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RedMarLitter

GUIDELINES FOR SUSTAINABLE MARINE LITTER MANAGEMENT

CROSS BORDER COOPERATION

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Manager:	**Assoc. Prof. PhD. Petar Petrov**
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1. INTRODUCTION

The seas and oceans are key to people - they are trade routes, climate regulator, sources of food, energy and resources and a preferred place for tourism and recreation. Connections with the sea are now more intense, more diverse and create more economic value than ever before. On the one hand, modern technology and know-how allow the extraction of more value from the sea, as the flow of people to the shores is constantly increasing. On the other hand, the overall effect of these activities leads to conflicts over the use of resources and to the deterioration of the marine environment on which human well-being depends.

The main reasons for the rapid growth and deepening of solid waste problems in the marine environment and along the coast arise mostly from the unprecedented anthropogenic pressure on the coastal zone and the marine environment. The problem of waste in the marine environment and along the coast is part of the wider problem of solid waste management. These issues are closely linked to other aspects of environmental protection, such as the protection of water, soil, human health, as well as the application of the principles of sustainable development in general.

The growing vulnerability of coastal areas, increasingly congested coastal waters, the key role of the oceans in the climate system and continued deterioration of the marine environment require more attention to be paid to marine litter management.

This report "Guidelines for the sustainable management of marine litter" has been developed under contract 93-OP20-10 (3) / 01.10.2020, concluded between the Municipality of Burgas and P-United Ltd. for Lot 2 "Guidelines for the sustainable management of marine litter ". The report shall examine the steps to be followed in identifying, assessing and categorizing hotspots along the Black Sea coast, affecting his condition. In essence, the Guidelines are applicable to any other sea.

This document "Guidelines for the sustainable management of marine litter" has been developed by a team of experts from P-United Ltd. as follows:

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	Expert	Position
4	Ch. Assis. PhD Nikolai Kodzhabashev	Non-key Expert Expert - Fauna
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7	Master of Ecology Stanimira Ivanova	Non-key Expert - Household waste
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11	Eng. Veneta Stefanova	Non-key Expert - Coordinator

2. MARINE LITTER A GLOBAL VIEW OF THE PROBLEM AND IMPACT

2.1 Nature and categories of marine litter

For the purposes of the document developed within the scope of this SP, the definition of the term marine litter includes any manufactured or solid waste entering the marine environment irrespective of the source (Coe and Rogers 1997). These are most often objects and materials that are made or used by man and intentionally or not thrown into the sea, rivers or beaches, brought by storms or wind. They may also be accidentally lost, for example as a result of bad weather.

Marine litter can be categorized into several different types of materials (Ribic et al. 1992, ANZECC 1996a, Kiessling 2003, Otley and Ingham 2003, Edyvane et al. 2004), including:

- Artificial polymer materials: e.g. cigarette butts and filters; Plastic/polystyrene pieces 2.5 cm > < 50cm; plastic caps/lids unidentified; cups and cup lids; crisps packets/sweets wrappers; Plastic/polystyrene pieces 0 - 2.5 cm; drink bottles >0.5l; Plastic caps/lids drinks, etc.;
- Rubber: e.g. balloons; tires; rubber boots; rubber bands, etc.;
- Cloth/textile: e.g. Clothing/rags; shoes and sandals (e.g. leather, cSPh); carpets; ropes; sails, canvas etc.;
- Paper/cardboard – e.g. paper bags; cardboard boxes; cartons/tetrapack milk; cigarette packets; newspapers and magazines, etc.;
- Processed/worked wood – e.g. corks; pallets; toothpicks; Ice-cream sticks; paint brushes, etc.;
- Metal – e.g. aerosol/spray cans; cans (beverage); cans (food); aluminium foil; bottle caps; tableware (plates, cups & cutlery); car parts; appliances (refrigerators, washers, etc.); paint tins; gas bottles, etc.;
- Glass/ceramics – e.g. bottles; jars; light bulbs; fluorescent light tubes; tableware (plates & cups), etc.;
- Unidentified – e.g. medicinal items; paraffin/wax, etc.

In the development of this document, organic waste of natural origin (e.g. food waste, algae and other marine vegetation, dead marine animals, etc.) is not classified as marine litter.

In recent years accumulate observations and research for marine litter. However, there are still no uniform classifications to help compare the results. The forming consensus proposes first steps towards harmonizing the criteria used to classify marine litter according to its size:

- Macroparticles: over 25 mm;
  - Mesoparticles: 5 - 25 mm;
  - Microparticles: up to 5 mm;
    - large: 1 - 5 mm;
    - small: less than 1 mm;
- Nanomaterials: aggregate of particles with size 1 - 100 nm.

The division on marine litter in different groups according to their size is needed both for the quantitative assessment of the litter entering the marine environment and for the monitoring of their impact on organisms.

While macroparticles pose a risk to the health and life of various species in entanglement or ingestion, then microparticles and nanomaterials fall into the food chain. This raises questions about the possible biological accumulation of persistent organic pollutants in marine organisms. The consequences of the accumulation of toxic materials will reflect negative of populations of affected species, but also pose a potential risk to humans from the consumption of seafood.

2.2 Sources of marine litter

The main sources of marine litter are sources located on land (land-based/on-shore). The share of litter generated by them reaches 80% of the total amount of solid waste generated and received in the marine environment. The solid waste generated by activities at sea, the so-called offshore (sea-based) sources, such as maritime transport, fishing, offshore installations form about 20% of the total waste. With regard to these marine resources, special attention must be paid to end-of-life lost or abandoned fishing gear and, in particular, fishing nets, which are a significant risk factor for the conservation of marine mammals. Regarding the composition of solid waste in the marine environment and along the coast, the data are that over 80% is the share of waste composed of or containing plastics or other polymer-resistant materials.

2.2.1 Land-Based (onshore) sources

Land-based sources include improperly located or illegal landfills, uncovered waste containers, garbage trucks, poorly managed waste from production processes, processing and / or transportation of goods, etc. Wastewater treatment plants, as well as rainwater drainage can also be sources of waste at sea, if they are unable to retain solid waste. Coastal activities as well

visitors to the beaches also often contribute to the load of the coast and the sea with waste of various kinds.

This type of waste is mainly disposable, namely beverage bottles, bottle caps, food packaging, plastic cups, stirrers and more. Wind is another factor that contributes to these items becoming waste, but many of them are intentionally or carelessly left on the beach. Materials used in the home, such as consumer cosmetics, as well as polyester and acrylic fibers, when washing clothes fall into the sewer, and from there - into the sea.

2.2.2 Sea-based (offshore) sources

Sources of marine litter are various activities that people perform at sea. Many items and materials fall directly into the marine environment from merchant, military and research vessels, passenger ships and yachts, offshore platforms and their associated vessels. Some of the waste falls into the water in case of accidental loss, others - as a result of gaps in the waste management systems or their illegal dumping. Fishing - professional and amateur - is a source of nets, ropes, buoys and floats, as well as other accessories. They can be intentionally dumped, abandoned or lost during a storm. Growth in fish farming, molluscs, crustaceans and other aquatic organisms such as aquaculture also contribute to the increase of similar materials in the marine environment.

2.3 Pollution of the marine environment and the coast

Pollution of the coast is visible to the public part of the flow of solid waste that reaches the sea. Data from numerous observations on European beaches show that 75 to 84% of litter along the coast is plastic. About 5% of the litter is glass, 3% - metal and 1% - paper and cardboard or textiles. This confirms the estimates of the predominant share of plastics in marine litter. Monitoring of beaches in Europe shows that 16% of all litter is cigarette butts. Observations on the Bulgarian coast also report an average of 9 - 18% part of cigarette filters in the total amount of

litter. This percentage reaches 50 percent during the summer season. Various plastic or polystyrene pieces with dimensions of 2.5 - 50 cm are the next group of litter, which significantly pollutes the beaches, followed by plastic caps, bottles, packaging of chips, saltines, or sweets.

Data for the degree of pollution of the beaches can be collected during cleaning campaigns or systematically through regular monitoring and electronic submission of information to common databases. In Europe, the Marine Litter Watch application of the European Environment Agency is used. Similar methods are used in North America and other parts of the world.

The pollution of the water surface with floating polymer materials varies in the range from 2 - 3 to 66 units / m^2 in the Black Sea and the Mediterranean Sea. The main part of the litter that enters the marine environment accumulates at the bottom of the sea. It is estimated that about 70% of all litter in the sea is at the bottom. The collection of a larger amount of litter in one place is influenced by the shape of the bottom and sea currents and varies from a few pieces to several tons of litter per square kilometer. Higher litter concentration is observed in bays and at anchorages, as well as in underwater canals, depressions, around rocks and sunken vessels. The density of artificial polymer materials is also higher in the areas where sludge from rivers and the circulation of sea water naturally collect.

2.4 Impact of marine litter on the environment

The scope and scale of impacts from marine litter are diverse (Dixon and Dixon 1981, Laist 1987, Jones 1995, GESAMP 2001, Moore et al. 2001, Barnes 2002, Derraik 2002, Kiessling 2003, Otley и Ingham 2003, UNEP 2005, NRC 2008). They are divided into the following groups: impacts on ecosystems, social impacts, economic impacts and public safety.

2.4.1 Impact on ecosystems

a) entanglements and ghost fishing;

b) ingestion (intestinal blockage, malnutrition and poisoning);

c) blockage of filter feeding mechanisms from small particulate (neustonic) plastic litter;

d) physical damage and suffocation of reefs, algae, etc .;

e) potential to vector marine pests, including invasive species.

2.4.2 Social impacts

a) loss of aesthetics and / or visual amenity;

b) loss of indigenous values;

c) antagonism against perceived polluters*;*

d) perceived or actual risks to health and safety.

2.4.3 Economic impacts

a) cost to tourism (loss of visual amenity and obstruction to beach use);

b) cost to vessel operators (downtime and damage due to entanglements);

c) losses to fishery and aquaculture operations due to damage or entanglements;

d) costs for clean up, animal rescue operations, recovery and disposal.

2.4.4 Public safety

a) navigational hazards;

b) hazards to swimmers and divers (entanglements);

c) cuts, abrasion and stick (puncture) injuries;

d) explosive risk (e.g. gas cylinders, etc.)

Litter accumulation in our seas and on our beaches depends upon both the rate at which litter is entering the system and the rate at which it is removed or decays. It is generally accepted that both current quantities and rates of litter generation are increasing (Ryan and Maloney 1993, Barnes 2002, Derraik 2002) despite measures aimed at controlling the problem (Williams et al. 2005, National Academy of Sciences 2008). The ever-increasing generation of litter (mostly plastic), which decomposes very slowly (Laist 1987), means that it will remain in ecosystems for long periods of time. During this time, they can travel long distances (Derraik 2002) and have significant effects on the environment.

3. ANALYZED INFORMATION FROM THE CONDUCTED SURVEYS, HANDBOOK ON HOW TO USE THE CREATED GENERAL DATABASE

3.1 Analysis of the information from the conducted researches

As part of the RedMarLitter project of "Nikola Vaptsarov" Naval Academy has been assigned the implementation of a public procurement for "Selection of a contractor to provide data on the state of the Black Sea" (SP 1 „Providing data for water currents and connected with them waste streams in the Black Sea (Bulgaria)"). In fulfillment of the order, the experts from "Nikola Vaptsarov" Naval Academy have made an analysis of the results of the monitoring of the waste floating on the sea surface according to Marine Strategy Framework Directive 2008/56/EC.

As a result of the analysis the following conclusions were made:

- The total number of waste on the sea surface is dominated by items from the category "artificial polymer materials" as their percentage is respectively 95% in 2016, 87% in 2017 to 91% in 2018;
- The size composition of the waste is dominated by the small fractions of category "A" (2.5 cm - 5 cm) and category "B" (5 cm - 10 cm);
- The maximum concentrations of waste on the sea surface in 2016 were registered in the area of the Kamchia River (8441 units / km^2) for the coast and in the shelf zone in front of the town of Sozopol (4857 units / km^2) and Kaliakra River (3115 units / km^2), characterized by the presence of intensive ship traffic;
- In 2018, the shelf regions of Kaliakra-Durankulak and Burgas, and the coastal regions of Galata, Kamchia and Sozopol-Aleppo are emerging as points of concentration of waste in surface waters.

3.2 Database - RedMarLitter

The data from the conducted researches are uploaded in the Database, created within the project "Innovative techniques and methods for reduction of marine waste in the coastal areas of the Black Sea" (BSB552 RedMarLitter). The project is implemented in order to improve the ecological condition of the Black Sea by reducing the amount of waste in it and along the coast.

3.2.1 Working with the "Water flows" and "Sea Waste" sections

The database contains 2 main modules with information about the project countries (Bulgaria, Romania and Georgia): water courses and marine litter. A page view is shown in **Figure 1**

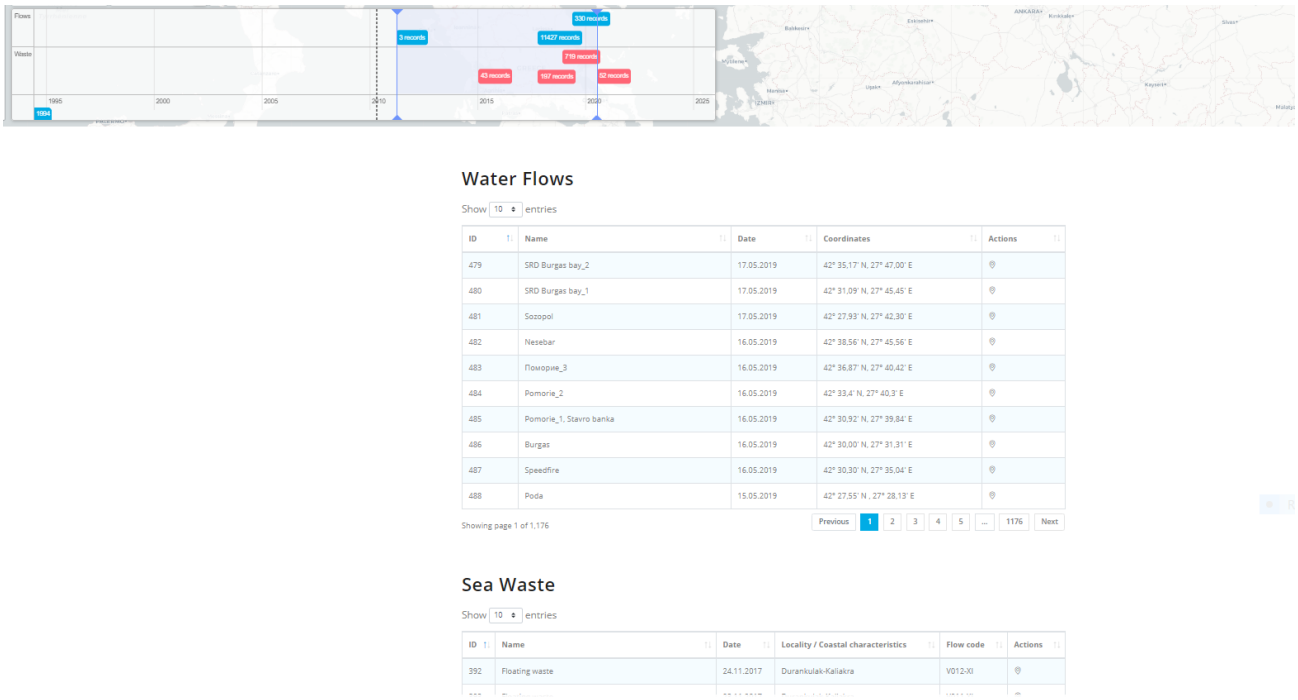
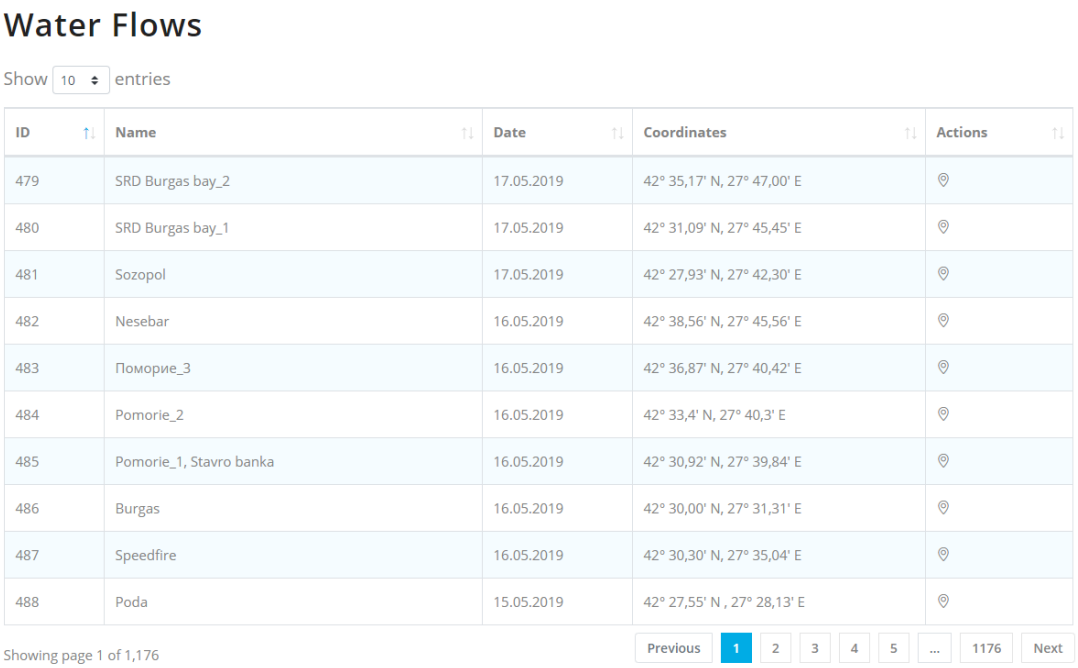


Figure 1. View from the RedMarLitter Database page

- **Water flows**

The section "Water flows" presents information about water flows in the Black Sea. Each record provides information about the record ID, the name of the stream, the date of entering the information, and the coordinates of the stream. View from the "Water flows" section is presented in **Figure 2.**



Water Flows

Show 10 entries

ID	Name	Date	Coordinates	Actions
479	SRD Burgas bay_2	17.05.2019	42° 35,17' N, 27° 47,00' E	
480	SRD Burgas bay_1	17.05.2019	42° 31,09' N, 27° 45,45' E	
481	Sozopol	17.05.2019	42° 27,93' N, 27° 42,30' E	
482	Nesebar	16.05.2019	42° 38,56' N, 27° 45,56' E	
483	Поморие_3	16.05.2019	42° 36,87' N, 27° 40,42' E	
484	Pomorie_2	16.05.2019	42° 33,4' N, 27° 40,3' E	
485	Pomorie_1, Stavro banka	16.05.2019	42° 30,92' N, 27° 39,84' E	
486	Burgas	16.05.2019	42° 30,00' N, 27° 31,31' E	
487	Speedfire	16.05.2019	42° 30,30' N, 27° 35,04' E	
488	Poda	15.05.2019	42° 27,55' N , 27° 28,13' E	

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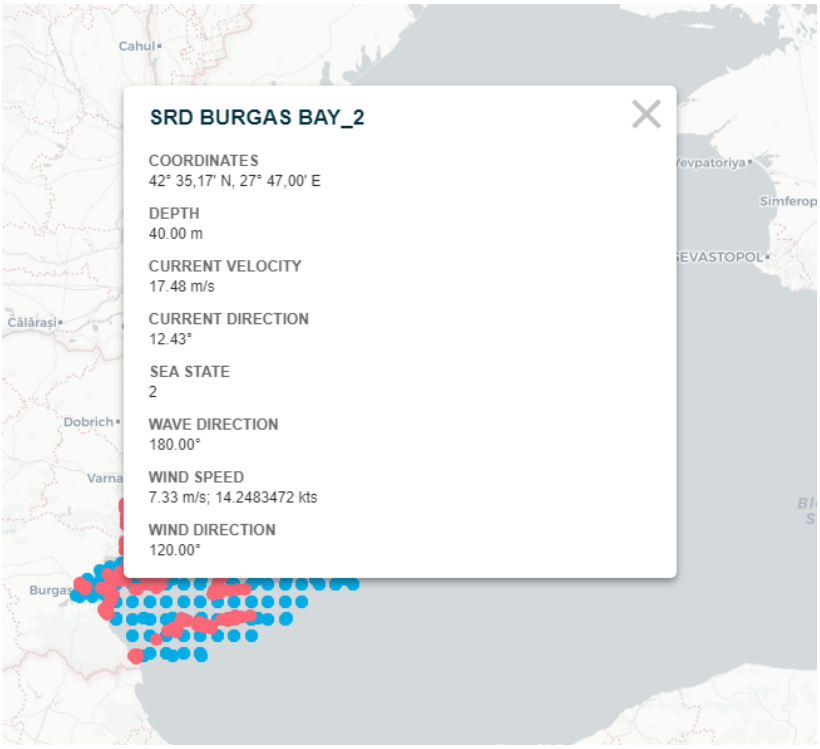
Figure 2. *View from the "Water flows" section*

When you click on the marker in the "Actions" column, the flow is displayed on the map - with a blue dot and a window opens. The following flow information is presented in the window that opens (**Figure 3**):

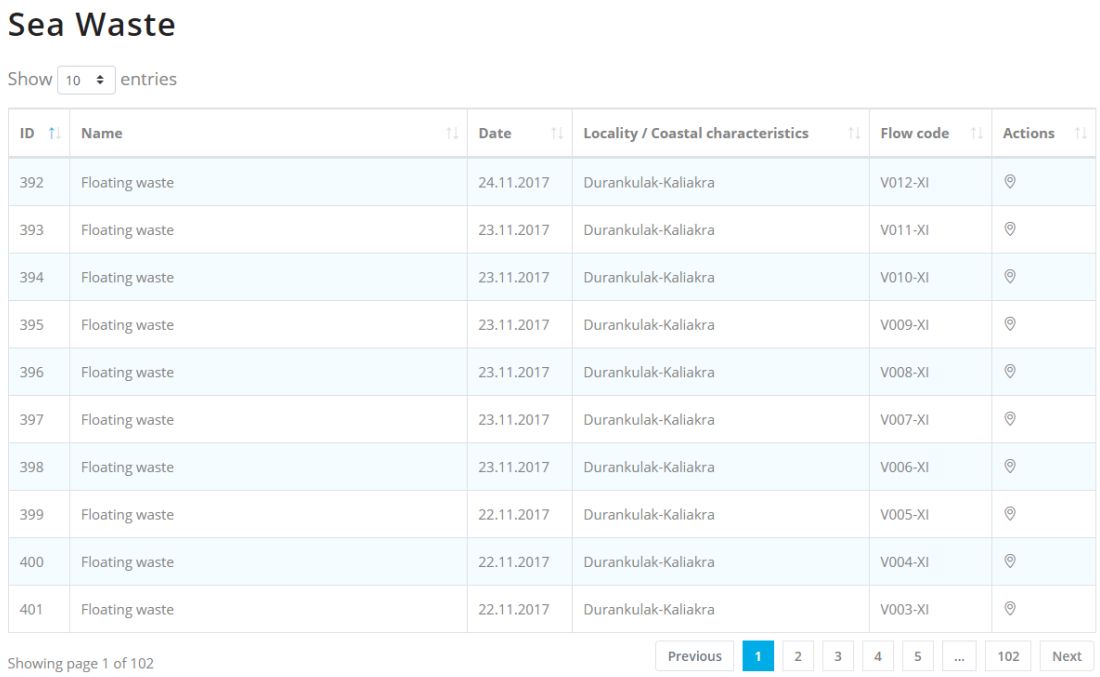


- Coordinates;
- Depth;
- Flow speed;
- Direction of flow;
- Water condition;
- Direction of waves;
- Wind speed;
- Wind direction.

Figure 3. *Information about water flow*

- **Sea waste**

The Sea Waste section provides information on marine litter in the Black Sea. Each record provides information on the record ID, the name of the waste, the date of entering the information, locality / coastal characteristic, flow code. A view from the Sea Waste section is presented in **Figure 4.**



Sea Waste

Show 10 entries

ID	Name	Date	Locality / Coastal characteristics	Flow code	Actions
392	Floating waste	24.11.2017	Durankulak-Kaliakra	V012-XI	
393	Floating waste	23.11.2017	Durankulak-Kaliakra	V011-XI	
394	Floating waste	23.11.2017	Durankulak-Kaliakra	V010-XI	
395	Floating waste	23.11.2017	Durankulak-Kaliakra	V009-XI	
396	Floating waste	23.11.2017	Durankulak-Kaliakra	V008-XI	
397	Floating waste	23.11.2017	Durankulak-Kaliakra	V007-XI	
398	Floating waste	23.11.2017	Durankulak-Kaliakra	V006-XI	
399	Floating waste	22.11.2017	Durankulak-Kaliakra	V005-XI	
400	Floating waste	22.11.2017	Durankulak-Kaliakra	V004-XI	
401	Floating waste	22.11.2017	Durankulak-Kaliakra	V003-XI	

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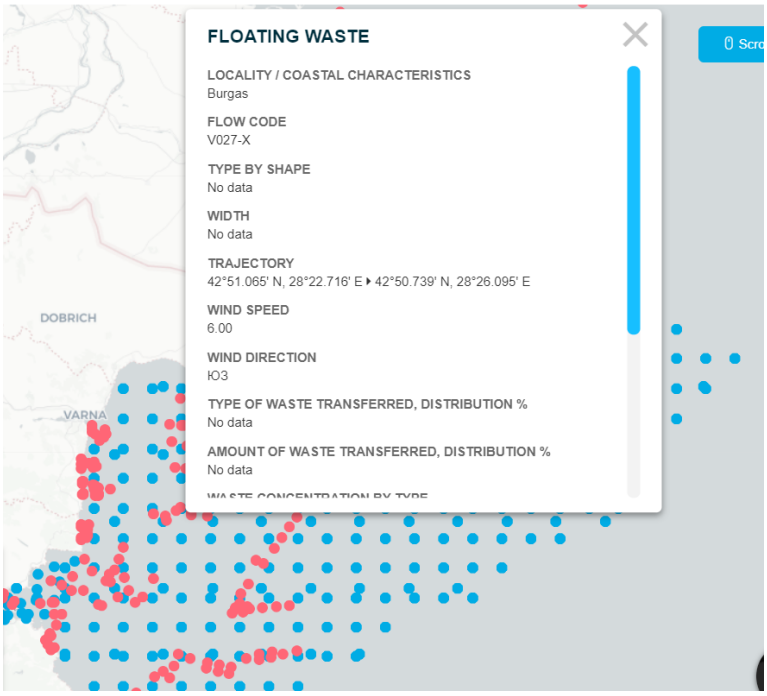
Figure 4. *View from the "Sea Waste" section*

When you click on the marker in the "Actions" column, the marine litter is visualized on the map - with a red dot and a window opens in which the following information about the water flow is presented (**Figure 5**):



- Locality / coastal characteristic;
- Flow code;
- Type by shape;
- Width;
- Trajectory;
- Wind speed;
- Wind direction;
- Type of transferred waste, distribution %;
- Amount of the transferred waste, distribution %;
- Concentration by type of waste;
- Concentration by size of waste;
- Type of periodicity;
- Nature of periodicity;
- Additional complex factor of periodicity;
- Date.

Figure 5. Information on floating waste

3.2.2 Working with the map on the Database page

The same information that can be displayed through the "Water flows" and "Marine litter" sections can also be displayed directly by directly clicking on a selected blue (water flow) or red (marine litter / sea waste) point on the map (**Figure 6**).

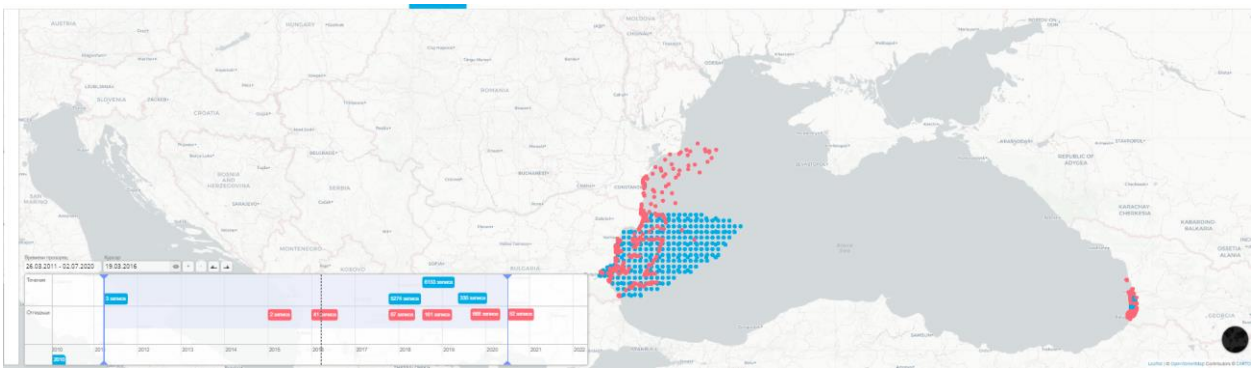


Figure 6. *View from the map with Water Flows and Sea Waste in the Black Sea*

The globe, located in the lower right corner of the map, allows you to change MapPad (**Figure 7**).

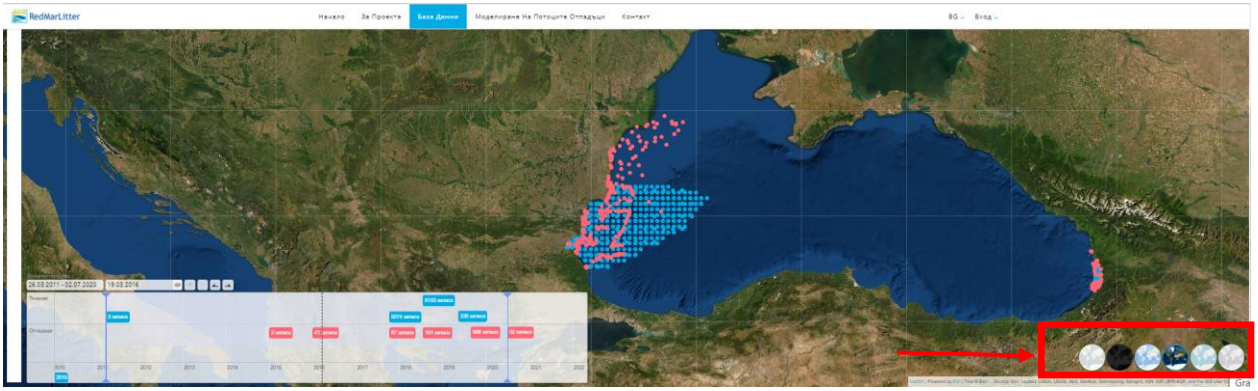


Figure 7. *Changing the MapPad*

The database also provides the ability to select a specific section of points using the buttons located in the upper left corner (**Figure 8**):

- Free fencing - 1;
- Square fencing - 2.

Figure 8 shows the use of the "square enclosure" function.

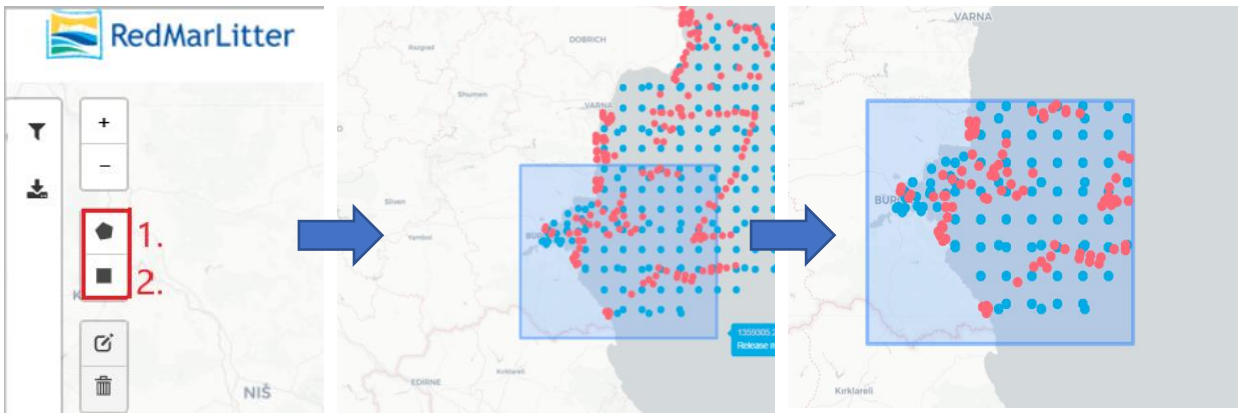


Figure 8. *Using the square enclosure function*

The selection of a section of points (whether by means of the option of free enclosure or square enclosure) can be edited or deleted using the "Edit" and "Delete" buttons shown in **Figure 9**.

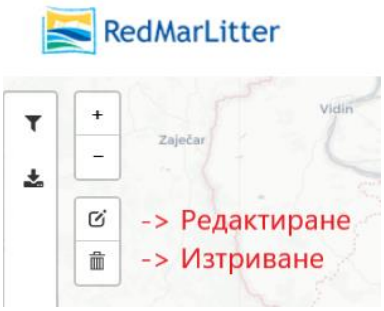


Figure 9. *Editing / deleting a selection*

The database also provides the ability to filter the results. The results for the currents can be filtered by the following indicators:

- Depth;
- Flow speed;
- Direction of flow;
- Water condition;
- Direction of waves;
- Wind speed.

The results for marine litter can be filtered by the following indicators:

- Type by shape;
- Width;
- Trajectory;
- Wind speed;
- Wind direction;
- Type of transported waste -%;
- Amount of the transported waste -%;
- Concentration by type of waste;
- Concentration by size of waste;
- Type of periodicity;
- Nature of periodicity;
- Additional complex factor of periodicity.

The results for both modules (flows and wastes) can also be filtered depending on the following types of sources:

- All sources;
- Own sources;
- Foreign sources.

The database also allows you to select a time window for which to visualize the data (**Figure 10**).

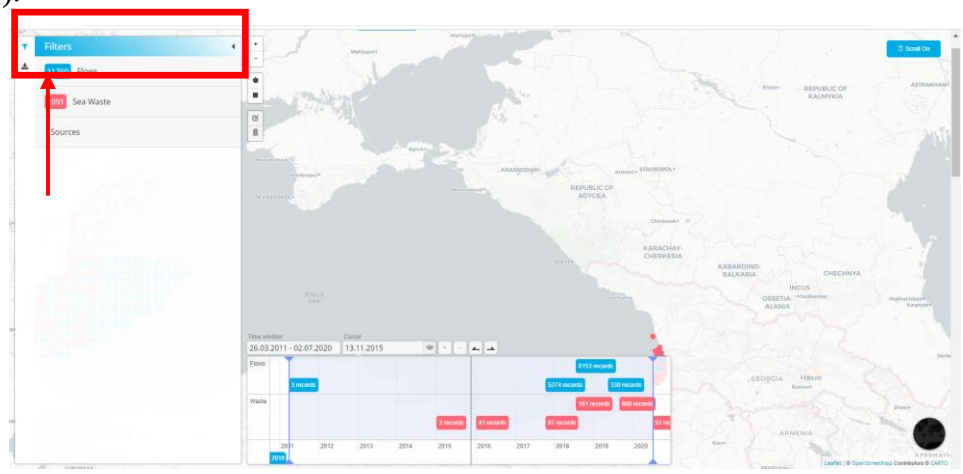


Figure 10. *Using the Filters option*

Once the specific time window is selected, it is possible to download the data (**Figure 11**).

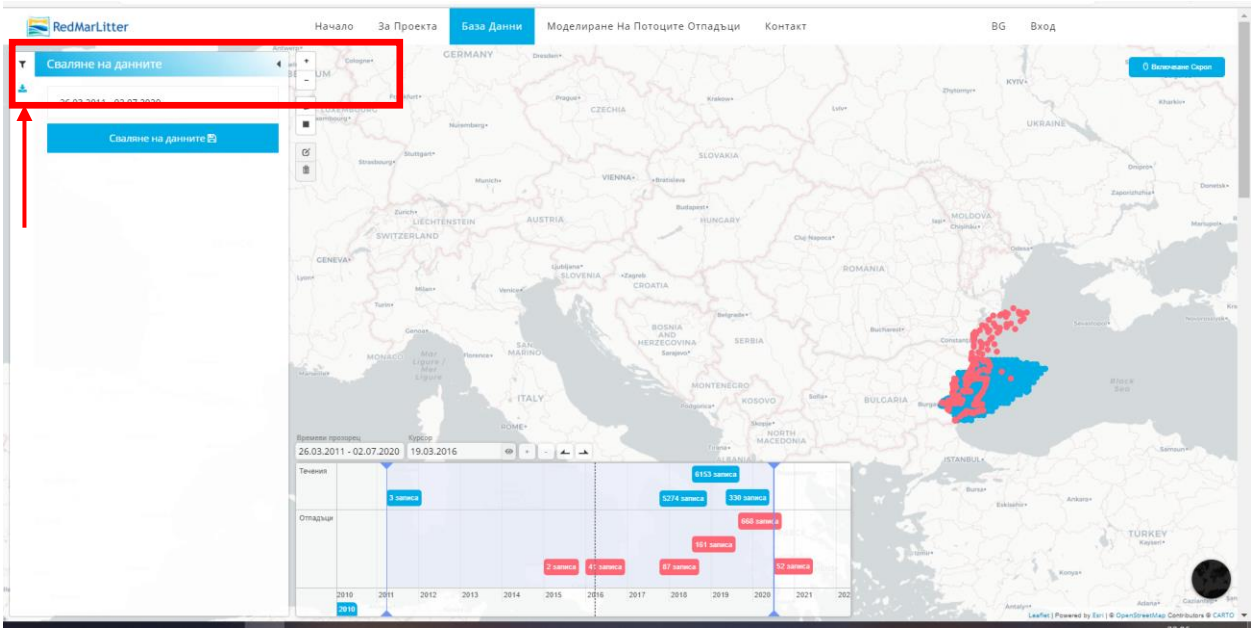


Figure 11. *Using the Download Data option*

The downloaded data are visualized in Excel (**Figure 12** and **Figure 13**), and the table contains columns corresponding to the above indicators for each of the modules (water flows and marine litter / sea waste).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	ID	Name	Date	lat [Deg, Min, Sec]	lng [Deg, Min, Sec]	Lat_Decimal	Lng_Decimal	Depth	Current_VelocityAvg	Current_DirectionAvg	Wind_SpAvg	Wind_Davg	Sea_State	Wave_D
2	479	СРД Бургаски залив_2	2019-05-17	42° 35,17' N	27° 47,00' E	42.586167	27.783333							
3	480	СРД Бургаски залив_1	2019-05-17	42° 31,09' N	27° 45,45' E	42.518167	27.7575							
4	481	Созопол	2019-05-17	42° 27,93' N	27° 42,30' E	42.4655	27.705							
5	482	Несебър	2019-05-16	42° 38,56' N	27° 45,56' E	42.642667	27.759333							
6	483	Поморие_3	2019-05-16	42° 36,87' N	27° 40,42' E	42.6145	27.673667							
7	484	Поморие_2	2019-05-16	42° 33,4' N	27° 40,3' E	42.556667	27.671667							
8	485	Поморие_1, Ставро банка	2019-05-16	42° 30,92' N	27° 39,84' E	42.515333	27.664							
9	486	Бургас	2019-05-16	42° 30,00' N	27° 31,31' E	42.5	27.521833							
10	487	Спийдфайър	2019-05-16	42° 30,30' N	27° 35,04' E	42.505	27.584							
11	488	Пода	2019-05-15	42° 27,55' N	27° 28,13' E	42.459167	27.468833							
12	489	Крайморие_2	2019-05-15	42° 27,92' N	27° 28,87' E	42.465333	27.481167							
13	490	Крайморие_1	2019-05-15	42° 26,71' N	27° 30,18' E	42.445167	27.503							
14	491	Росенец, Нефтохим	2019-05-15	42° 27,70' N	27° 31,40' E	42.461667	27.523333							
15	492	Нос Атия	2019-05-15	42° 28,10' N	27° 35,58' E	42.468333	27.593							
16	493	Нос Акин	2019-05-15	42° 27,96' N	27° 37,38' E	42.466	27.623							
17	494	Нощен Замер, Залив Врамус	2019-05-14	42° 26,80' N	27° 36,80' E	42.446667	27.613333							
18	495	Емине	2019-05-14	42° 39,77' N	27° 51,83' E	42.662833	27.863833							
19	12219	Poti_Batumi_WF	2019-09-09			41.906243	41.732336							
20	12220	Poti_Batumi_WF	2019-09-09			41.896243	41.732336							
21	12221	Poti_Batumi_WF	2019-09-09			41.886243	41.732336							
22	12222	Poti_Batumi_WF	2019-09-09			41.876243	41.732336							
23	12223	Poti_Batumi_WF	2019-09-09			41.866243	41.732336							
24	12224	Poti_Batumi_WF	2019-09-09			41.856243	41.732336							
25	12225	Poti_Batumi_WF	2019-09-09			41.846243	41.732336							
26	12227	Poti_Batumi_WF	2019-09-09			41.836243	41.732336							
27	12228	Poti_Batumi_WF	2019-09-09			41.826243	41.732336							
28	12229	Poti_Batumi_WF	2019-09-09			41.816243	41.732336							
29	12230	Poti_Batumi_WF	2019-09-09			41.806243	41.732336							
30	12231	Poti_Batumi_WF	2019-09-09			41.796243	41.732336							
31	12232	Poti_Batumi_WF	2019-09-09			41.786243	41.732336							
32	12233	Poti_Batumi_WF	2019-09-09			41.996243	41.722336							

Worksheet

Figure 12. *Data downloaded from the Water Flow section*

	A	B	C	D	E	F	G	H
1	ID	Местност / брегова характеристика	Код на потока с отпадъци	Наименование	Вид по форма	Ширина	Траектория	Скорост на вятъра (m/s)
2	535	Шкорпиловци-Бяла	V012-c1					
3	534	Шкорпиловци-Бяла	V013-c1					
4	533	Шкорпиловци-Бяла	V014-c1					
5	532	Шкорпиловци-Бяла	V015-c1					
6	530	Созопол- Велека	V047-XI	Плаващи отпадъци				
7	531	Шкорпиловци-Бяла	V016-c1					
8	528	Созопол- Велека	V049-XI	Плаващи отпадъци				
9	529	Созопол- Велека	V048-XI	Плаващи отпадъци				
10	527	Созопол- Велека	V050-XI	Плаващи отпадъци				
11	526	Созопол- Велека	V051-XI	Плаващи отпадъци				
12	525	Созопол- Велека	V052-XI	Плаващи отпадъци				
13	524	Бургас	V024-X	Плаващи отпадъци				
14	523	Бургас	V025-X	Плаващи отпадъци				
15	522	Бургас	V026-X	Плаващи отпадъци				
16	521	Бургас	V027-X	Плаващи отпадъци				
17	520	Бургас	V054-X	Плаващи отпадъци				
18	519	Бургас	V055-X	Плаващи отпадъци				
19	518	Бургас	V056-X	Плаващи отпадъци				
20	509	Бургас	V032-XI	Плаващи отпадъци				
21	510	Бургас	V031-XI	Плаващи отпадъци				
22	511	Бургас	V030-XI	Плаващи отпадъци				
23	512	Бургас	V029-XI	Плаващи отпадъци				
24	513	Бургас	V061-X	Плаващи отпадъци				
25	514	Бургас	V060-X	Плаващи отпадъци				
26	515	Бургас	V059-X	Плаващи отпадъци				
27	516	Бургас	V058-X	Плаващи отпадъци				
28	517	Бургас	V057-X	Плаващи отпадъци				
29	431	EEZ intensive trafic	V025-XI	Плаващи отпадъци				

Figure 13. *Data downloaded from the Sea waste section*

4. SHORT INFORMATION ABOUT POSSIBLE METHODS OF MONITORING BY USERS AND SHORT GUIDELINES FOR HOW THE GENERAL PUBLIC CAN CONTRIBUTE TO A REDUCTION OF SEA POLLUTION

Receiving sufficient information and data on marine litter is essential to deal with it, as legislation alone cannot solve this problem. All people contribute to the accumulation of marine litter and are affected by it in one way or another. It is crucial to work towards the involvement of citizens, which will lead to a better understanding of the problem of marine litter, and hence contribute to their prevention and reduction. For this reason in recent years is working very intensive in providing monitoring methods by citizens and consumers who are directly or indirectly affected by the marine litter problem. The active participation of the public in data collection activities can significantly help to raise awareness among citizens and communities about the environmental problems prevailing in their area. It is in order to fill the data gaps and increase citizens' involvement in environmental issues - in this case marine litter - that the European Environment Agency has developed the MarineLitterWatch (MLW) mobile application. This app combines users' commitment to modern technology to help tackle the problem of marine litter. MLW aims to collect data on marine litter on beaches that are relevant to the Marine Strategy Framework Directive (MSFD) in order to complement the data from official monitoring, with the help of interested citizens and communities. It also allows the collection of data from informal initiatives such as beach cleaning.

The database created within the project "Innovative techniques and methods for reducing marine litter in the Black Sea coastal areas" (BSB552 RedMarLitter) (presented above) can also be considered as a method that allows users to monitor the development of the marine litter problem. In it can be found information about the type and concentration of waste at certain points. The role of the general public in reducing marine pollution is essential, especially once consumers have access to up-to-date information. Through their actions - direct and indirect - people can make a significant contribution to reducing the amount of waste entering the marine environment.

4.1 Direct action by the general public that can lead to a reduction in marine litter

4.1.1 Regulated dumping of waste on the beach

Disposal of waste at regulated areas on the beach and in the coastal zone would lead to a reduction in the amount of waste that potentially would enter in the marine environment. If possible, it is advisable to use waste containers with a lid or other waste retention mechanism. This will prevent the waste from being blown away by the wind or carried away by the birds. Waste generated at sea during navigation should not be dumped overboard, but should be collected in appropriate containers and taken ashore. In cases where waste is dumped, abandoned or forgotten on the beach and the coastal area, it is very likely to end up in the water.

4.1.2 Participate in campaigns to clean beaches or rivers

The participation of every citizen, as a volunteer, in campaigns for waste collection and cleaning of the coastline, especially during the tourist season, is important for reducing the pollution of the coastal strip and the marine environment. Also, everyone, regardless of age, can contribute to reducing pollution by collecting both their own and found scattered foreign waste from the beach or rivers on their own, with family and friends, thus preventing their entry into the marine environment. .

4.1.3 Reporting of points contaminated with marine litter

Reporting to local authorities on found points / sections with accumulations of litter on the beaches / shores is an effective way to reduce pollution. To this end, citizens should provide data on the location of the contaminated area to the authorities. An appropriate way to present information about detected pollution is to use mobile applications such as MarineLitterWatch.

4.1.4 Support for organizations whose activities are related to the reduction of waste at sea

Most of the organizations whose activities are related to the reduction of waste at sea are supported by donations, and sometimes even small donations are of great importance to them. Another way to support is by participating as a volunteer in campaigns organized by them,

participating in campaigns to promote their activities, sharing on social networks their activities and the events they organize so as to reach a wider circle of people and ect.

4.2 Indirect action by the general public to reduce marine litter

4.2.1 Reduction of generated waste

As part of the waste generated on land inevitably falls into the sea - through rivers or sewers, the reduction of the total amount of waste generated in households will accordingly lead to a reduction of those that reach the marine environment. In this way, the reduction of generated waste will have a beneficial effect on both marine and terrestrial ecosystems.

4.2.2 Reduce the use of disposable products

Disposable products in most cases are made mainly of plastic, which makes up a significant part of marine litter. These are, for example, plastic bags, water bottles, straws, cups, utensils and any other plastic items that are used once and then discarded. By purchasing and carrying with them alternatives to these products, which are intended for repeated use or their rejection in restaurants and shops, everyone can contribute to one degree or another to reduce pollution of the marine environment. Disposable products pose a significant threat to the marine ecosystem, as the average time to complete the decomposition of a plastic bottle is about 450 years, and in addition, marine animals often mistakenly accept floating plastics for food and swallow them. This often causes their death. Another problem is that through ingestion by animals, this waste reach the human body along the food chain.

4.2.3 Waste recycling

Recycling of waste is extremely important to reduce the amount of waste, respectively, and those entering the sea. It is also important to buy mainly recyclable products as well as those made from recycled materials.

4.2.4 Avoid the use of products containing microplastics

In recent years, microplastics have become a growing source of pollution in water bodies. They are contained in some mandatory personal hygiene products - toothpastes, body cleansing gels, face creams and many others and easily reach the sea through the sewer system. Once there,

they significantly affect hundreds of marine species. Avoiding cosmetic products that contain microplastics (these ingredients are labeled as polyethylene and polypropylene) will certainly have a beneficial effect on marine pollution with microplastics.

4.2.5 Dissemination of information on the problem of marine pollution

Awareness of the problem of marine pollution and helping others to understand the problem can be key to tackling it. By providing up-to-date, accurate and accurate information to people around them (family, friends), they become potential active participants in the fight against marine litter.

4.2.6 Use of biodegradable products

The use of biodegradable products helps to reduce the amount of plastic used - for example, bamboo earplugs, food boxes made of bioplastic and others.

4.2.7 Buying clothes made of natural fibers

Microfiber is a significant source of plastic pollution in the sea, because every time you wash artificial fabrics (for example from polyester, acrylic, etc.), plastic particles are released, which fall into the sea through the sewer. In this case, it may also be useful to place special devices on the washing machine or before discharge to capture microfiber.

These guidelines for reducing marine pollution can have different variations and are just some of the ways in which the general public can contribute to tackling this problem. The most important step is for everyone to get involved and take part (no matter how small or large) in solving the problem of marine litter.

5. GUIDELINES FOR SUSTAINABLE MARINE LITTER MANAGEMENT

These guidelines summarize the measures developed as a result of the implementation of SP 1 to reduce pollution and to improve the condition of already polluted hotspots from the previous task.

In order to achieve sustainable management of marine litter, leading to mitigation of the impacts caused by them, it is necessary to achieve a good understanding of the problem and in particular the behavior and impact of the main types of litter in the marine environment and their sources. It is necessary to ensure that qualitative data are available that allow a comprehensive analysis of the nature and sources of litter and the way in which they change over time and in response to the measures taken.

The guidelines for sustainable marine litter management include 2 main components - monitoring of coastal areas and taking measures for waste management.

5.1 Monitoring of coastal areas

Monitoring is the method most commonly used to determine the waste load in coastal areas. The method is relatively simple (does not require high expertise and specialized equipment), is not expensive and is effective for determining the amount of waste and to facilitate the implementation of preventive measures. Monitoring can provide sufficiently reliable data to allow the identification of geographical and seasonal variations in the amount and distribution of waste in coastal areas. The monitoring is based on several methodologies, most of which include dividing the area into sections, manual collection, counting and categorization of waste by type, size, total weight, color and others.

The monitoring provides detailed data on the nature of the litter and its origin, which is the basis for the planning of measures to reduce the pollution of the coastal zones and the risk of pollution of the hateful environment, incl. taking direct measures to clean contaminated areas, taking preventive measures, conducting information campaigns, etc.

The main steps in planning and conducting coastal monitoring that could affect the results are: Defining the coastline category; Organizing periodic (seasonal) monitoring to cover as large a coastal area as possible; Consideration of the periods for cleaning the beaches with the nesting

periods of the Shore birds (species nesting on the beach strip); Separation and classification of litter - by type (plastics, metals, glass, construction materials, etc.), by size, by total weight, by color and others; Storage of data in tabular form, to facilitate their further processing; Assessment of the current ecological condition of the studied areas. In the best cases, comparisons are made with retrospective data, background data and monitoring data from other countries under similar conditions.

5.1.1 Defining the coast line category

When starting to monitor the coastline, it is necessary to define its category. This is done to determine the environmental factors that affect the spread of litter, sources of pollution and measures that can be taken to prevent the accumulation of litter or their cleaning. The coastline can be:

- **Settlements with moderate human activity** - coastline, in which is located a settlement with a population of less than 10,000 inhabitants.
- **Highly urbanized natural environment** - coastal strip in which the settlement is located - administrative (district) center with a population of over 10,000 inhabitants and a territorial concentration of different industries, infrastructure, and higher population density.
- **Industrial zone** - a coastal strip in which an area designated for industrial development is located. There is more than one production activity in it.
- **Protected areas and protected zones** - a coastline in which a protected territory / protected zone is located that meets the requirements of the Protected Areas Act (PAA) or the Biodiversity Act (BDA). According to the PAA, protected areas are designed to protect the biological diversity of ecosystems and the natural processes occurring in them, as well as characteristic or remarkable objects of inanimate nature and landscapes. According to the BDA, protected areas are intended for protection or restoration of the favorable condition of the natural habitats included in them, as well as of the species in their natural range.
- **Agrarian environment** - a coastal strip in which are located areas that are intended for agricultural production and: are not located within the urban areas (settlements), defined by the Detailed Urban Plan or the ring site; are not included in the forest fund; are not built with buildings of: industrial or other economic enterprises, holiday or health establishments, religious

communities or other public organizations, nor represent courtyards or warehouses to such buildings; are not occupied by open pit mines and quarries, energy, irrigation, transport or other public facilities, nor are they adjacent to such facilities).

5.1.2 Organizing periodic (seasonal) monitoring to cover the largest possible coastal area.

In the Guide about the Monitoring of Marine Waste in European Seas, the European Commission recommends conducting at least four (seasonal) monitoring studies per year - in spring, summer, autumn and winter. However, given the large fluctuations in the amount of landfilled waste, a higher frequency of surveys may initially be needed. This is necessary to identify seasonal patterns. Seasonal models can be taken into account when processing raw data for long-term trend analyzes.

It is proposed that the study periods be:

1) Winter: mid-December - mid-January

2) Spring: April

3) Summer: mid-June - mid-July

4) Autumn: mid-September - mid-October

It is recommended that surveys for all beaches in a region be carried out as soon as possible within the survey period. If possible, a beach should be explored on approximately the same day each year.

It is also recommended that monitoring covers as large a coastal area as possible in order to collect the maximum amount of data.

5.1.3 Compliance of the periods for cleaning the beaches with the nesting periods of Shore birds (species nesting on the beach strip)

Shore birds are a large order in the bird class that includes over 350 ubiquitous species. All species of this order are associated with coastal areas in one way or another - for nesting, feeding or resting.

Most species of Shore Birds prefer for nesting open spaces with little vegetation and near shallow water. These areas in most cases include beaches and beach areas. Studies show that the

disturbance of Shore birds as a result of various human activities has a negative effect on their nesting, migration and feeding. Nesting birds can abandon their nests, eggs or young if they are repeatedly disturbed.

Due to the great variety of the order Shore birds their nesting period cannot be unambiguously determined, as it is species-specific. In addition, these birds are affected by the temperature of the environment, which can lead to partial fluctuations in their nesting period. Usually the species that lay their eggs on the beach choose places that are not visited by humans

There are many wetlands along the Bulgarian Black Sea coast. In them the birds have the necessary conditions for laying eggs and raising small birds and they are undisturbed by humans. More significant ornithologically important places for the Shore birds are: BG034 Mandra Poda Complex, BG035 Burgas Lake, BG036 Atanasovsko Lake, BG049 Shabla Lake, BG050 Durankulak Lake and others. For this reason, beaches that are subject to cleaning are very unlikely to have nesting Shore birds, as in most cases these are places that are visited by many people. Such places can be used by birds for rest or feeding, but very rarely for nesting.

However, the cleaning of the beaches must consider the nesting periods of the Shore birds, as in most cases the coloring of the eggs and young of these birds is very similar to that of the environment, which makes them difficult to notice. Most of the birds of this order lay their eggs from the end of April to the end of May, so before the start of the active tourist season, the young have already hatched and in these cases cleaning the beach is not dangerous for them.

From the information presented so far it follows that it is not recommended to clean the beaches / costal in the period from the end of April to the end of May. It should be carried out before and after the end of this period to ensure that the birds are not disturbed.

5.1.4 Separation and classification of litter - by type (plastics, metals, glass, construction materials, etc.), by size, by total weight, by color and others.

As a result of the performed monitoring, it is necessary for the litter found on the shoreline to be classified according to different parameters such as type, size, weight, etc.

Type: The litter identified in each study must be classified by type into the following main categories:

• Artificial polymer materials;

• Rubber;

• Cloth / Textile;

• Paper / Cardboard;

• Processed / worked wood;

• Metal;

• Glass / Ceramics;

• Unidentified.

Each category includes a different number of subcategories - a total of 217. The largest number of subcategories to be monitored in the category "Artificial polymer materials" - 124, while the other categories include a significantly smaller number of subcategories from 7 to 26.

Annex 3 to the Methodology for Identification of Hotspots and Waste Reduction Measures provides a Photo Guide for the visual identification and classification of marine litter categories / subcategories, which is recommended for use in coastal monitoring.

Size: There is no upper limit on the amount of litter found on beaches.

If no lower size limit is set, it is determined by the ability to detect the litter with the naked eye and depends on the visual perception (vision) of the experts performing the monitoring and the visibility of the litter, which in turn depends on their size, color, and shape. The lower limit of detection is about 0.5 cm, but it is uncertain whether such small litter can be subject to effective monitoring that can be repeated during each study. The recommended lower limit for litter monitored is 2.5 cm. This ensures that the results of each study will consider bottle caps, cigarette butts, pieces of plastic and other widespread small wastes.

Total weight: The classification of litter by weight cannot be done very accurately. It depends on whether they are wet or dry, and often whether they are covered or filled with sand (Jambeck & Farfour 2011). Some of the litter is too large to be weighed and its weight must be estimated. The weight-based results of the studies cannot be directly compared to those based on the number of litter. An assessment of the weight of the waste could be made if the average weights of the assessed litter are known. However, this would not be possible for all waste, e.g. the nets found on the beaches come in a wide range of sizes and weights.

5.1.5 Storage of data in tabular form to facilitate their further processing

All litter identified in the study must be correctly described in the monitoring form. Ideally, the data should be entered while the litter is being collected. The collection of the litter and its identification only after that can lead to distortion of the results, because during the collection the litter becomes entangled in each other or can break.

The data from the completed forms must then be entered and stored in an appropriate tabular form to facilitate their further processing. The use of such a system will allow a detailed analysis of the data, providing the opportunity to make statistically sound comparisons of data from different periods or study sites (Cheshire et al., 2009). It is recommended to use widely available data processing software, which also allows performing computational operations.

5.1.6 Assessment of the current ecological condition of the studied areas. Compared to retrospective data, background data and monitoring data of other countries under similar conditions

An assessment of the current ecological condition needs to be carried out when monitoring the study area. The assessment should be compared with available retrospective data, background data and monitoring data from other countries under similar conditions. The assessment is made in order to identify trends in pollution of the study area, the impact of environmental factors, identify sources of pollution, assess the effectiveness of applied measures to reduce marine litter and more.

The assessment of the current situation should cover the following parameters:

- Information about the study area - general parameters for the study area should be described such as location, shape of the coastline, substrate of the study beach / shore and others that would be relevant to the pollution. For example: location is an important parameter for determining the sources of pollution, marine currents that would be relevant to coastal pollution, measures that could be applied to remove existing accumulations of marine litter.
- Environmental factors - the environmental factors that were observed during the monitoring of the study area and that would be relevant to the study (storms, fog, floods, sea currents, etc.) should be described. The assessment of these parameters is necessary in order to

determine the factors / events that are relevant to the pollution of the study area and to determine the measures that could be taken to limit the spread of marine litter.

- Status of the study area - the status of all components of the environment must be described - water (water quality status), biodiversity (presence of nesting birds, presence of dead animals, etc.), condition of the shoreline substrate traces of contamination or disturbance of the substrate), the presence of waste on the beach, the presence of floating litter, etc., so as to determine the degree of pollution and the measures that could be applied to prevent or eliminate pollution with marine litter.
- Sources of pollution - determines the presence of sources of pollution - settlements, rivers, wastewater discharges, commercial sites, etc., so as to determine the degree of pollution and measures that could be applied to prevent or eliminate marine litter pollution.

When assessing the current state of the study area, it is advisable to make a comparison with retrospective data, background data and monitoring data from other countries under similar conditions. For this purpose, it is recommended to use the information in the MSFD, reports on the implementation of these plans and reports of the EEA (respectively RIEW) on the state of the environment, research in connection with the requirements of Directive 2008/56 / EC establishing a framework for Community action in the field of marine policy (Marine Strategy Directive), scientific articles and others.

The best option is to use data from consecutive studies using a uniform methodology. As in most cases, the available data are not collected according to the current monitoring methodology, it is necessary for the archival data to be well analyzed and redistributed to the categories of litter described in the current monitoring methodology.

5.1.7 Preparation of a forecast for the ecological condition of the studied area.

Based on all collected data, a forecast is made for the ecological condition of the studied area. The forecast should cover - the state of the components of the environment, trends in marine pollution, the impact of environmental factors on pollution in the study area, the effectiveness of the implemented measures, a plan for implementing new measures to prevent the accumulation of marine litter and disposal them from the shoreline.

The longer the information on litter pollution, the more accurate the forecast will be and will allow for much better targeted measures to eliminate litter and prevent marine pollution.

5.2 Waste management measures

5.2.1 Increasing the ecological capacity of the users of ecosystem services along the Black Sea coast by organizing informative events on the negative consequences and impact of solid waste at sea

Ecosystem services are the contribution of ecosystem structures and functions, in combination with other elements, to human well-being.

The following ecosystem services are distinguished (Kandziora et al. (2013)):

- Regulating services contribute to human well-being by regulating natural processes, such as climate regulation or nutrient regulation;
- Provisioning services are all materials and products that people receive from nature and use, for example for food and energy;
- Cultural services are the non-material, intangible benefits that people receive from ecosystems, e.g. recreation, inner and religious experiences, inspiration, education.

Pollution of the marine environment and coastal areas with waste leads to a decrease in the quality of ecosystem services provided.

The organization of information events on the negative consequences and impact of solid waste at sea, aimed at increasing the ecological capacity of users of ecosystem services along the Black Sea coast, is an important step towards more sustainable waste management.

5.2.2 Upgrading the research experience in the field of minimization and utilization of marine litter

In the modern world, science is an important activity in which countries invest significant funds to achieve economic and social prosperity, to seek solutions to significant problems of today and to provide conditions for further development and upgrading of knowledge accumulated by previous generations. Part of the currently significant problems is related to marine litter (its reduction and recovery). Upgrading research experience in this area is a key measure to address the problem. Its implementation will allow the possible development of innovative technologies

for minimization and recovery of marine litter, which in turn will contribute to more adequate management.

The accumulation of monitoring information on the amount of litter, modeling of waste flows, development of new easily degradable materials, development of new technologies and methods for cleaning both coastal areas and the marine environment are key areas through which science contributes to reducing pollution of the marine environment.

5.2.3 Introduction of educational programs in kindergartens and schools

The introduction of educational programs related to marine litter in kindergartens and schools is a tool for raising awareness on the topic and promoting responsible behavior of children and young people. Discussing very real challenges such as marine litter in kindergartens and schools will contribute to educating a more informed and active generation.

Curricula can provide in an attractive way information about:

- The different types of marine litter and their characteristics;
- Sources, causes and impact of marine litter pollution;
- The time required for the decomposition of certain types of marine litter;
- The impact of marine litter on marine organisms, etc.

Presented in an attractive and fun way (e.g. games, quizzes, workshops, experiments, practical classes, exhibitions, competitions, excursions, etc.), this information remains in the minds of children for a long time. This is extremely important as they usually have the ability to inform and influence others in their immediate environment. In addition to being able to have responsible environmental behavior of their own, they also have the potential to bring about change by influencing peers, family and the general public. Research shows that children actually shape their parents' values and have a strong influence on their peers. In this sense, the application of such a measure will have a double effect, changing the thinking and attitudes of two generations simultaneously.

5.2.4 Establishment of mechanisms for exchange of detailed information between the Black Sea states regarding the pollution of the Black Sea with solid waste

The serious deterioration of the ecological health of the Black Sea gives rise to the six coastal ones countries: Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine signed the Convention on the Protection of the Black Sea against Pollution (Bucharest Convention) in April 1992 in Bucharest, Romania, which is a legal and diplomatic platform for joint action.

Cooperation between all six Black Sea countries is essential to maintain the sustainability of this shared resource (Black Sea). Establishment of mechanisms for the exchange of detailed information between them regarding solid waste pollution will contribute to the adoption of joint integrated decisions related to waste management. As litter is not affected by national borders, the solution to this problem can only be achieved through active cooperation between the countries in the Black Sea basin. Such cooperation can be greatly facilitated by the establishment of mechanisms for the exchange of detailed information on solid waste pollution. This can be done, for example, by setting up a single common database to store important information provided by each country on Black Sea litter, such as the results of monitoring or other studies; quantities and type of litter in the most polluted points; identification of trends based on comparison with previous results (if any), etc. In addition, a platform can be developed for the exchange of information on an operational basis in the event of an urgent need.

5.2.5 Integrated coastal zone management in the Black Sea

Integrated Coastal Zone Management (ICZM) in the Black Sea Basin allows for the introduction of mechanisms to stimulate environmental protection. ICZM should be aimed at increasing the expertise of employees in state and municipal institutions, activists from the non-governmental sector, among the scientific community and other participants in relation to the processes of spatial planning, with an emphasis on the integrated management of the Bulgarian Black Sea coast.

5.2.6 Control of wild sunbathing and camping

It is necessary to exercise control over wild beaching and camping for the protection of the marine environment. It is necessary to monitor it to occur only in places regulated by law and under regulated conditions.

For the places with permitted camping it is necessary to provide facilities for collection of the generated waste from the beachgoers / campers and their collection.

Raising the self-awareness of holidaymakers with regard to environmental protection and in particular reducing litter pollution will contribute to reducing litter pollution in coastal areas and the marine environment.

5.2.7 Development of systems for identification of illegal sources of pollution from sailing vessels and land-based facilities

The development of systems for the identification of illegal sources of pollution from sailing vessels and land-based facilities would contribute to reducing the accumulation of solid and liquid waste in the marine environment. This can be done by connecting to satellite sources for real-time monitoring. Radar is needed to locate the sources and a satellite to identify the pollutants themselves. Despite the innovativeness of the measure, the disadvantage is that in not all situations the floating remains of sunken ships or the waste dumped by the sailing vessels can be seen from satellite sources.

5.2.8 Evaluation of hazardous waste transportation

All risks posed by the transport of hazardous waste, possible accidents and the consequences for the environment must be assessed.

All shipments of hazardous waste must be carried out in the ways determined by the Bulgarian legislation or in accordance with the international agreements to which the Republic of Bulgaria is a part.

In addition to complying with international requirements, the transport of goods dangerous to the marine environment must be accompanied by additional measures aimed at protecting the environment. Measures to protect against pollution of goods dangerous for the marine environment

must be applied both during loading and unloading operations and during their transportation by sea in close cooperation with the port authorities, the operators of reception facilities in ports.

It is necessary to monitor the types and quantities of litter that will be transported and any waste that will be generated during their transportation. This can be done through the introduction of software to achieve higher standards for safe, environmentally friendly and quality transport services.

5.2.9 Provision of funds for separate waste collection in coastal areas, especially in areas without a concessionaire

According to the Law on Waste Management, all settlements with a population of more than 5,000 inhabitants and resort settlements are obliged to develop and implement systems for separate collection of packaging waste.

Separate collection systems will ensure a reduction in the amount of waste that enters the marine environment, as they contribute to the amount of waste recycled and, on the other hand, create responsible behavior in the public.

The funds for the implementation of the separate collection systems can be provided through various financial mechanisms such as the Norwegian Financial Mechanism, OPE and others.

5.2.10 Improvement and control of the sewerage infrastructure

The improvement, expansion and control of the sewerage infrastructure contributes to the collection of wastewaters so that it reaches the treatment plants, where the waste carried by them is captured at the entrance of the system, through gratings. Water treatment ensures less solid waste and pollutants that can reach the marine environment.

The implementation of such a measure will improve the condition of water bodies by reducing the burden of pollution.

5.2.11 Organized collection and transportation of waste from ports and boat docks and their subsequent disposal

Ports and berths must establish conditions for the collection of waste generated by vessels. For this purpose, sites must be organized to which waste can be transferred. On ships and floating technical facilities visiting and staying in ports, the generated household waste must be collected separately in sturdy plastic bags and stored in containers designated for this purpose. When filling the volume of the containers, the waste must be taken ashore for temporary storage in containers marked for the individual types of waste.

The transportation of household waste from the territory of the ports must be carried out by companies holding the relevant permit according to an approved schedule. The waste generated from onshore activities must be stored on designated sites. The generated waste from the vessels must be stored temporarily on the decks, in places determined by the master and periodically brought ashore with the help of a shore crane. Waste brought ashore to be stored by type on the respective sites. After filling the volume of the sites, the waste is handed over to companies. Oil-contaminated solid waste must be stored in sturdy polyethylene bags and metal barrels on board the ship until delivery and transported by the company for follow-up.

5.2.12 Establishment of a register of fishing nets

To reduce the amount of abandoned fishing nets, it is recommended to create a register with them. Each network must be entered with a unique registration number with information about the owner and type of network. The corresponding number must be placed on each registered network. Thus, in case of abandonment of the networks and their unauthorized disposal, the owners will be able to be found and brought to justice.

5.2.13 Restrictive financial instruments for waste minimization

Restrictive financial instruments for waste minimization aim to limit the amount of waste that is disposed of illegally in the marine environment. This can be done by introducing a register of networks, satellite tracking of waste, etc., through which to establish the persons responsible for the illegal dumping of waste.

On the other hand, to encourage the removal of waste from the marine environment or the collection of waste from it, it can be achieved by abolishing the fee due to ships and boats in cases where they export waste caught in their nets.

5.2.14 Effective implementation of existing and creation of new legal management measures by the state and local authorities.

Proper waste management is needed to reduce the amount of waste that enters the marine environment or has the potential to end up in it. It is necessary to create and maintain a system for separate waste collection, regular garbage collection, providing the necessary infrastructure for waste collection, which will ensure that they will not be scattered by animals or carried away by the wind.

On the other hand, it is important to monitor compliance with the measures established by law and violators to be sanctioned.

5.2.15 Development and implementation of incentives for proper storage and disposal of waste.

Human behavior is a particularly important tool in waste management, as its reduction, reuse and recycling are highly dependent on it.

Human behavior has a key role to play in waste management, as it is directly linked to the protection of natural resources and the reduction of environmental impact. This is not only because they can directly positively or negatively affect the state of the environment, but also because engaging more people with this problem is still a difficult task.

In the busy and hectic life of people it is practically impossible to invest time and effort to deal with a problem, the solution of which in most cases depends on management decisions. For this reason, it is not surprising that many people do not consider it necessary to engage in activities such as recycling and / or waste disposal. The lack of commitment from most people is a critical component of any waste management approach that depends on community participation and response.

The development and implementation of incentives for the proper storage and disposal of waste can be used as a key tool in this regard. Such incentives can be targeted, for example, at fishermen who collect waste in their nets and take it ashore.

5.2.16 Development of clean technologies leading to minimization of waste materials.

The introduction of clean technologies, industrial symbiosis in the industry, so as to achieve a circular economy, would lead to a reduction in waste generated. That will directly affect the amount of waste that has the potential to enter the marine environment.

The circular economy is a model aimed at extending the life cycle of products. In practice, this means sharing, borrowing, reusing, repairing and recycling existing materials and products for as long as possible.

When a product reaches the end of its life, the materials of which it is composed continue to be used in another way, which will minimize waste generation.

6. SYNCHRONIZATION OF ACTION PLANS FOR MARINE WASTE MANAGEMENT IN THE BLACK SEA REGION AT EUROPEAN, NATIONAL AND REGIONAL LEVEL

Cooperation between the countries of the Black Sea region is carried out through the Convention for the Protection of the Black Sea against Pollution (Bucharest Convention). Over time, this cooperation becomes stronger and more focused. At the 34th Meeting of the Parties to the Convention in 2018, the Black Sea Marine Litter Regional Action Plan was adopted, together with a work program for the implementation of the activities / measures included in it. .

The adoption of this action plan by the countries that have ratified the Bucharest Convention is the result of:

- Recognizing that marine litter in the semi-enclosed Black Sea basin has a particularly negative impact on marine and coastal ecosystems, the health status of the population and the normal development of the maritime economy, including tourism, fishing and shipping;

- Awareness that the right approach to marine litter problems at European, national and regional level has so far not been taken and that even real levels of marine litter pollution have not been properly assessed in the countries of the Black Sea;

- The agreement of the Contracting Parties to the Bucharest Convention to continue to strengthen cooperation with international organizations in the implementation of the Convention and its Protocols,

- The conviction that special activities must be carried out to overcome the problems of marine litter in the Black Sea;

- The signing of a Memorandum of Understanding (MOU, 2016) between the UN Environment Program and the Bucharest Convention, which aims to consolidate and strengthen cooperation between the parties, improve the exchange of information and strengthen regional cooperation to achieve their common goals and tasks in the field of marine and coastal protection.

The geographical scope of the action plan corresponds to that of the Convention (Black Sea with a southern border, representing the line connecting Capes Kelagra and Dalyan). The overall objective of the plan is to consolidate, harmonize and implement the necessary

environmental policies, strategies and measures for sustainable synchronized management of marine litter in the Black Sea region.

Specific objectives are:

- Prevention and minimization of marine litter pollution in the Black Sea and its impact on public health and safety, ecosystem services, species (especially endangered) and their habitats;

- Eliminate, as far as possible, existing marine litter using environmentally friendly methods;

- Raising awareness of marine litter;

- The management of marine litter in the Black Sea, which is carried out in accordance with accepted international standards and approaches and, if necessary, in accordance with programs and measures applied in other seas;

- Full implementation of the Joint Work Plan on Marine Litter and the Memorandum of Understanding between the United Nations Environment Program / Mediterranean Action Plan and the Permanent Secretariat of the Commission for the Protection of the Black Sea against Pollution, with a view to strengthening their cooperation by coordinating actions to achieve their common goals and objectives.

The parties under the Bucharest Convention, they must develop and implement, individually or jointly, national and regional action plans and programs containing measures and deadlines for their implementation.

National action plans may include:

- Development and implementation of appropriate policies, legal instruments and institutional arrangements, including solid waste management plans;

- Program for monitoring and assessment of the current state of the marine environment in relation to marine litter;

- Measures to prevent and reduce marine litter;

- Programs for disposal and environmentally sound disposal of existing marine litter according to the national legislation for management of this type of waste;

- Educational programs and awareness raising campaigns.

The establishment of action plans for marine litter management in the Black Sea region puts on the agenda the need to join forces at both European and national and regional levels by creating an integrated action program to achieve environmental and economic sustainability of maritime regions. This action program must be tailored to cover both land-based human activities and those related to the immediate use of the marine environment, as well as natural processes and changes.

7. CONCLUSIONS

Based on the studied information, we can conclude that the Black Sea coast is vulnerable to anthropogenic and man-made activities. The litter enters the sea through the river outflow, from coastal facilities, embankments, through dredging, shipping activities, tourist activities, sewerage, etc.

Every year, huge amounts of marine litter fall on the coast, sea surface and bottom and lead to deterioration of water quality and living conditions of marine biocenoses. Marine litter includes materials of various origins and composition - plastic, metal, wood, rubber, glass or paper, intentionally and directly disposed of in the sea, on beaches or introduced indirectly through rivers, sewers, rainwater collectors, storms, wind and more.

Marine litter has an extremely important impact on the balance of the Black Sea ecosystem. Marine litter sources are an issue that is closely linked to the ecosystem and public health, environmental protection, marine habitat dynamics, biodiversity and the sustainable development of the Black Sea region.

Marine litter has a negative impact on both populations and ecosystems, human health and the economy, which makes solving the problem of marine litter crucial.

The RedMarLitter project gives citizens access to information on the state of marine litter in the Black Sea. Through the developed database, the project provides access to information on marine litter available in the Black Sea, such as type and amount of litter transferred, concentration by type and size. In addition to informing citizens, the activities aim to show the general public that everyone can contribute to reducing pollution in the Black Sea basin.

These guidelines provide information to the general public on how it would contribute to the improvement of the marine environment through its direct and indirect actions and what measures should be taken by state and local authorities, business and academia for a cleaner sea.

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