

## WP4.2 Proposal of actions for developing public policies for an improved management of marine litter

### Activity 4.2.1. Best policies and proposal collection and fine-tuning



**Title:**

**Marine litter tackling in Lebanon: actions and recommendations**

**Ali Badreddine-Rebecca Baissari**

## Introduction and aim of task:

COMMON project (COastal Management and MONitoring Network for tackling Marine Litter (ML) in Mediterranean Sea), is funded by the **European Union** under the **ENI CBC MED programme**, this project aims to use the Integrated Coastal Zone Management (ICZM) principles to tackling marine in 5 pilot coastal areas in Italy, Lebanon and Tunisia.

The project is composed of 5 Work Packages. INSTM (as PP1) is a leader of WP4 (Institutional capacity building in tackling marine litter throughout ICZM plan). This WP aims to pull out legal recommendations (rules and law) and best practices for developing public policies for improved management of marine litter and governance of targeted coastal areas.

In this regard, **the activity 4.2.1: “Best Policies and proposal collection and fine-tuning”** aims to collect from involved people the good concrete practices, best experiences, and ideas for marine litter disposal for each active country and at Mediterranean level to improve waste management reviews, community-based methodologies, wastes reducing rules and laws, individual and corporate behavior changes, communication best actions.

The recommendation will be pulled out during training sessions, awareness days, scientific actions (Beach monitoring, microplastic sampling, biota analysis), and from the created networks.

### **\*The outputs of the task are:**

Four final reports with legal recommendations (rules and laws) and best practices for improving the management of marine litter. Three reports will collect all the propositions for each involved country (Italy, Lebanon, and Tunisia), and one report will be the same for the Mediterranean basin.

### **\*Target Group:**

EU and Mediterranean local, regional and national policy makers and wastes agencies.

**\*This document** provides guidelines and a template to the consortium partners on the redaction of the final report of recommendation and proposition for improving ML management for each targeted country.

## Report Plan:

### Overview:

#### State of play:

#### Each partner:

- \*Provides statistics on marine litter at local level and on the pilot areas if available.
- \*Present the main current laws regarding waste management, especially plastics, the existing gaps and how to improve.

The Lebanese coast is affected by a wide range of anthropogenic pressures. Urban sprawl and pollution from wastewater effluents, including river discharges, appear to be the most severe and permanent coastal zone problems (UNEP ERML, 2012). In addition, numerous mismanaged open-air dumpsites and landfills along the coast point out their potential contribution to MP's entry into the marine environment (UNDP, 2017<sup>1</sup>; Kazour *et al.*, 2019<sup>2</sup>). As a result, Lebanon leaks into the sea a total of 3,321 tonnes/year of macroplastics compared to neighboring countries like Egypt (74,031 tonnes/year), Turkey (23,966 tonnes/ year), and Cyprus (332 tonnes/year) (Boucher & Bilard, 2020<sup>3</sup>). It is worth noting that Plastics do not constitute the most significant proportion of the municipal solid waste generated in Lebanon (11.5%). Still, it was shown that it becomes the major pollutant once it reaches the sea, making 85% of floating litter. Up to 95% of waste lies on the seafloor, with the highest percentage of plastics as packaging's such as bottles and drink containers, food boxes, bags, and single-use disposable items, including cotton sticks, lighters, and plastic dining utensils. (UNEP/MAP, 2015<sup>4</sup>).

In 2019, a study of the Microplastics in surface water, sediments, and biota samples of three sites on the Lebanese coast (Tripoli, Beirut, Sidon) showed high contamination of microplastic in the sea surface with a concentration of 4.3 items/m<sup>3</sup>. The study also confirms the increased occurrence of MPs in the biota, with 83.4% and 86.3% in anchovies and spiny oysters, respectively. In addition, the study confirms microplastic ingestion by *Spondylus spinosus* while indicating the most common polymers found in the three matrices (water, sediments, and biota) in the Eastern Mediterranean (Kazour *et al.*, 2019).

In 2021, a study of the floating Marine Litter in two sites in the Lebanese waters (Beirut and Tyre) showed 23,023 plastic items. The obtained results demonstrated that the average macroplastics and microplastics concentration was  $0.45 \pm 0.6$  items/m<sup>3</sup> and (12.13 items/m<sup>3</sup>), respectively. The average microplastic concentration was  $20.1 \pm 21.8$  and  $3.78 \pm 5.2$  items/m<sup>3</sup> in spring and fall, respectively. During fall, MPs fragments were dominant in Beirut (97%), and

<sup>1</sup> UNDP (2017). Updated Master Plan for the Closure and Rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon, volume A, 443.

<sup>2</sup> Kazour, M., Jemaa, S., Issa, C., Khalaf, G., and Amara, R. (2019). Microplastics Pollution along the Lebanese Coast (Eastern Mediterranean Basin): Occurrence in Surface Water, Sediments and Biota Samples. *Sci. Total Environ.* 696, 133933. doi: 10.1016/j.scitotenv.2019.133933.

<sup>3</sup> Boucher, J., and Bilard, G. (2020). *The Mediterranean: Mare Plasticum*. Gland, Switzerland: IUCN, 62.

<sup>4</sup> UNEP (2015). Regional Seas Programme, UNEP. Marine Litter: An Analytical Overview. Available at: <http://hdl.handle.net/20.500.11822/8348>.



Tyre (91%), and no pellets were observed. During spring, filaments were most encountered in Beirut (76.5%). The most dominant marine litter color was blue, followed by black and white. The Pollution Load Index (PLI) values showed moderate contamination of the Lebanese coast with MPs (PLI:  $5.79 \pm 3.93$ ) except for several sites in Beirut that showed high values of PLI, highlighting the local influence of cities and rivers on MPs concentration (Jemaa *et al.*, 2021<sup>5</sup>).

In the same year, 2021, a study of the marine debris presents on the beach of Tyre showed, respectively, a dominance of Cigarette butt with a percentage of 33.2%, Plastic fragment – film (23.0%), Plastic fragment-hard (12.2%), Caps/ lids/ lid rings (7.1%), multi-layer/food packaging 6.1%, Beverage bottles (4.6%), Metal bottle cap (4.5%), straws (3.5%), Plastic cups (3.1%), and Tissues/kleenex (2.7%). At the same time, the marine debris in Tyre waters showed, respectively, a dominance of Cigarette butt with a percentage of 65.3%, Plastic fragment – film (8.8%), Plastic fragment-hard (5.4%), Metal bottle cap (4.9%), Caps/ lids/ lid rings (4.2%), Plastic cups (3.1%), Tissues/kleenex (2.9%), multi-layer/food packaging (2.5%), Beverage bottles (1.9%), straws (2.0%), and Polystyrene fragment (2.1%)<sup>6</sup>.

In 2022, a study of the microplastics (MPs) in the sediment, between 2 and 120 m dept, of 10 sites, including Tyre and Tyre Coast Nature Reserve, showed concentrations ranged between 0 and 4500 MPs/kg of dry sediment ( $1126 \pm 1363$  MPs/kg). Polypropylene, polyethylene, polyethylene terephthalate, and polystyrene were the polymers identified on micro-Raman. In addition, coastal landfills and raw sewage effluents were identified as the primary sources and routes for MPs into the Lebanese coastal marine environment (Mahfouz *et al.*, 2022)<sup>7</sup>.

Since 2019, the impact of marine litter has been analyzed through a sea turtles stranding network (SPA/RAC-UNEP/MAP ,2020)<sup>8</sup>, and a Lebanon National strategy for monitoring IMAF Candidate Indicator 24 (SPA/RAC-UNEP/MAP 2021a)<sup>9</sup>. As results, from 26 necropsied sea turtles in 2019 and 2020, an average of 40 % of marine litter were ingested by the stranded sea turtles SPA/RAC-UNEP/MAP (2021a)<sup>10</sup>. While in 2021, from 22 sea turtles necropsied, the marine litter ingested was 10, 21 %.

<sup>5</sup> Jemaa S, Mahfouz C, Kazour M, Lteif M, Hassoun AER, Ghsoub M, Amara R, Khalaf G and Fakhri M (2021) Floating Marine Litter in Eastern Mediterranean From Macro to Microplastics: The Lebanese Coastal Area as a Case Study. *Front. Environ. Sci.* 9:699343. doi: 10.3389/fenvs.2021.699343

<sup>6</sup> Baseline study for Marine Litter in Lebanon-MoE-World BANK Group-PROBLUE-BALAMAND UNIVERSITY-MORES under the framework of the project: Building capacity to prevent and Reduce pollution in Marine Environments in Lebanon.

<sup>7</sup> Celine, Mahfouz, Jemaa Sharif, Kazour Maria, Hassoun Abed El Rahman, Lteif Myriam, Ghsoub Myriam, Ouba Anthony, Amara Rachid, and Fakhri Milad. "First assessment of microplastics in offshore sediments along the Lebanese coast, South-Eastern Mediterranean." *Marine Pollution Bulletin* 186 (2023): 114422.

<sup>8</sup> SPA/RAC-UNEP/MAP (2020). A Stranding Network for Sea Turtles and Cetaceans & A Protocol for Monitoring the Interaction between Marine Litter and Marine Turtles in Lebanon. By Badreddine, A., Samaha, L., Joumaa, F., Abderrahim, M., Limam, A., & Ben-Nakhla, L. Ed. SPA/RAC. Marine Litter MED project Tunis: pages 19 + Annexes.

<sup>9</sup> SPA/RAC-UNEP/MAP, 2021a. Lebanon National strategy for monitoring IMAF Candidate Indicator 24. By Badreddine, A., Samaha, L., Abderrahim, M., Limam, A., & Ben-Nakhla, L. Ed. SPA/RAC. Marine Litter MED project. Tunis: pages 25.

<sup>10</sup> SPA/RAC-UNEP/MAP, 2021a. Results of the stranding networks for sea turtles in Lebanon. By Badreddine, A., Samaha, L., Abderrahim, M., Limam, A., & Ben-Nakhla, L. Ed. SPA/RAC. Conservation of Marine Turtles in the Mediterranean Sea project. Tunis: pages 20 + Annexes.



Lebanon ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal under law #387 of 21/12/1994. Furthermore, it approved the Stockholm Convention on Persistent Organic Pollutants for Adoption by the Conference of Plenipotentiaries by law #432 of 8/8/2002.

The Lebanese government, within the same framework, prepared for the issuance of several related decrees:

- Decree to regulate and monitor the import-export of industrial waste, including hazardous wastes.
- Decree to classify wastes (industrial and toxic) and to regulate waste disposal methods for each of the classifications.
- Decree to regulate the licensing process for industrial and toxic waste disposal companies.

Several draft laws are still caught in the legislative process, particularly the draft of the Integrated Coastal Zone Management (ICZM) law and the new draft Fishing Law. The ICZM law provides a clear definition of the CZ and includes articles stipulating the creation of the National Council for ICZM. In contrast, other articles are related to sanctions and penalties. On the other hand, the draft Fishing Law prepared by the Ministry of Agriculture (MoA) considers the new challenges in fisheries management and the new scientific references and benchmarks for the sustainable management of marine resources.

There is a significant need to raise awareness of everyone's responsibility to tackle the source and impact of marine pollution and to mobilize policies that provide new legislation for banning plastics and establish a legal framework for a waste management plan. In addition, behavior changes for citizens and building capacity of municipalities for law enforcement (Preventive policies including bans, taxation, and fines) are crucial as some local groups and municipalities are active in terms of beach maintenance and cleanup.

According to Law 444/2002 - Framework for the protection of the environment and the national legislation related to ISWM Law #80/2018, it is recommended to promote plastics/solid waste management and circular economy, support chemical and waste management plans in a joint effort with partners including with government agencies, research institutions, private sector, and international agencies and support local initiatives from raising awareness on waste management including plastics to reduce, reuse and sorting at the source. In addition, Law No. 444/02 (Code of Environment) Article 31 requires a permit for sea discharge, and Article 44 requires a permit for the import, handling, or disposal of dangerous/ hazardous chemicals. While Law No. 80/2018 Integrated Solid Waste Management law setting integrated solid waste management principles. It provides guidelines for the management of non-hazardous waste and hazardous waste.

#### *Report objectives:*

\* A common objective between the three countries will be welcome (drafting a guideline to present practical solutions and proposed recommendations to influence policymakers, the general public and the media in order to reduce marine litter by using ICZM approach).

The present report aims to present the following:

- The impact of marine debris on the beach and water of the pilot areas of the three countries.



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- The influence of these results on the local/ national level.
- The impact of the awareness to reduce the use of plastics, especially from local communities.
- Increase the degree of knowledge on the impact of marine litter through monitoring training programs for fishers/ divers/ students/ scouts/ beach visitors.
- Creating coastal city networks allows for reduction of the use of plastics. In addition, it helps to make decisions and regulations, enforce the application of laws, and ensure the strategy of stopping "single-use plastic."

### I- State of play of marine litter issue regarding the national COMMON pilot areas:

#### I-1- Knowledge of litter sources and impact on marine ecosystems resulting from the COMMON project scientific actions:

(A general paragraph mentioning the Beach monitoring results, microplastic sampling results etc. )

During the “Cleanup the Med” campaign held by Tyre Coast Nature Reserve (TCNR)-PP5 on 22 May 2022, 55 plastic bottles were found, 33 glass, 495 cigarette butts, 10 woods, 35 plastic bags, 21 plastic chicha, eight papers, 18 straws, 68 steel bottle caps. This result agrees with the study done by the “World BANK Group-PROBLUE-BALAMAND UNIVERSITY-MORES under the framework of the project: Building capacity to prevent and reduce pollution in Marine Environments in Lebanon” in 2021, where cigarette butts were the highest item found in Tyre Coast Nature Reserve beach.

#### I-2- Institutional capacity building in tackling marine litter: training activities with local stakeholders, focuses and proposals:

\* **General part:** indicate the number of achieved workshops, place of training, number of involved people etc.

\* **Specific part:** Describe each training, focusing on the theme discussed, the proposals that came out etc.


During the project, Amwaj (PP3), and TCNR (PP5) organized (Table 1):

- 10 meetings with stakeholders represented by local communities (women of Hima/ divers/ fishers/ Palestinian refugee’s/ Beach kiosks owners), local authorities (Civil defense/ Litany River Authority) focusing on:
  - Cooperation, coordination and law enforcement.
  - Enhancing fishing behaviors and combatting marine litter.
  - Improving environmental responsible media and engaging media sector.

- Promoting responsible fishing and encouraging good practices marine ecosystem conservation.
- Activating the marine rescue unit.
- Training on good practices for reducing marine litter.
- Good management of Water resources.
- Monitoring of marine life in deep seas.
- Enhancing the role of women in protecting marine life.
- Importance of sorting waste.
- Degree of knowledge and education related to marine litter pollution and its impact.
- 3 training workshops for students and fishers focusing on:
  - Actions and techniques for releasing a caught sea turtles/ birds/ sharks/ and dolphins
  - Monitoring techniques to study the impact of marine litter ingested by turtles
  - Monitoring techniques to study the impact of marine litter on fishes (especially Lionfish)
- 1 local workshops with stakeholders represented by local local (Fishers/ Divers/ Palestinian Refugee/ Beach Kiosks owners), Ministries of Environment and Agriculture, Coastal Municipalities, Marine Protected Areas team, Non-Governmental Organizations and National organizations (Local authorities/ Civil defense) from Tyre area focusing on The importance of protecting sea turtles from Marine Litter.

**Table 1**

Meetings/ Trainings/ Local workshops done by Amwaj (PP3), and TCNR (PP5), including the target groups, Place and Date of the activity, Themes and Objectives, Number of Participants, and comments (if there were).



Meetings					
Target Group	Partner	Place & Date	Themes and Objectives	Number of Participants	Photos/ Comments
Local Authorities	PP3	Tyr House 20/12/2021	Corporation, coordination and law enforcement.	11	




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Fishers Syndicate Members	PP3	Fishers Syndicate Center 22/12/2021	Enhancing fishing behaviors and combatting marine litter.	9	
Media	PP3	Elissar Boat Restaurant 23/05/2022	Improving environmental responsible media and engaging media sector.	7	
Fishers in Tyr	PP3	Tyr Port 24/05/2022	Promoting responsible fishing and encouraging good practices marine ecosystem conservation	34	
Civil Defense	PP3	Civil Defense Center 26/05/2022	Activating the marine rescue unit.	12	



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Touristic Operators (Restaurant )	PP3	Tyr Beach Reserve 31/05/2022	Training on good practices for reducing marine litter.	8	
Litany River National Authority	PP3	Litany River Center	Good management of Water resources.	6	
Divers	PP3	Fonar Tyr Beach	Monitoring of marine life in deep seas.	8	
Women in Marine Hima	PP3	Hima Farm Center	Enhancing the role of women in protecting marine life.		

Citizens in Rashidiyeh Camp	PP5	Al Jaleel organization at Rashidiyeh camp 13/10/2020	Importance of sorting waste.	25	
<b>Trainings</b>					
Students	PP5	Tyre Coast Nature Reserve 15 of September 2022	Actions and techniques for releasing a caught sea turtles/ birds/ sharks/ and dolphins.	37	 <p data-bbox="873 1016 1419 1115">The students have been trained on the field to collect and sort the marine litter. They have also been trained in disabling a sea turtle and studying the impact of marine litter on a sea turtle.</p>
Fishers	PP5	Syndicate of Tyre 29 of November 2022	<ul style="list-style-type: none"> <li>• Monitoring techniques to study the impact of marine litter ingested by turtles</li> <li>• Monitoring techniques to study the impact of marine litter on fishes (especially Lionfish).</li> </ul>	20	 <p data-bbox="873 1493 1101 1520">It has been recommended:</p> <ul style="list-style-type: none"> <li>•To work more on the involvement of fishers in the monitoring activities.</li> <li>•The importance of declaring the loose of nets by the fishers.</li> <li>•The importance of cleaning the sea waters from marine litter.</li> <li>•Help the fishers by training them and involving them in the ongoing projects.</li> <li>•The importance of contacting Tyre Coast Nature Reserve and especially the national expert in case of accidentally catching a flag species.</li> </ul>

Beach kiosks operators	Tyre Beach Reserve/tourist zone 28/07/2021	PP5	Recycling marine litter as a good source of economy Increase the circular economy	20		
<b>Local workshops</b>						
Main stakeholders of Tyre		PP5	Tyre Resort (Rest House Hotel). 17 September 2022 at	The importance of protecting sea turtles from Marine Litter	29	 <p>It has been recommended:</p> <ul style="list-style-type: none"> <li>• Protection and conservation of sea turtles should be a priority.</li> <li>• More connection with Tyre Coast Nature Reserve- and- the sea turtles first aid rescue center.</li> <li>• To focus on the awareness to fight plastic.</li> <li>• Importance of recycling.</li> <li>• Importance of working with kids (new generations).</li> <li>• Priority to enhance the link between Ministries and Municipalities and Reserves to reduce the use of plastic</li> <li>• Involvement and Work more with divers and fishers to clean the sea.</li> <li>• Synergy between all the projects dealing with plastics to a better management.</li> </ul>

### I-3- Best practices collected in pilot areas:

#### a- Management of Waste collected during fishing activity:

Based on a survey done by TCNR (PP5), best practices have been collected from different NGOs/ Municipalities, and Local authorities, as follow:

- Collection of losing nets (ghostnets)
- Collection of marine debris on sea surfaces



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- Awareness on the importance of cleaning the beach (plastic free beaches/sea campaign)

b- Reduction of waste production/recycling (touristic operator, etc):

Based on a survey done by TCNR (PP5), best practices have been collected from different NGOs/ Municipalities, and Local authorities, as follow:

- Remove the tar and oil residues from beach to prevent damage to wildlife and marine species and protect the environment from tar pollution.
- Reduce the environment pollution and the amount of waste dumped.
- Enhance waste management and reduce the risk of waste incineration in dump.
- Improved Capacity Building on Coastal governance and waste management Improved services and quality to the TCNR activities/service.
- Empower citizens (workers, fishermen, tourists ...) towards more ecological behaviors.
- Participative Cleaning and awareness campaign.
- Pilot actions for reducing litter production and better coastal waste management.
- Find solutions for non-recyclable materials.
- Transform chips bags into some accessories and keys.
- Manufacture speed bumps with the use of colored glass powder.
- Develop the environmental awareness of students through sorting wastes.
- Learn upcycling to manufacture art crafts.
- Reduce the quantity of waste produced from the school to less than half.
- To benefit from old fabrics and convert them to new art pieces.
- For continuous training for women to learn sewing crafts.
- To enhance the economic status of women in the region and provide them learning an old craft.
- The quantity of non-recycled fabrics decreased.
- Women and girls started selling their products made of plastics and promoting them in the center and on social media.
- Beginning of the creation of “plastic free schools”.
- Segregation of wastes in specific bins and sea turtle’s activity are more noticeable.

### I-4- Awareness actions:

\* Describe briefly the awareness actions (e.g., number of released awareness days, target group, number of involved people etc. ...). You can also use the questionnaire shared with fishers, tourism operators etc....

(Insert a photo for each awareness day)



TCNR (PP5) focused on questionnaires survey, in this context:

- 31 questionnaires were filled with fishers
- 12 questionnaires were filled with associations and some schools, scouts, and coastal municipalities.
- 20 questionnaires (Table 2) were filled before and after the summer season of 2020, 2021, and 2022.

**Table 2**

Number & Date of the survey before and after the summer season and the location

Years	Number & date of questionnaires before season filled	Number & date of questionnaires after season filled	Location
Year 2020	20 questionnaires July 2020	20 questionnaires October 2020	Tyre beach reserve/tourist zone
Year 2021	20 questionnaires July 2021	20 questionnaires October 2021	Tyre beach reserve/tourist zone
Year 2022	20 questionnaires August 2022	20 questionnaires October 2022	Tyre beach reserve/tourist zone

In addition, TCNR (PP5) and Amwaj (PP3) organize six awareness campaign (Table 3) for local scouts/ divers/ students, focusing on:





- Importance of sea turtles
- Impact of Plastic Recycling
- Impact of plastic on Marine Lives, especially sea turtles
- How to collect Marine Litter samples
- Importance to stop single use plastic
- Push for a Plastic free beach

**Table 3**

Awareness done by Amwaj (PP3), and TCNR (PP5), including the target groups, Place and Date of the activity, Number of Participants, and comments (if there were).

Target Group	Partner	Place & Date	Number of Participants	Photos/ Comments
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Scouts	PP3	Scouts Center 30/05/2022	22	
Beach Goers/visitors	PP3	Tyr Beach Reserve 01/06/2022	9	
Farmers of Tyr Reserve	PP3	Tyr Beach Reserve 01/06/2022	8	
Hima Community	PP3	Hima Farm Center 15/06/2022	16	

Scouts	PP5	TCNR (visitor center and turtle expedition)- 7 September 2022	138	
Local community (students, beach lovers, divers, fishers)	PP5	TCNR (scientific zone) - 11 September 2022	21	

## I-5- Creation and support of networks:

Amwaj establish 4 networks (Table 4) including:

- Coastal Cities Network
- Touristic Operators Network
- Turtle Rescue center network
- Blue Network



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In this context TCNR (PP5) organize a workshop for the establishment of coastal cities networks. It has been done was done on the 30 of December 2022 at Tyre Resort (Rest House Hotel) with 33 participants including the presence of Union of Municipality of Tyre and Zahrani (south Lebanon) president, south Lebanon coastal cities president of municipalities (Tyre, Zahrani, Nakoura, Mansouri, Koulaylé, Borj Rahal, Abbasiyeh), local NGO (AMWAJ and ACE), students, divers, fishers, local community, Hima Mansouri and Abbasiyeh Coast Nature Reserve representative.



Figure. Coastal cities workshop organized by TCNR

Table 4

Networks organized including number of meetings/ Number of involved municipalities and administratives/  
Location and date and Comments/ Photos.

Partner	Networks	Number of meetings	Number of involved municipalities and administrations	Location /Date
PP3	Coastal Cities Network  	6	30	Tyr, Naqoura, Qoleily, Zahrani, Saida, Jiyeh



PP3	Touristic Operators Network	20	100	Tyr Beach Reserve 01/06/2022
PP3	TRCs	2	56	Tyr Beach Reserve 01/06/2022
PP3	Blue Network	1	50	Hima Farm Center 15/06/2022

## II- Recommendations to tackle marine litter:

\* Categorize the recommendations collected from different project actions (Part I), as well as recommendations according to our own experiences

### II-1- Scientific actions (beach monitoring, microplastic sampling, biota)

TCNR (PP5) contracted the Lebanese National Center for Marine Sciences (NCMS/ CNRS) for collecting and analyzing micro/ macro litter data. In this context, the amount and types of micro and macro particles (plastics or others) in the marine area of Tyre city during wet and dry seasons of 9 sampling sites were performed in 9 sampling sites Table 5, Table 6, and Figure 2.

**Table 5**

Description and coordinates of sampling transects in wet season

Date	SAMPLE ID	SAMPLING AREA	SAMPLING STATION (nm)	Time of sampling	Starting Coordinates (Lat/Long)	Ending Coordinates (Lat/Long)
19/05/2022	1.5N	Tyre	1.5 NM offshore Northern Tyre in front of the port Entrance	10'	N33°17.129' / E35°11.313	N33°17.582' / E35°11.496
19/05/2022	3N	Tyre	3 NM offshore Northern Tyre in front of the port Entrance	10'	N33°17.778' / E35°09.569	N33°17.490' / E35°09.595
19/05/2022	6N	Tyre	6 NM offshore Northern Tyre in front of the port Entrance	10'	N33°18.960' / E35°05.690	N33°19.499' / E35°05.748
19/05/2022	1.5M	Tyre	1.5 NM offshore the TCNR	10'	N33°15.434' / E35°10.971	N33°15.834' / E35°10.951
19/05/2022	3M	Tyre	3 NM offshore the TCNR	10'	N33°15.463' / E35°09.105	N33°15.126' / E35°09.154
19/05/2022	6M	Tyre	6 NM offshore the TCNR	10'	N33°15.830' / E35°05.499	N33°16.298' / E35°05.422

19/05/2022	1.5S	Tyre	1.5 offshore Southern in front of Ras-el-Ain	10'	N33°13.376' / E35°11.023	N33°14.147' / E35°11.210
19/05/2022	3S	Tyre	3 offshore Southern in front of Ras-el-Ain	10'	N33°13.665' / E35°09.166	N33°13.415' / E35°09.379
19/05/2022	6S	Tyre	6 offshore Southern in front of Ras-el-Ain	10'	N33°13.590' / E35°05.401	N33°14.053' / E35°05.523

**Table 6**

Description and coordinates of sampling transects in dry season

Date	SAMPLE ID	SAMPLING AREA	SAMPLING STATION (nm)	Time of sampling	Starting Coordinates (Lat/Lon)	Ending Coordinates (Lat/Log)
18/08/2022	1.5N	Tyre	1.5 NM offshore Northern Tyre in front of the port Entrance	10'	N33°17.135' / E35°11.328'	N33°17.498' / E35°11.533'
18/08/2022	3N	Tyre	3 NM offshore Northern Tyre in front of the port Entrance	10'	N33°17.777' / E35°09.482'	N33°17.382' / E35°09.341'
18/08/2022	6N	Tyre	6 NM offshore Northern Tyre in front of the port Entrance	10'	N33°18.952' / E35°05.828'	N33°19.445' / E35°05.938'
18/08/2022	1.5M	Tyre	1.5 NM offshore the TCNR	10'	N33°15.325' / E35°10.923'	N33°15.868' / E35°11.167'
18/08/2022	3M	Tyre	3 NM offshore the TCNR	10'	N33°15.436' / E35°09.047'	N33°15.036' / E35°09.055'
18/08/2022	6M	Tyre	6 NM offshore the TCNR	10'	N33°15.908' / E35°05.475'	N33°16.398' / E35°05.664'
18/08/2022	1.5S	Tyre	1.5 offshore Southern in front of Ras-el-Ain	10'	N33°13.672' / E35°10.906'	N33°14.092' / E35°10.959'
18/08/2022	3S	Tyre	3 offshore Southern in front of Ras-el-Ain	10'	N33°13.573' / E35°09.100'	N33°13.104' / E35°08.892'
18/08/2022	6S	Tyre	6 offshore Southern in front of Ras-el-Ain	10'	N33°13.571' / E35°05.609'	N33°13.959' / E35°05.752'



**Figure 2.** Sampling transects offshore Tyre coastal area



### As results:

In wet season (May 2022):

- A total of 8796 items of plastics were identified. The most abundant fraction is the Microplastics (MPs) and constitute 8199 items followed by the mesoplastics 532 items and by macroplastics 65 items.
- A total of 285947 items were found on the sea surface during the survey in Tyre region. The highest number was found in site 6N (264786 items) followed by site 6M (20005 items) and site 1.5 M (566 items). The lowest number of items was found in site 3S (6 items) and site 6S (17 items) followed by 1.5S, 3M and 3N with respectively 18, 260 and 289 items.

In dry season (August 2022):

- A total of 1962 items of plastics were identified. The most abundant fraction is the Microplastics (MPs) and constitute 1799 items followed by the mesoplastics 159 items and by macroplastics 4 items.
- A total of 4324 items were found on the sea surface Tyre region during the dry season. The highest number was found in site 3N (2082 items) followed by site 1.5N (944 items) and site 3M (5633 items). The lowest number of items was found in site 6M (3 items) and site 6S (13 items) followed by 1.5M, 6N and 3S with respectively 16, 42 and 48 items.

TCNR (PP5), through its marine turtle expert, analyzed the ingested marine litter from 15 sea turtles (10 *Caretta caretta* and 5 *Chelonia mydas*). As a result, 55 Marine litter items (7.62 g) were observed in the GI of the necropsied and analyzed sea turtles. Therefore, marine litter ingested from the necropsied sea turtles constituted 32.20 % of the GI contents.

For the biota (Fish and Mollusks), the samples from TCNR were shared with Higher Institute of Biotechnology Monastir, Tunisia and the data was not shared yet with the Lebanese partners.

It is highly recommended, and crucial to share these data with TCNR.

### II-2- Institutional capacity building (training workshops):

As training workshops, it is highly recommended to:

- Regularly organize training on plastic sorting/ recycling; waste collection for local community, especially divers/ fishers/ tourist
- Push for a free plastic beach and seas
- Organize awareness for reducing the use of plastic
- Stop the single use plastic
- Develop the coastal cities networks for fighting against plastic pollution
- Increase the knowledge on regulations/ laws/ decision allowing the decrease of use of plastics
- Train on monitoring techniques of Marine litter on the beach and on the sea

### II-3- Best practices collected in pilot areas

As best practices, some actions are recommended:

- Providing support to fishers of Tyre pilot area for conserving marine life and enhancing the fishers' income.
- Improving measures for protecting marine resources in Tyre waters.
- Organize a plastics collection for touristic operators and sell them for recycling.
- Supporting and equipping marine rescue centers for immediate intervention.
- Providing touristic beach operators with bins for waste segregation and tools for awareness and guidance.
- Changing behaviors to be more environmental to reduce waste production and tackle marine litter and environmental issues, like non-using single plastic bottles.
- Plant trees that absorb water.
- Support best practices and encourage initiatives and efforts for combatting marine litter.
- Stop discharge of rivers and waste water containing pollutants in the sea.
- Treatment of waste water and rivers.
- Engaging all schools in marine litter and environment.
- Apply environmental rules like stopping single plastic use, follow-up on applying rules.
- Put taxes on pollutants.

### II-4- Awareness action:

Awareness action should focus on:

- The importance of cleaning the beach and sea from plastic
- The impact of marine litter on beach/ sea/ marine life/ human/ economy
- The importance of sorting/ Recycling/ Reuse plastics
- The importance of recycled plastic as an economical resource
- The importance to work together to fight against plastics
- The importance of the execution of regulation/ laws/ decision
- Increase the awareness for reducing the use of plastics (especially through national/ regional/ and international projects).
- Implement awareness campaigns for the local community, and visitors (especially during summer) on solid waste management.
- Work more on the behaviors in parallel with the awareness to reduce the use of plastics.



## II-5- Creation and support of networks:

It is recommended to:

- Create a network to be called Blue-Green Network for marine protected areas and Himas.
- Develop the local cities networks created for reducing the use of plastics
- Create a regional network for reducing plastics

## Conclusion

Wrap up the recommendations and classify them in to short, medium and long term

From a protection and conservation point of view, there is a big necessity to move faster for reducing the use of plastic.

In this context it is recommended for:

- The short term:
  - ❖ Providing touristic beach operators with bins for waste segregation and tools for awareness and guidance.
  - ❖ Support fishers in the area of Tyre Reserve and respect the rules.
  - ❖ Stop discharge of polluted water in the sea.
  - ❖ Coordinate and cooperate with the municipality to clean the waste.
  - ❖ Develop a proposal for funding integrated solid waste management in TCNR.
  - ❖ Distribute small bins for cigarette buds across the sandy beach and smoking stations in collaboration with kiosks owners, especially during summer.
- Medium term:
  - ❖ Organize the collection of plastics in touristic operators and selling for recycling.
  - ❖ Support and encourage best practices for combating marine litter.
  - ❖ Increase the number of compartments bins across the reserve including organic, recyclables, and other waste.
  - ❖ Collaborate with Material Recovery Facilities near Tyre to collect segregated waste from the reserve.
  - ❖ Clean TCNR waters from ghostnets.
- Long term:
  - ❖ Act in line with the Protocol of Barcelona for the Protection of the Mediterranean Sea Against Pollution from Land-Based Sources.
  - ❖ Regularly remove garbage marine litter brought to TCNR by sea currents, in cooperation with local community, local NGOs, through projects and in cooperation with the municipality of Tyre.



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- ❖ Forbid the use of single-use plastics within TCNR zones by taking some decisions and agreement with the union of Municipalities of Tyre.
- ❖ Offer alternative to single-use plastic to kiosks owners by collaborating with national recycling facilities to supply recyclable disposable cutlery made from paper or decomposable material (cups, plates, forks, knives, boxes).
- ❖ Impose a penalty or violation fee for any action of marine littering or waste dumping in the reserve.
- ❖ Incentivize the visitors to recycle by installing reverse-vending machines where each plastic bottle will earn the depositor a point, and the collection of points can be redeemable against a coupon.
- ❖ Implement techniques for sorting the litter mixed with the beach sand in cooperation with Tyre Municipality.