position in the Qukes-Skender village as well.

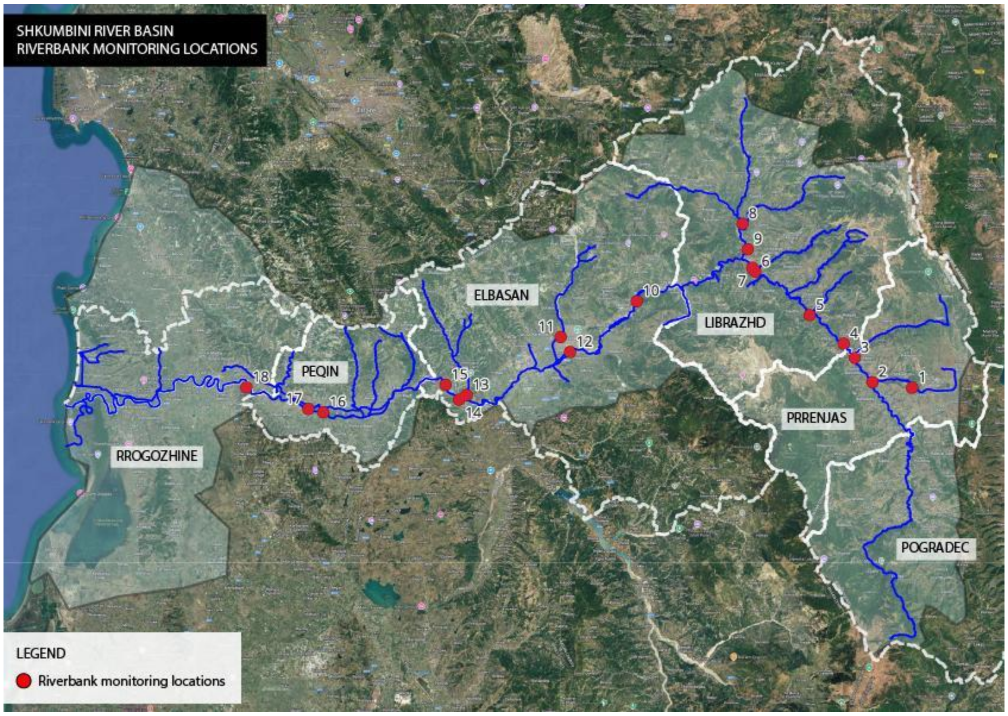


Figure 4 The riverbank monitoring stations

In the municipality of Librazhd are conducted 4 litter monitoring activities. The L5 consisted on river bank monitoring is conducted in the Hotolisht village, followed by L6 conducted in the entrance of the Librazhd city. The monitoring method realized in L6 was riverbank methods. The L7 was realized in the exit of the city, so called the city bridge. Following that, the L8 is located in the HEC Rapuni, in which was estimated the plastic flux estimation by using the hydropower as a collecting point. The L9 took place in Togez village belonging to city center. The monitoring methods in this location consisted on riverbank approach. As it is shown in the figure, the locations described above, belong to the secondary stream who flows into Shkumbini river. The experts, as per local conditions, based the assessment mainly in plastic flux combined with riverbank. The river stream flows through 20 villages before reaching out in Shkumbini river. **The midstream** is considered the territory on the Municipality of Elbasan. In Elbasan are conducted 6 litter monitoring.

Out of 6 there is realized as well as platic monitoring along the Zaranika river stream. The L10 was monitoring in the entrance of city so called ‘’Ura e Polisit belonging to Polis village. As mentioned before, the L11 is conducted along the Zaranika river stream located in the city. The approach followed was on plastic flux monitoring, by using a net and holding it for 3 hours to measure the amount of plastic that is collected. The L12 (riverbank monitoring) was conducted in the city center, so called the Shkumbini Bridge.

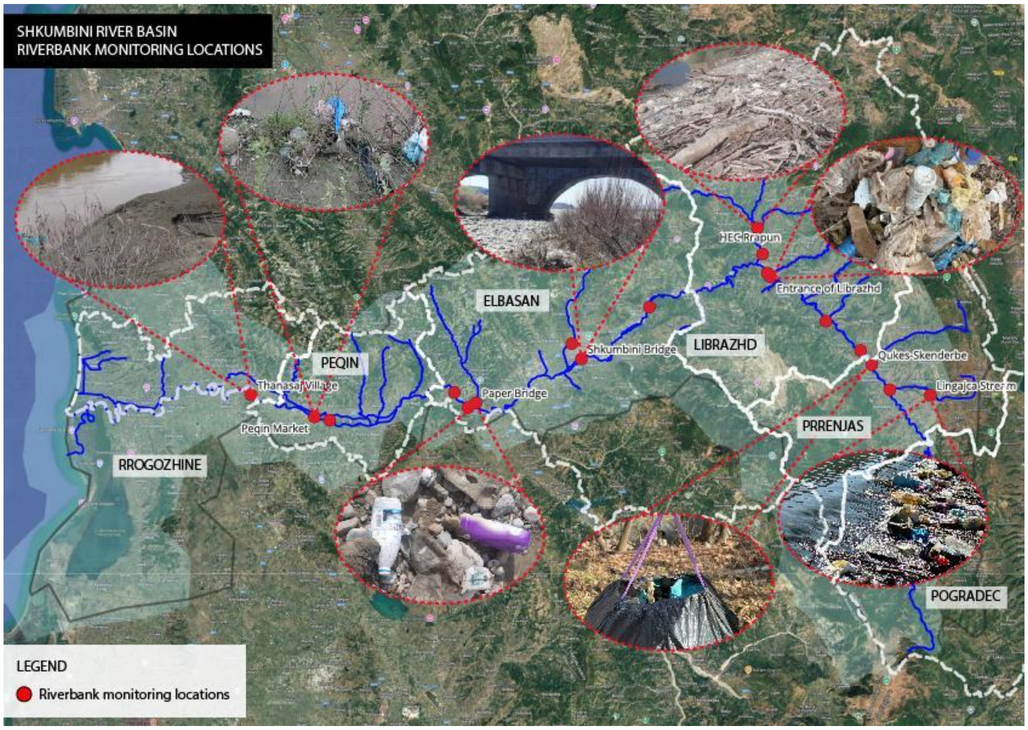


Figure 5 The river monitoring locations

Following that, the L13 was monitored in the exit of the city so called ''Ura e Paprit''. The monitoring approach used along the riverbanks by applying the same methodology. The L14 waste monitoring in the so called ''Ura e Zeze'' and L15 was monitored in the so called placed ''Broshka Bridge'' both located in the Paper administrative units. **The downstream part** is considered the Municipality of Peqin and Rrogozhina. Along the municipality of Peqin are realized riverbed monitorings in L16 as so called ''City bridge'' located in the entrance of the city and L17, to the city market. The last riverbed monitoring (L18) was realized in the municipality of Rrogozhina.

3.3. Results

3.3.1. Quantities of riverbank debris – plastic flux

A total of 1,859 riverbank debris items, weighting 63,67 kg were sampled and evaluated in the study (Fig 5, Fig 6). In the following figure is presented the weight of collected waste along the river basin. The total weight of the collected waste is estimated to be 130 kg. The weight of the plastic waste results to be 66 kg and the weight of other type of waste collected is 64 kg. According the figure, the highest weight of the waste is considered to be on the L2 and L6 for the upstream part. With the blue color are considered the plastic waste (including all type of waste) and with orange are considered other type of waste (textile, etc). The project team used the nets and hydropower plants (as reservoir) to collect the waste and make a rough estimation. From the estimations the amount of waste collected from the hydropower plant for the L1 (Lingajca stream in Prrenjas) is approximately 2,160 kg waste per year. There was 1,440 kg plastic waste annually discharged from this location. The estimation of plastic flux from other locations was hard to be accurate estimated. The second location where the plastic flux took place was on the L8 (HEC Rapuni, Librazhd) the amount of waste collected was 6 kg (collected on the weekly bases on the hydropower plant barrier). The approximately the annual plastic flux from this river stream is 337 kg. In order to have a total plastic flux for the whole river basin are required seasonal monitoring since the water flow (weather conditions) plays a significant role in the plastic generation. Despite that, the project team conducted a rough estimation regarding the total flux along the whole river basin. In the total riverbank length (1500m) the amount of plastic collected was 60 kg. Following that, we multiply the amount with the total length of the river (180km) the total plastic flux in Shkumbini river is estimated to be **7-ton plastic per year** discharged in Adriatic Sea.

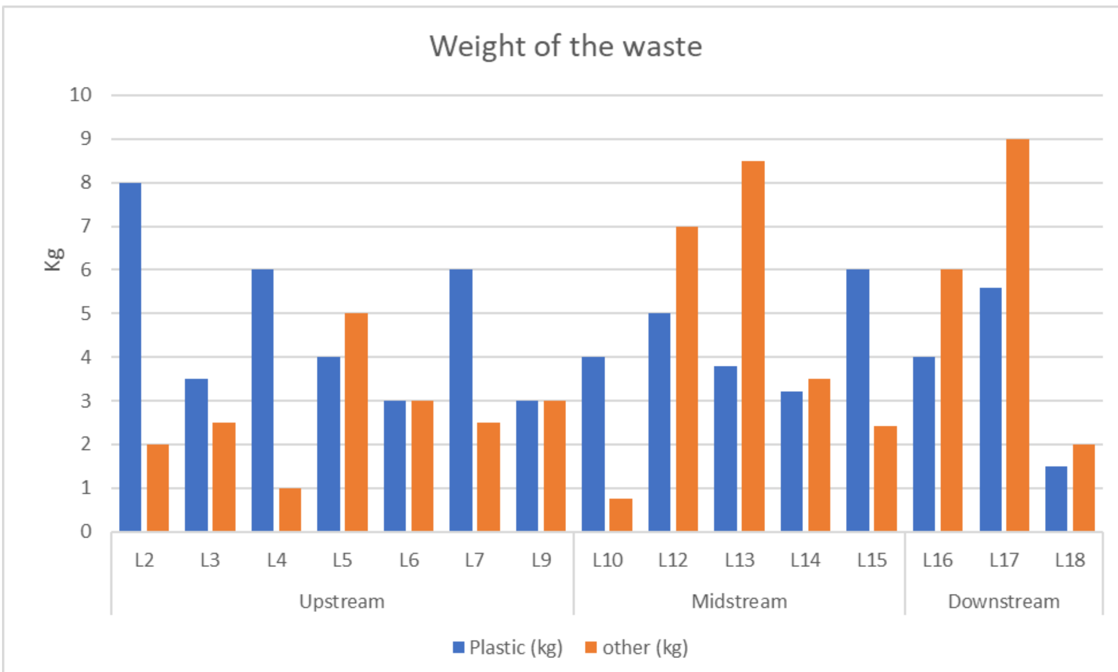


Figure 6 Weight of the waste for each location

In the Fig. 6 are presented the items abundance across the river. As it is shown, the L2 belongs to Prrenjas municipality with the highest accumulation of plastic waste. In the L2, the total number of plastic items is estimated to be 195 plastic items (including all type of polymers) and 15 items (categories). This location is considered with the highest number of items abundance. The second highest locations (midstream) with high accumulation of plastic waste are L16 with 156 plastic items and L12 with 119 plastic items. In the downstream the L16 has a plastic accumulation of 156 plastic items. In order to make comparison in fig 7 are shown the threshold values of EU (20 items/100m) and some references values from Ishem river (2.65 items/100m) and Erzeni river (2.3 items/100m). In the case of Shkumbini river the highest plastic density is on L2 (2.1 item/100m). The plastic waste density has the highest peak on the upstream part of the basin, but as well the levels of plastic density on other locations are as well high. In the downstream the concentration of the plastic density is a bit lower. It is to be highlighted that the amount of plastic density in the rural part of the basin compared to urban part of the river basin is higher.

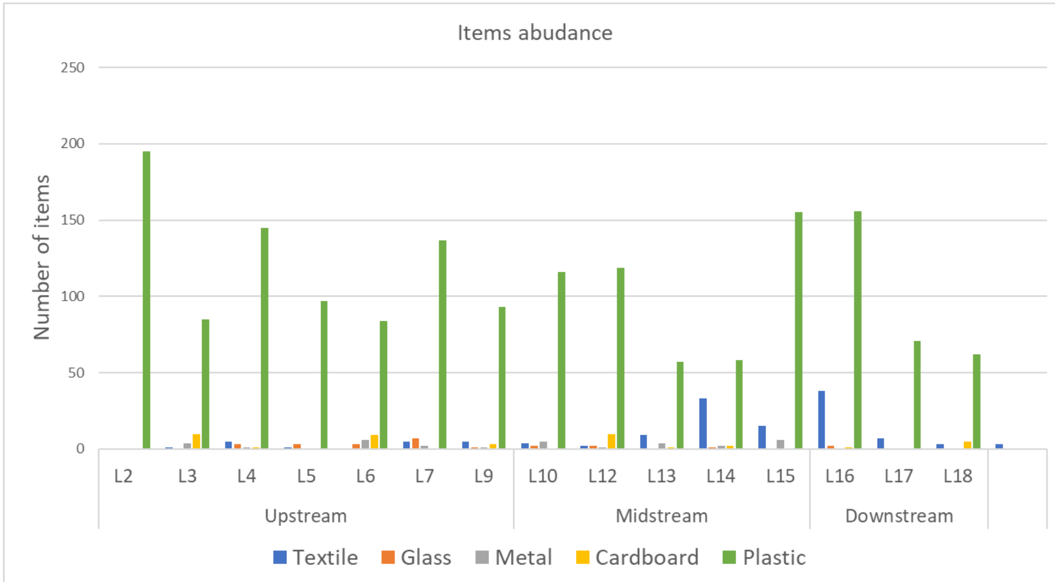


Figure 7 The items abundance across the riverbanks

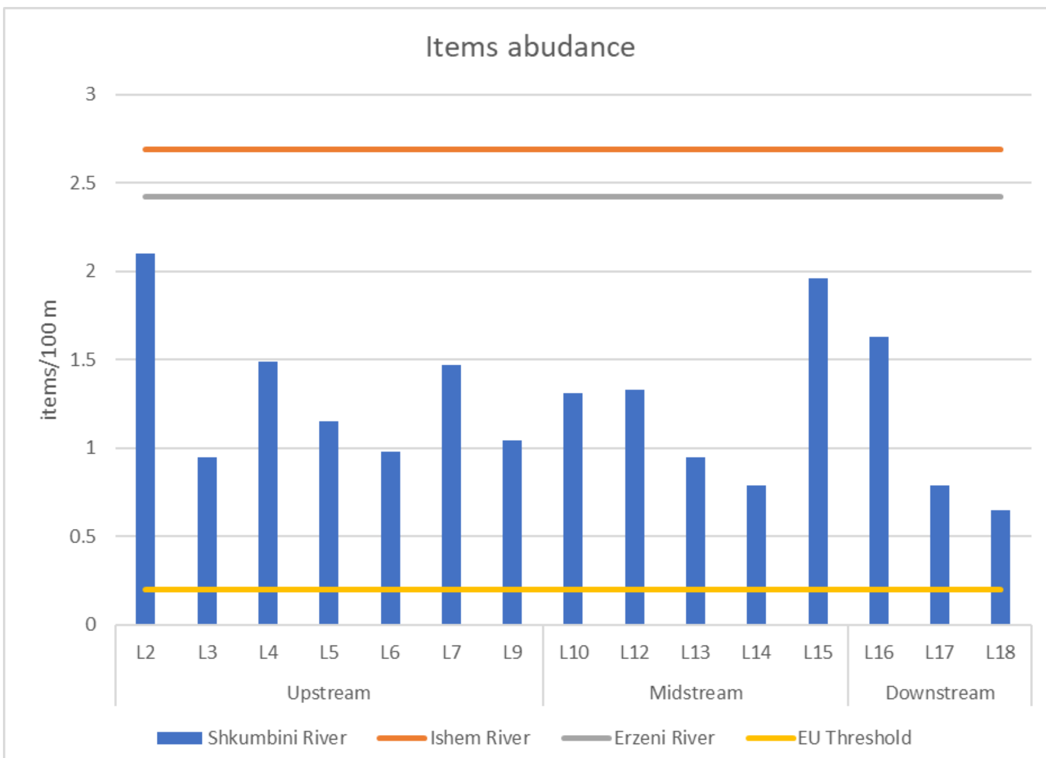


Figure 8 Items abundance (items per 100 m)

Table 3 The number of debris found in each location

	Locations	PET	PE	PP	HDPE	LDPE	OTHER	Plastic Total	Textile	Glass	Metal	Cardboard	Total
Upstream	**L2**	3	0	1	3	153	35	**195**	1		4	10	210
	L3	10	0	0	7	65	3	**85**	5	3	1	1	95
	L4	8	0	3	0	100	34	**145**	1	3			149
	L5	66	0	15	0	0	16	**97**	0	3	6	9	115
	L6	7	0	2	4	50	21	**84**	5	7	2		98
	L7	37	0	0	12	80	8	**137**	5	1	1	3	147
	L9	53	0	0	26	0	14	**93**	4	2	5		104
Midstream	**L10**	18	0	0	3	70	25	**116**	2	2	1	10	131
	L12	7	0	0	0	100	12	**119**	9		4	1	133
	L13	10	0	0	1	27	19	**57**	33	1	2	2	95
	L14	3	0	0	0	0	55	**58**	15		6		79
	L15	16	0	0	6	120	13	**155**	38	2		1	196
Downstream	**L16**	1	15	3	2	65	70	**156**	7				163
	L17	27	7	5	11	0	21	**71**	3			5	79
	L18	1	0	2	0	45	14	**62**	3				65
Total		**267**	**22**	**31**	**75**	**875**	**360**	**1630**	**131**	**24**	**32**	**42**	**1,859**

3.3.2. Riverbank debris composition

From the analyses is noted that the 88% of the total waste are plastic waste, followed by 6% textile waste, 4% cardboards, 2% metals and 1% glass. The highest volume remains plastic waste. Furthermore, a more detailed assessment is conducted to identify the polymer type in each location. In L2, the highest percentage of the polymer present are LDPE, (78%), associated with other type of plastic (18%) and 3 % are PET. In L3, there are PET (12%), HDPE (8%) and LDPE (76%) and other type of plastic are estimated around 4%. There is an increase number of PET comparing with L2. In the upstream, the highest concentration is PET (68%) found in L5 (Hotolisht village) followed by L9 (Togez, Librazhd) with PET (57%), 28% (PET) and 15% (other type of plastic waste). In the midstream the most present plastic item is LDPE. In L10 (Ura e Polisit – Entrance of Elbasan Municipality), there is high concentration of LDPE (60%), followed by PET (16%) and other type of plastic waste (22%).

Following that, L12 (city center) has high concentration of LDPE (84%) and PET (6%). Furthermore, L13 (Papri Bridge) has LDPE (47%), other type of plastic waste (33%). In next location, L14 (Ura e Zeze), there is a high concentration of other type of plastic (95%) not identifiable. In the next location, L15 (Broshka Bridge – exit of the city) the concentration of LDPE accounted around 77% of the total, followed by PET (10%) and other type of plastic (8%). In the down-stream part of the river, are three more locations assessed from the project team. The L16 (entrance of Peqin municipality) the concentration of LDPE (42%) has the highest percentage, followed by other type of plastic not identifiable (45%), and PE (10%). In the next location, L17, there is high presence of PET (38%), followed by other type of plastic not identifiable (30%), HDPE (15%) and PP (7%).

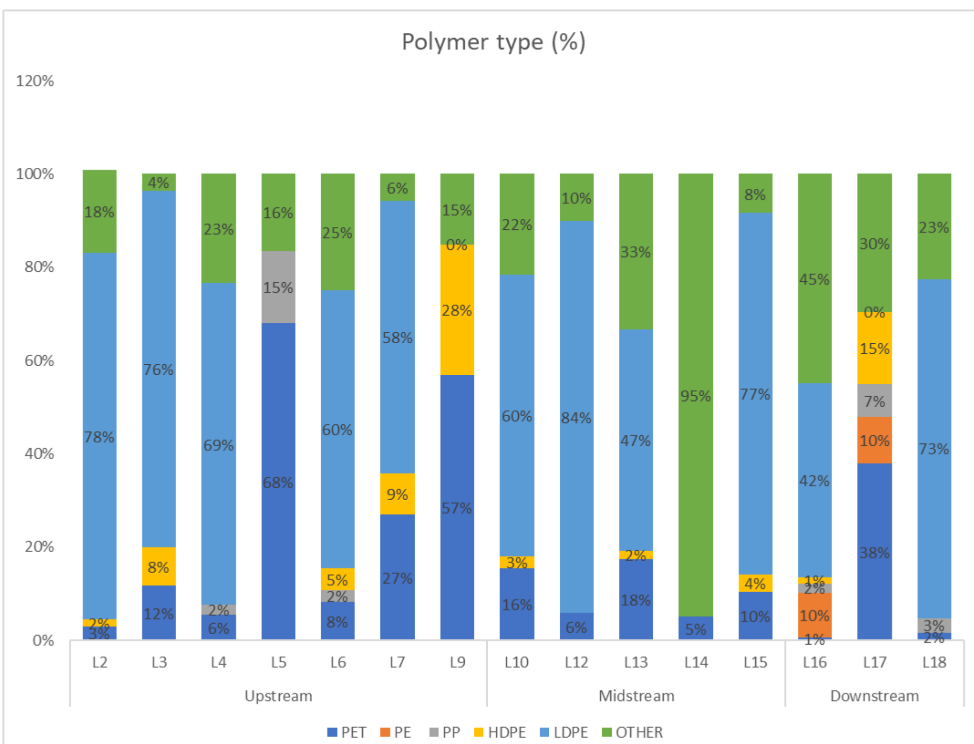


Figure 9 Polymer types (%)

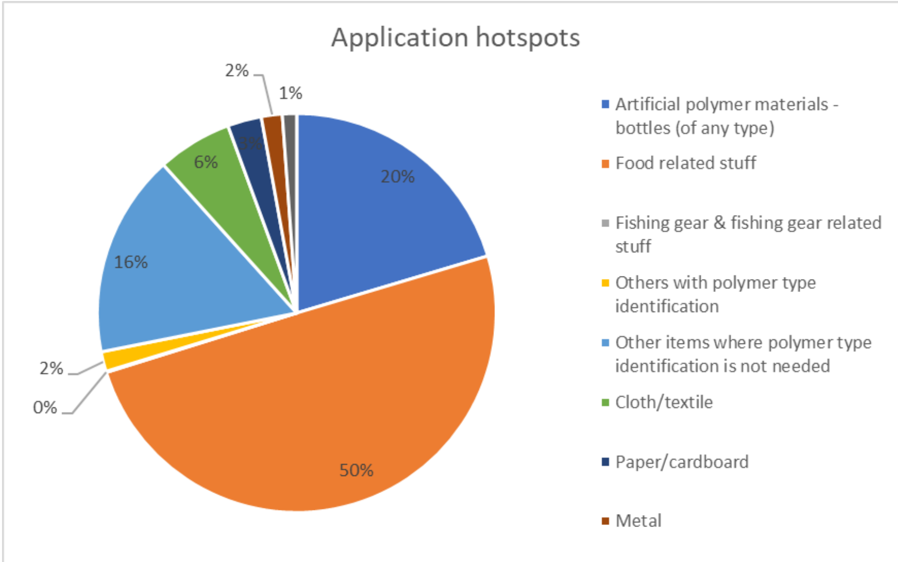


Figure 10 Application hotspots

As described in the sampling approach, the project team referring to the Marine Litter Framework Directive, has make the assessment based on 7 (seven) categories. In the following paragraph are described the sub-categories in detail. The highest percentage contain Food related stuff (50%), followed by artificial polymer materials-bottles (20%) and other types (16%). The other items where polymer types identification is not needed are estimated to be 16%, followed by clothes/textile (6%) and metal (2%), paper/cardboards (1%). In regards to artificial polymer material, the highest concentration are plastic drink bottles more than 0.5 l (39%), followed by plastic bottles less than 0.5 l, plastic bottles and cleaning products (21%) and the less found items where plastic non-beach use (6%) and plastic engine of bottles. The highest concentration has the SUPs (Single use plastic), in particular plastic bottles with less than 0.5 l and more than 0.5 l.

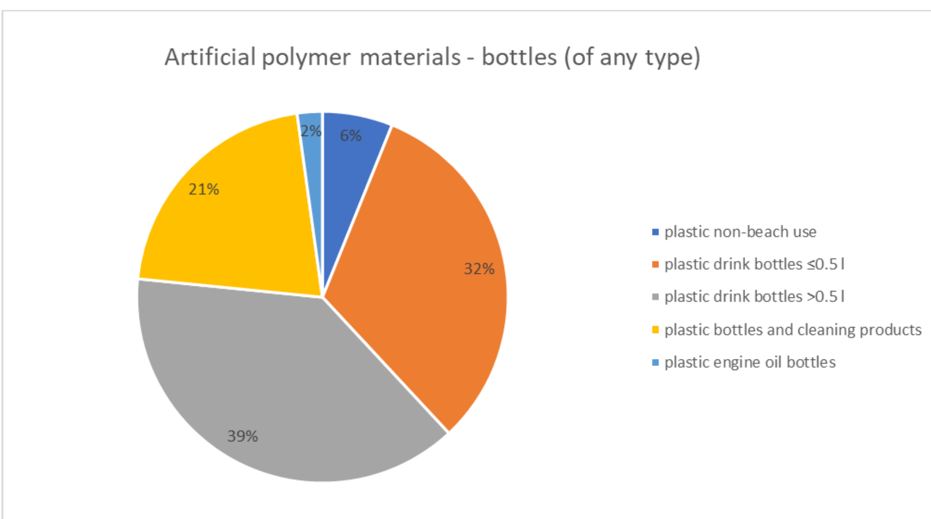


Figure 11 Artificial polymer materials (bottles)

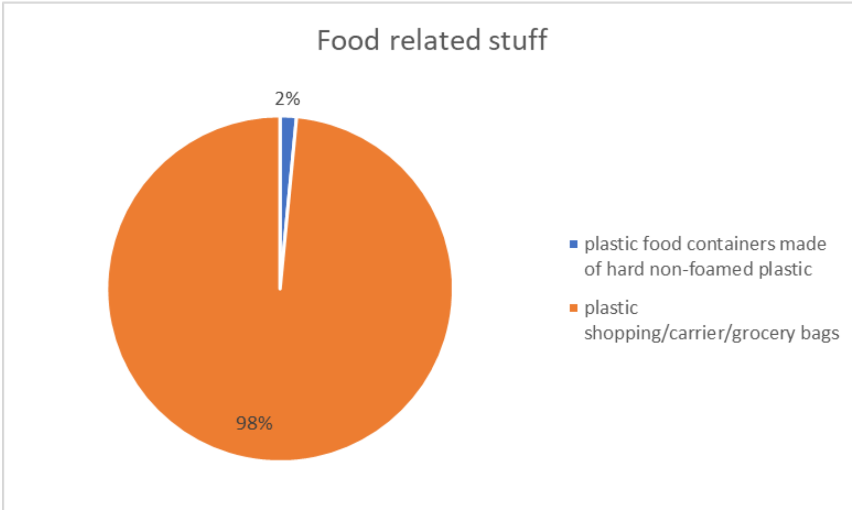


Figure 12 Food related stuff

The food related stuff has the highest distribution of plastic waste in the river basin. The highest percentage found are SUPs (single-use plastics) with a value of 98% of the total amount. Here are identified plastic shopping/grocery bags (LDPE). Also, are found small plastic bags in the riverbanks. In Fig 12 are described the other polymer type identification, where the highest percentage has fragments of non-foamed plastic[1] (42%), followed by plastic sheets, industrial packaging[2] (26%), plastic toys and party poppers (19%), fragments of non-foamed plastic (more than 50cm) with the value of (7%) and plastic pens and lids (3%). As it is described the non-foamed plastic has the highest contribution in the accumulation under such type of identification.

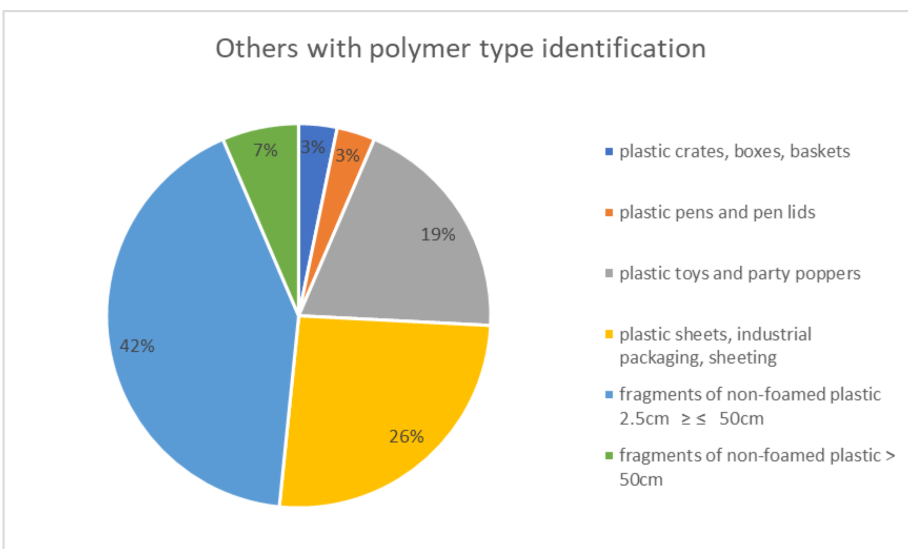


Figure 13 Percentage of others with polymer type identification

[1] https://mcc.jrc.ec.europa.eu/main/photocataloguedetails.py?N=41&O=457&jcode=J79
[2] https://mcc.jrc.ec.europa.eu/main/photocataloguedetails.py?N=41&O=457&jcode=J67

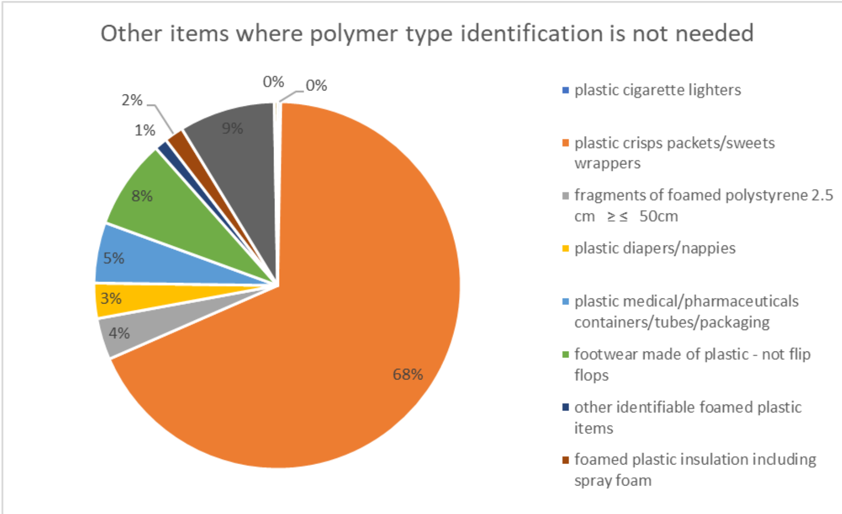
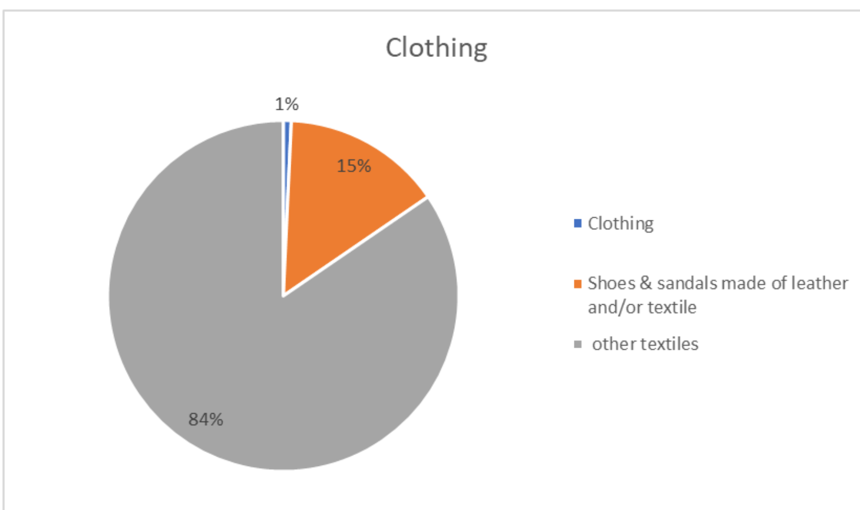
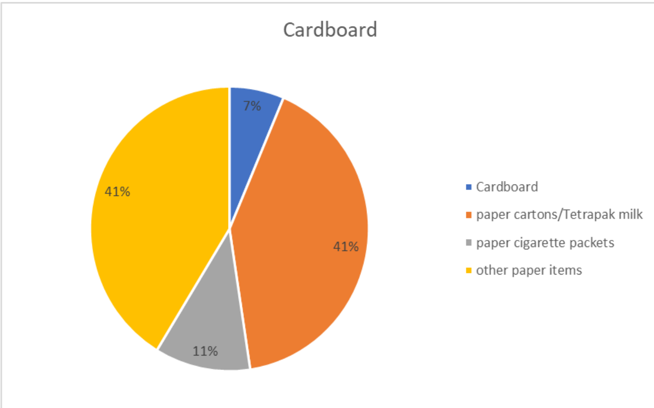


Figure 14 Other items where polymer type identification is not needed

In Fig 13, are shown the polymer types where identification is not needed. The highest percentage are plastic crisps packets/sweets wrappers[3] (68%), followed by fragments of foamed polystyrene 2.5 cm (9%), footwear made of plastics (8%), plastic medical/tubes/packaging (5%), plastic diapers/nappies (3%). There is a high presence of plastic crisps/sweet wrappers among other items found in the riverbanks. There are found as well foamed plastic insulation including spray foam (2%). The less found material, are other identifiable foamed plastic items with the lowest value (1%) compared to the total amount in this sub-category. In Fig 15, are shown the percentage of clothing textiles[4] (84%), shows and sandals made of leather (15%) and other related clothing 1 %. There are found pieces of textile which was not found in the list as identifiable materials.



[3] https://mcc.jrc.ec.europa.eu/main/photocataloguedetails.py?N=41&O=457&jcode=J30
[4] https://mcc.jrc.ec.europa.eu/main/photocataloguedetails.py?N=41&O=457&jcode=J145



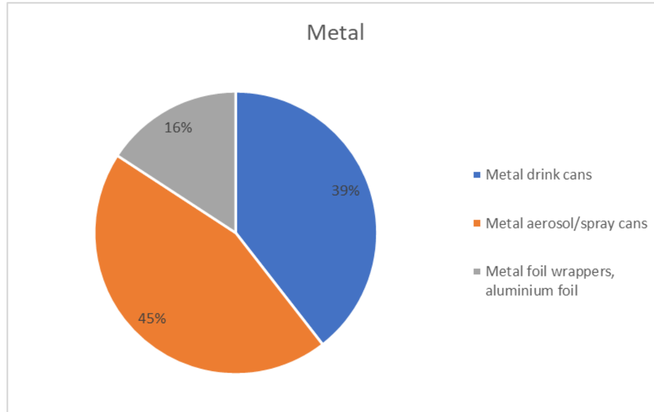


Figure 17 Percentage of types of metal

Figure 15 Clothing category

In Fig 16, it is shown the percentage of paper cardboard found in the riverbanks. The most present material is paper cartoons/tetrapak milk (41%), followed by paper cigarette packets (11%), other paper items (41%) and cardboard (7%). There is a mixed and balanced distribution of types of cardboard. Furthermore, the Fig 17 it is presented the percentage of metals where the highest concentrations go for metal aerosol/spray cans, followed by metal drink cans and the last amount is metal foil wrappers, aluminum foil. In Fig 18, are presented the different types of glasses, where the highest percentage has the glass bottles with a high percentage of 81% followed by glass light bulbs with 19%. The distribution of glasses is throughout the river basin. To sum up, under these categories, the highest percentage have other paper items and tretrapak milk, followed by metal drink cans and glass bottles.

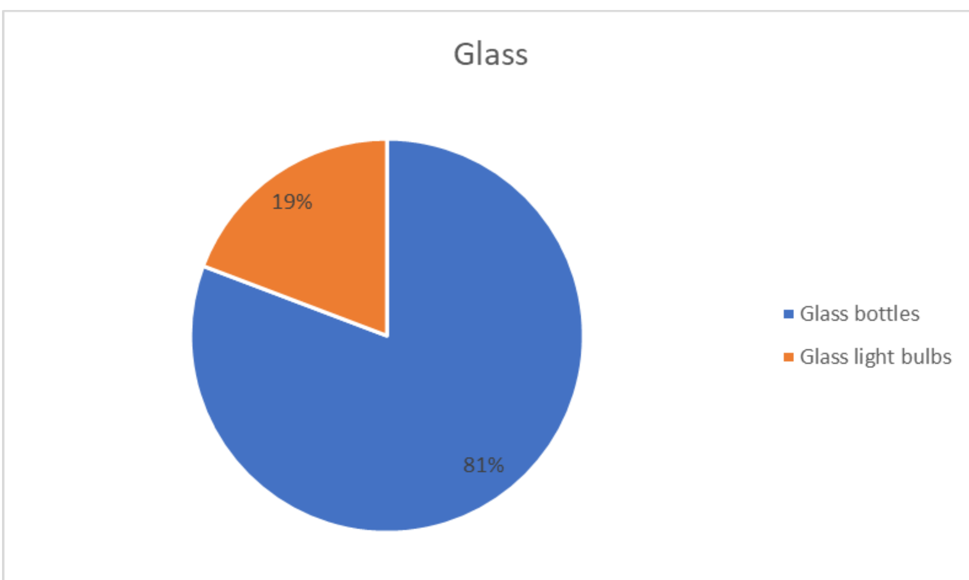


Figure 18 Percentage of types of glass

4. Conclusions

The riverbank debris baseline report presented in this study hold a great potential as a foundation resource for a waste management database within Albania. This baseline can be utilized to pinpoint the specific sources of anthropogenic debris and provide valuable support to the local municipalities and policy makers at national level in in implementing prevented measures with a particular focus in the community education, implementing waste management strategies. Additionally, the establishment of such comprehensive baseline report plays a critical role in enhancing monitoring and modeling initiatives focused on litter assessment. Furthermore, this locally derived data has the ability to extend its scope to regional or even other river context in Albania. Moreover, the framework provided by riverbank debris baseline analyses serves as an invaluable tool for academia and stakeholders seeking assistance in developing and optimizing effective strategies for monitoring riverbank debris that align with local conditions and aspirations.

The study presents the first quantitative and descriptive analyses of anthropogenic debris items on the riverbanks of Shkumbini river spanning from upstream (Prrenjas and Librazhd municipality) to midstream (Elbasan municipality) until downstream to Peqin and Rrogozhine municipality. Plastic debris constitute approximately 88% of all items found. The presence of riverbank debris has the potential to contribute between 12 tons per year towards marine pollution, with an estimated 7 ton being plastic waste specially. Riverbank debris is more present in the upstream (Prrenjas and Librazhd municipality) compared to other locations along the river. The most present polymer type is LDPE which is present almost in the whole river but in particular to upstream (L2 – Prrenjas), midstream (L12 – Elbasan) and downstream (L16-Peqin). The most common application hotspots are SUPs especially, artificial polymer materials (PET -bottles, less and more than 0.5 l), food related stuff accounting around 1119 items where 98% of the items are SUPs (plastic shopping/carrier/grocery bags).

Moreover, beside the plastic waste, there is presence of textile waste accounting 6% of the total amount or 136 items found along the river basin. In terms of plastic waste quantity, the mean abundance is 1.23 items/100 m. Comparing to other rivers in the country (Ishem:2.69 items/100m, Erzen: 2.42 items/100m), Shkumbini river has lower leakage rate but comparing with the EU threshold value (0.2 items per 100m) the values are a bit higher. Other items where polymer type identification is not needed accounts 16% of the total amount of waste. Under this category plastic crisps packets/sweets wrappers has the highest concentration of the debris found in the river basin. The rural areas have the highest concentration of the plastic waste comparing with urban areas but still the accumulation of debris in the urban areas remain high as well.

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