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Seville, Spain, 17-18 May 2022

Agenda Item 4: Best Practices Addressing the New Elements of the Regional Plan on Marine Litter Management in the Mediterranean

Overview of measures/instruments to prevent, control and manage marine litter generation from wastewater treatment plants, aquaculture activities, riverine inputs, and shipping

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UNEP/MAP
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Note by the Secretariat

The Regional Plan on Marine Litter Management in the Mediterranean in the Framework of Article 15 of the Land Based Sources Protocol was adopted in 2013 (COP 18, Decision IG.21/7); became operational in 2014; and updated in 2021 during COP 22 (Decision IG.25/9), held in Antalya, Turkey, 7-10 December 2021.

The Updated Regional Plan on Marine Litter Management takes into consideration lessons learnt and gained experience from its implementation during the period 2014 – 2020. The updated Regional Plan encompasses substantive elements over the 2013 version including new definitions; expanded scope of measures to strengthen the prevention and circular economy approaches under four key areas: (i) economic instruments, (ii) circular economy of plastics, (iii) land-based, and (iv) sea-based sources of marine litter. Amendments target plastic waste and microplastics. Furthermore, two new annexes are introduced. The first provides a list of single-use-plastic items and the second includes a list of chemical additives of concern used in plastic production further to the Stockholm Convention. The year 2025 constitutes an important milestone in the implementation of the Regional Plan as it coincides with the commitments under SDG 14 and the Naples Declaration.

Further to the update of the Regional Plan and its provisions (Art. 9: 15.1.d.i; 15.2; 15.3;15.3.e; 15.3.f; 15.3.g; 15.4; 15.4.m), the present document aims at providing specific information related to the availability of measures to control plastic pollution, including on microplastics, generated from wastewater treatment plants, aquaculture activities, riverine inputs and shipping. This document also provides information related to important economic sectors using or benefiting from important resources deriving from the marine and coastal environment, like the marine aquaculture and shipping industries.

The present document is submitted to Regional Meeting on Marine Litter Best Practices (Seville, Spain, 17-18 May 2022) with the aim of instigating substantive discussions towards specifying measures and actions that may be realized in support of the implementation updated Regional Plan for Marine Litter Management in the Mediterranean related to inputs of marine litter originating from wastewater treatment plants, riverine inputs, in addition to aquaculture and shipping activities.

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List of Abbreviations / Acronyms

ALDFG	Abandoned, Lost of Otherwise Discarded Fishing Gear
BAT	Best Available Techniques
BEP	Best Environmental Practice
COP	Meeting of the Contracting Parties
EcAp	Ecosystem Approach
EO	Ecological Objective
EP	Emerging Pollutants
EPR	Extended Producer Responsibility
EU	European Union
FAO	Food and Agriculture Organization
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
GPML	Global Partnership on Marine Litter
GPNM	Global Partnership for Nutrient Management
GW^{2}I	UNEP Global Wastewater Initiative
HBM	Human Biomonitoring Data
HELMEPA	Hellenic Marine Environment Protection Association
ICZM	Integrated Coastal Zone Management
IMAP	Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria
IMO	International Maritime Organization
ISO	International Standard Organization
LBS	Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources
MEPC	Marine Environment Protection Committee
MSFD	Marine Strategy Framework Directive
NAP	National Action Plans
NGO	Non-Governmental Organization
PET	Polyethylene terephthalate
PWP	Plastic Waste Partnership
SCP	Sustainable Consumption and Production
SDGs	Sustainable Development Goals
SPAMI	Specially Protected Areas of Mediterranean Importance
SUP	Single-Use Plastics
UHMWPE	Ultra-high molecular weight polyethylene (
UNEA	United Nations Environmental Assembly
UNEP	United Nations Environment Programme
UNEP/MAP	United Nations Environment Programme / Mediterranean Action Plan
WFD	Water Framework Directive
WWTP	Wastewater Treatment Plants

1. Introduction

1. The legally binding Regional Plan on Marine Litter Management in the Mediterranean was introduced in 2013 (Decision IG.21/7, COP18); entered into force in 2014; and updated in COP 22 (Antalya, Turkey, 7-10 December 2022; Decision IG.25/9) to further reflect global and regional agenda relevant to marine litter management.

2. The Updated Regional Plan on Marine Litter Management includes stronger links to global agenda, i.e. the United Nations Environmental Assembly (UNEA) Resolutions[1] on marine plastic litter, microplastics and single-use plastic products pollution; UNEP marine litter partnerships and initiatives like the Global Partnership on Marine Litter (GPML) and the Clean Seas Campaign; the IMO Action Plan to Address Marine Plastic Litter from Ships; the Basel Convention - Plastic Waste Partnership (PWP); as well as the EU Policies[2] on Marine Litter and Plastic.

3. The Updated Regional Plan on Marine Litter Management:

a. Introduces a number of new, region-wide agreed definitions on marine litter (e.g., ALDFG, BAT-BEP, Circular Economy, EPR, Fishing Gear, Lightweight plastic carrier bags, monitoring, micro-litter/plastics, primary/secondary microplastics, SUPs etc.);
b. Expands the scope of measures in four key areas: (i) economic instruments, (ii) circular economy of plastics, (iii) land-based and (iv) sea-based sources of marine litter;
c. Introduces ambitious, amended targets for plastic waste and microplastics; and
d. Introduces two new appendices with lists on (i) single-use-plastic items, and (ii) chemical additives of concern used in plastic production further to the Stockholm Convention.

4. The Regional Plan also incorporates a number of additional, important principles and measures are addressed, including:

- Phasing out single-use plastic items and promote reuse options;
- Setting targets for plastic recycling and other waste items;
- Introducing economic instruments such as environmental taxes, bans and design requirements, and Extended Producer Responsibility (EPR) schemes (land and sea-based sources);
- Promoting new technologies and measures for the removal of marine litter;
- Applying prevention measures to achieve a circular economy for plastics addressing the whole life cycle of plastics;
- Reducing packaging;
- Promoting voluntary agreements with industry;
- Integrating the informal sector into regulated waste collection and recycling schemes;
- Strengthening measures related to Sustainable Consumption and Production (SCP) programmes;
- Phasing-out chemical additives used in plastic products, in particular those under Stockholm Convention;
- Introducing concrete measures on microplastics reduction;

[1] UNEP/EA.1/Res.6; UNEP/EA.2/Res.11; UNEP/EA.3/Res.7; UNEP/EA.4/Res.6; UNEP/EA.4/ Res.9; UNEP/EA.5/L.32/Rev.1

[2] Marine Strategy Framework Directive (MSFD); EU Plastics Strategy; New Circular Economy Action Plan; Single-use Plastic Directive; European Green Deal Policy Framework; Waste Framework Directive

- Implementing measures to prevent and reduce marine litter in Marine Protected Areas (MPAs);
- Minimizing the input of marine litter associated with fisheries and aquaculture;
- Establishing national marine litter monitoring programmes as part of IMAP EO10, including on riverine inputs and wastewater treatment plants (WWTP);
- Enhancing public awareness and education; and
- Introducing measures to Specially Protected Areas of Mediterranean Importance in the (SPAMIs) to combat marine litter.

5. The present document aims to provide specific information related to plastic pollution from two major sources and/or pathways, (i) effluents of wastewater treatment plants, and (ii) riverine systems such as water streams and flood drainage canals. Plastic items under consideration include microplastics, emerging pollutants and packaging waste. This document also provides information on sources of marine litter pollution for two key marine industrial sectors: (i) aquaculture, and (ii) shipping industry. An overview is presented of commonly implemented measures to prevent, control and monitor discharges of marine litter and microplastics in the Mediterranean.

2. Plastic pollutants transported by wastewater treatment plants effluents and riverine systems

6. Plastics enter the marine and coastal environment through various pathways, including through improper disposal, direct dumping, leakage from waste infrastructure or industry, flow out of wastewater treatment plants, sewage discharge, etc. A number of hydrometeorological variables such as wind and surface runoff, as well as extreme weather events including flash floods, rainstorms, landslides severely affect the said sources (van Emmerik et al., 2022).

7. The presence of microplastic in the marine environment has been reported in the form of polyester foam and filaments associated often with fishing gear, and other small plastic fragments covering a diverse range of chemical/polymer composition (e.g., polyethylene, polystyrene, polyester, and polypropylene), consisting also the most abundant forms of microplastic found in the Mediterranean Sea (Sharma S., et al., 2021). Aquaculture and shipping industry also have substantive impact on the Mediterranean areas due to the rapid growth of the aquaculture sector and the intense traffic of cargos and other carrier and passenger shipping activities (UNEP/MAP, 2020).

2.1 Wastewater treatment plants

8. There is an inextricable link between microplastics, emerging pollutants and wastewater. Discharged municipal, industrial, or urban wastewater (i.e., mixed municipal and industrial) are, in fact, a primary pathway for their wide diffusion in the aquatic environment. Wastewater effluents increase the nutrient load of water bodies, while at the same time introduce various emerging pollutants that affect the local biota. Wastewater treatment plants (WWTP) are considered to be a point source of microplastic (particles <5 mm), especially for aquatic environments. However, data on microplastic effluent concentrations in WWTPs is collected with a broad range of methods, which impede comparisons across data sets (Schmidt, C., et al 2020). While more research is needed, it is widely acknowledged that emerging pollutants are increasingly becoming a hazard to the aquatic environment (Tang, Y. et al. 2019).

9. Numerous studies indicate that wastewater treatment plants (WWTPs) play an important role in releasing microplastics discharges to the environment (Sun et al., 2019; Lofty et al., 2022). Therefore, effective detection of the microplastics and understanding their occurrence and fate in WWTPs are of great importance towards microplastics control and effective management.

10. Collection and treatment of wastewater are key to reduce pressures of microplastics and their risks to human health and the environment, especially to rivers, lakes, and coastal waters. Many studies

have pointed out to water treatment as an instrumental step in active removal of microplastics in the environment as water treatment intercepts industrial wastewater or natural water streams (Tang, Y., et al 2019).

2.2 Riverine systems

11. Several studies have been dedicated in documenting and assessing riverine inputs of marine litter, entering into the marine environment (van der Wal et al., 2015; González et al., 2016; Schirinzi G.F. et al., 2020). Riverine systems play a major role in transporting land-based plastic waste into the world's oceans (van Emmerik, T., et al., 2022). Once plastics enter the estuary, the combination of riverine and tidal dynamics determine the fate of plastics and its entrance to the marine environment. Rivers have been identified as major pathways that connect land-sources of plastics with marine environments.

12. Freshwater bodies such as lakes and reservoirs and rivers are threatened by plastics contamination in the same way as the marine environment. Despite the relevance, the current understanding of transport processes, loads and impacts of marine litter in freshwater bodies is limited, mainly because data are lacking and most published data on freshwater plastics stem from individual projects which apply different sampling and analysis techniques. This lack of harmonization hampers the comparison and ultimately the synthesis of data.

3. Marine litter generation from aquaculture, shipping,

3.1 Aquaculture

13. The environmental impact of aquaculture is largely determined by the farming method that is used. The aquaculture production methods used to farm fish can be grouped into four different types: ponds, cages, raceways, and recirculation systems. Open nets or cages are considered systems with higher environment risk as they are in direct contact with the marine/aquatic environment. These systems exert free exchange of waste, chemicals, parasites and disease between the farm production site and the surrounding environment (Halwart M. et al., 2017). Farmed fish can also scape and invade the aquatic ecosystems or attract predators such as marine mammals that can be entangled in the fish farm nets.

14. Other kind of farming such as ponds, which are semi or fully enclosed bodies of water, and typically used to farm tilapia and shrimp are also considered of high environmental risks, due to the discharge of untreated wastewater directly in the marine environment causing habitat damage and increase of pollutants in the water.

15. The food used to feed fish farming animals is a major source of environment impact and pollution. About 25% of the global commercial marine fisheries landings are used to produce fishmeal and fish oil (Thiele, C.J., et al., 2021). Other products used in the aquaculture farms are also relevant for the discharge of contaminants in the water, such as the use of the fish supplements, chemicals used in the form of medications, disinfectants and antifoulants, and fish fecal material (Babatunde Dauda, et al., 2019).

16. The origin of the ingredients contained in the aquaculture feed can be divided basically into two major categories: (i) marine resources, and (ii) terrestrial resources. Marine resources mainly consist of fishmeal and fish oil, and the production is highly depended on wild fisheries, normally pelagic fish already exposed to certain level of pollution such as oil spill and microplastics are caught to be transformed in fish oils and fish meal .The replacement of marine ingredients with plant based components such as soybeans, maize and rice, results in introduction of pesticides used in terrestrial agriculture into the aquaculture production facilities (Olsvik P.A. et al., 2019).

17. The exposure of farmed fish to microplastics and other emerging pollutants are likely to arise from the ingestion of particles in the water column, the seafloor or by the food. Fishmeal is both a source of microplastics to the environment, and directly exposes organisms for human consumption to these particles (Thiele C.J. et al., 2021).

18. A significant portion of gear utilized for aquaculture both in marine and freshwater systems are made of plastic. Expanded polystyrene storyboard is the most frequently form of aquaculture sourced marine litter in the scientific literature. Aquaculture operations produce marine litter through normal wear and tear of plastic gear, and accidents that damage equipment such as the interaction of aquaculture equipment with vessels, extreme weather events, and improper waste management by aquaculture operators (GESAMP 2021).

19. In the Mediterranean region, marine fish farming includes a first phase which is taking place on a land-based hatchery following by the moving of juvenile fish to floating cages at sea made of plastic and other materials.

3.2 Shipping

20. The constant expansion in merchant shipping since 1970 has led to the increase of environmental impacts to the ocean. Marine litter from shipping comprises different activities, such as cargo ships, passengers' ships, fishing vessels, recreational boats and ship breaking or dismantling. Each activity generates some specific kind of waste while all activities produce the same kind of waste in terms solid waste daily, sewage, galley waste, domestic waste from crews and maintenance waste (GESAMP, 2021).

21. Marine litter impacts resulting from shipping include air and water pollution from daily operation, chemicals from oil, sewage, garbage, Sulphur oxides and particulates, nitrogen oxides and the impacts related to the processes of scrapping and decommissioned vessels (Jagerbrand et al. 2019). Some specific types of shipping activities may be of a greater concern, such as cruise ships, because of the large number of passengers and the large volume of waste that it is produced and discharged in the marine environment including microplastics via sewage and grey waters (GESAMP 2021). The cruise industry experienced an increase of 4 million passengers in 1990 to 27 million in 2020 (Cruise Market Watch 2021) and despite that this activity comprises a small percentage of the global shipping industry, it is estimated that around 24% of all waste produced by shipping come from cruise ships (Caric and Mackelworth, 2014).

22. Also, due to heavy maritime traffic, some specific geographic areas are more exposed to the accumulation and impacts of marine litter derived from shipping, such as some countries in the Mediterranean Sea like Malta, where 78% of marine litter arises from shipping, Libya 43%, Cyprus 33% and Greece 22%. It is estimated that shipping activities contribute to the entrance of 20,000 tons of marine debris in the Mediterranean Sea per year (Liubartseva et al., 2018).

23. According to GESAMP (2021), chemicals derived from different shipping activities, cleaning maintenance, lost containers, shipwrecked vessels, industrial pellets lost, packaging items discarded, other floating structures such as fishing boxes that may degrade and become microplastics are considered important sources of microplastic and toxicity to the marine environment.

24. It is estimated that 40% of marine coatings use microplastics as biding agents and that accounts for 3.7% of microplastics releases in the world ocean (IUCN 2017).

25. The damages to fisheries' vessels and other shipping cargos as well as recreational boats related to collisions with marine litter also generate an economic impact within the sector. Marine litter clean-ups in harbors may fall in the shipping sector. Every year, the estimation of economic losses is between €60 to €300 million with damages caused by fouling of propellers, blocked intake pipes and valves and contamination of catch within the fisheries sector in the EU (Mouat J.et al. 2010).

26. Studies in the Adriatic Sea (Turner, 2010) found the deposition of paint polymers and paraffin wax in the seawater. The synthetic paint polymers are produced during the maintenance, repair, and cleaning of ship decks and other intense marine shipping activities. Paraffin wax is utilized for insulation purposes, and also acts as a corrosion protective agent in marine handles and candle construction. These polymers are transported in huge quantities by marine cargo ships and used to discharge at specific areas of the Mediterranean See (GESAMP 2021).

4. Measures and instruments to prevent, control and monitor discharges of marine litter and microplastic

27. In implementing Article 15 of the LBS Protocol, a number of Regional Plans have been adopted by the Contracting Parties to the Barcelona Convention:

- The Regional Plan on Marine Litter Management in the Mediterranean (Decisions IG.21/7 COP18 and IG.25/9, COP 22);
- The Regional Plans on Urban Wastewater Treatment and Sewage Sludge Management (Decision IG.25/8, COP 22);

28. In their efforts for the implementation of the regulatory and policy instruments under the MAP/Barcelona Convention, every effort is made to ensure and maximize synergies with other regulatory system applicable in the Mediterranean under the relevant EU Directives.

4.1 Wastewater treatments plants

29. At the global level, the UNEP Global Wastewater Initiative (GW^2I) represents a voluntary network of stakeholders that promotes good wastewater management practices. The Global Partnership for Nutrient Management (GPNM) also provides support to governments, UN agencies, scientists and the private sector in a platform of best practices and integrated assessment for policy making and investments effectively nutrient-proofed, following the 2030 Agenda for Sustainable Development.

30. At the Mediterranean level, the Contracting Parties to the Barcelona Convention in their 22nd COP (Antalya, Turkey, 7-10 December 2021) adopted Decision IG.25/8 related to the Regional Plans on Urban Wastewater Treatment and Sewage Sludge Management in the framework of Article 15 of the Land-based Sources Protocols. Among several measures to ensure their sustainable and safe use and discharge of wastewaters, the regional plan on wastewater treatment addresses for the first time in its scope microplastics. The updated Regional Plan calls for the introduction of emission limit values for emerging pollutants considering the identification of potential microplastic sources and adoption of related policy and methodology further to state of the art on related research on this topic.

31. The Regional Plan on Sewage Sludge Management gives particular attention to the presence and effective management of microplastics on Pharmaceuticals and Personal Care Products (PPCP) (e.g., lotions, soaps, facial and body scrubs and toothpaste) being present in sewage sludge and proposes methods for reduction at the source as provided hereunder:

a) Regulatory approvals for new products potentially harmful to the environment to be introduced for most/all of personal care materials or detergents. However, the said measure may be difficult to be applied for medication products;
b) Education on the correct use of substances containing drugs, and especially the use of the right dose without excess, including ecolabels to raise awareness of ecological impacts of PPCPs;
c) Encouraging the return of unused or expired pharmaceuticals to specific collection points; and
d) Subjecting wastewater originating from pharmaceutical industries, hospitals or healthcare centers to regulations that limit the concentration of organic pollutants in their effluents.

32. Wastewater treatment plants (secondary + tertiary levels of treatment with adequate sludge management) to efficiently remove microplastics from sewage, trapping the particles in the sludge and preventing of entrance into aquatic environments. Treatment plants are essentially taking the microplastics out of the wastewater and concentrating them in the sludge (Corradini et al., 2019). Therefore, sludge management is of great importance for microplastic removal. Controls should be exercised however on the subsequent use of sludge.

33. Measures that can contribute toward reducing sewage concentrations of microplastics include:

a) Bans on single-use plastics and microplastics in personal care and cosmetic products;
b) Behavior changes and campaigns to reduce the use of such products;
c) Certain textile designs can reduce microfibre generation during washing;
d) Development of household-based systems to prevent microplastics from being released into sewer lines or directly into the environment; and
e) Incineration of sewage sludge to avoid soil and water contamination by microplastics. Care should be exercised however to monitor pollutants in air emissions

4.2 Riverine systems

34. In its 2020 report for monitoring plastics in rivers and lakes, UNEP calls for intervention and prevention policies. "*Intervention policy*" refers to strategies used to reduce existing plastic concentrations in fresh water; whether "*prevention policy*" refers to methods used to prevent the input of plastics to the environment. The relevance of intervention and prevention policies depends on the local contextual conditions such as existing plastic pollution, current waste management systems or the interest of local stakeholders.

35. A Conceptual flow of plastic from production to consumption, waste management and leakage into the environment (i.e., land, rivers and ocean) with possible points of action for policies should be considered. Minimizing leakage on land will subsequently minimize the riverine inputs deriving from wind and rain transportation, as well as from direct dumping and sewerage, and will further reduce the amount of plastics (incl. microplastics) entering the ocean.

36. As rivers in most of the cases is the final repository of litter coming from the various land-based sources the application of measures on land are very relevant for the control and effective management of litter in riverine systems.

37. The updated Regional Plan on Marine Litter Management in the Mediterranean:
a) Takes into consideration the occurrence and extent of marine litter accumulations, and calls for identification and assessment by the year 2025, on the impacts of these accumulations in upstream regions of rivers and their tributaries, and to apply measures to prevent or reduce their leakage into the Mediterranean, particularly during flood seasons and other extreme weather events;
b) Envisages the application of enforcement measures to prevent, reduce and sanction illegal dumping and illegal littering in accordance with national and regional legislation, in particular on coastal zones and rivers, in the areas of application of the Regional Plan; and
c) Couples the aforementioned provisions with aspects related to monitoring of marine litter originating from riverine inputs.

38. Storm water is an important contributor of riverine inputs of marine litter especially for the Mediterranean where seasonal, in several occasions extreme, weather events take place such as flash floods. And with the impacts of climate change, this aspect is becoming more significant as the Mediterranean is experiencing rainfalls, more intense and in shorter periods of time, the impact of which is less infiltration into the ground and more surface run-off.

39. A more systematic approach should be also offered when developing urban storm water management plans. Those plans typically address how urban storm water quantity and quality should be managed to protect ecological, social/cultural and economic values. Urban storm water management plans are used to assist decision making to ensure that remedial measures (structural and non-structural) in existing developed areas are undertaken in a cost-effective, integrated and coordinated manner, and that decisions in relation to areas of new expansion (including redevelopment) are made with the implications for storm water impacts taken into account in order to achieve the quality goals for water bodies.

40. Urban storm water management (USWM) plans have been developed to a various extent across the Mediterranean. This ranges from major cities having USWM Plans to smaller municipalities where such plans are non-existent, or at best are under preparation. USWM Plans in the Mediterranean mostly include only flooding control segments, i.e., no pollution control, while segments on risk management and information on location of land-based activities are covered only on a basic level. In some cases, some elements of the USWM plans are incorporated into Urban Plans but only to a limited extent, such as collection systems layout, principles and recommended techniques regarding flood and pollution control management, as well as principles on how to achieve environmental water quality goals for water bodies.

41. The Establishment of separate collection systems for surface water run-off should be also promoted[3]. A separate storm water sewer system is a collection of structures, including retention basins, ditches, roadside inlets and underground pipes, designed to gather storm water from built-up areas and discharge it, with or without treatment, into local water bodies, e.g., streams, rivers, coastal waters (National Research Council. 2009). Separate collection prevents the overflow of sewer systems and treatment stations during rainy periods and the mixing of the relatively little polluted surface run-off with chemical and microbial pollutants from municipal wastewater. Separate storm water systems allow for design of sewers and treatment plants that consider the volume of the wastewater only, while surface run-off and rainwater can be reused after a simplified treatment (e.g. for landscaping or agriculture).

42. Measures for combined collection systems are of great importance. Combined collection systems are sewer networks designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Most of the time, combined sewer systems transport all of their wastewater to a wastewater treatment plant (WWTP) where it is treated and then discharged to a water body (National Research Council, 2009). During periods of heavy rainfall, however, the wastewater volume in a combined collection system can exceed the capacity of the sewer system or the treatment facilities, for which reason the combined collection systems are designed to overflow occasionally and discharge excess wastewater directly into nearby streams, flood drainage canals rivers, lakes or coastal waters.

43. A variety of additional measures could be also proposed with the aim of reducing the occurrence and impacts of storm water overflows and associated floods and pollution (Milieu, 2016), including the following:

a) End-of-pipe solutions such as building water storage capacity to optimising the use of the wastewater treatment plant and sewer system (e.g., using sewer networks for additional storage and optimising pumping operations);
b) Reduction of clean storm water entering a sewer system (e.g., de-connecting impervious areas from combined sewer systems);
c) Alternative green infrastructures as potentially cost-effective measures to reduce storm water (e.g., retention basins, infiltration trenches).

[3] UNEP/MED WG.509/40: Assessment of state of urban storm water management in the Mediterranean. Meeting of the MED POL Focal Points, 27-28 May and 6-7 October 2021.

44. In addition, it would be valuable to close the knowledge gaps by gathering comparable information across the Mediterranean on the extent of storm water overflows from combined collection systems, which should include inventory of the locations of overflow structures, inventory of functioning of the overflow structures, inventory of sewage storage capacity structures (e.g. starting with agglomerations of more than 100,000 p.e.[4]), with the aim of acquiring better understanding of the occurrence of storm water overflows and their impacts on the quality of receiving water bodies.

45. Promoting Sustainable Urban Drainage Systems (SUDS) is another measure which aims to minimize the impervious cover by promoting infiltration, ponding and harvesting of storm water runoff. Furthermore, in this decentralized management approach, storm water runoff and pollution are primarily controlled by measures located near the source to strive towards well-integrated measures that perform multiple functions, including flood protection, pollution removal and groundwater recharge, as well as recreation, biodiversity and urban aesthetics.

4.3 Aquaculture

46. In the past years, considerable attention has been brought to the scale of abandoned, lost and discarded fishing gear (ALDFG), the impacts on the marine environment through ghost fishing, and possible measures for reducing its occurrence like the FAO Voluntary Guidelines on the Marking of Fishing Gear. Given that aquaculture now supplies over half the seafood produced worldwide, it is considered of great importance that this issue is also examined at farm level, especially given the continued expansion of global aquaculture development (Huntington, 2019).

47. Measures targeting specifically on aquaculture farming should focus on overall recommendations and to propose measures scoping to reduce marine litter from aquaculture, block the relevant pathways to the marine environment and reduce the contribution to marine plastic pollution by aquaculture. Moreover, a second level of measures should be introduced touching upon the specific requirements and standards to be applied on a mandatory basis for aquaculture practices.

48. There are several strategies and guidelines developed by FAO/GFCM to assist a sustainable growth for aquaculture sector in, including the Ecosystem-based Approach to Fisheries and Aquaculture aiming to assist and set limits for aquaculture production given the environmental limits and social acceptability of sector. The strategy is led by three key principles: (a) Aquaculture development and management should take account the full range of ecosystem functions and services and should not threaten the sustained delivery of these to society; (b) Aquaculture should improve human well-being and equity for all relevant stakeholders; and (c) Aquaculture should be developed in the context of other sectors, policies and goals.

49. The 5R's' (i.e., Reduce, Re-use, Recycle, Recover and Refuse) principle do perfectly fit when touching upon measures targeting to reduce the contribution of aquaculture on marine litter plastic generation (Huntington, 2019):

a) Reduce:
   - Replace to the extent possible plastic infrastructure components with other of physical nature;
   - Use higher density plastics (e.g., Polyethylene terephthalate (PET) or Ultra-high molecular weight polyethylene (UHMWPE)) which are more resistant to fragmentation, UV-irradiation;
   - Develop and intensify maintenance schemes to reduce equipment failure, and contingency plans for equipment being susceptible to extreme weather conditions;
   - Re-design aquaculture operations to reduce intentional or unintentional dumping of plastic into the marine environment (e.g., plastic bag feed sacks) and put in place mitigations plans and actions.

[4] Population equivalents

- Develop awareness raising trainings for aquaculture staff similar to those offered from the shipping sector (e.g., HELMEPA[5]).

b) Re-use:
- Reduce single-use plastic with the introduction of relevant alternatives and invest in developing recovery, cleaning and re-distribution schemes;
- Establish mandatory plastic waste collection points connected with the recycling schemes being placed in the mainland;
- Train aquaculture staff for maintaining and fixing, rather than replacing, appropriate equipment;

c) Recycle:
- Establish partnerships with aquaculture industry to develop recycling schemes from which industry could benefit from lower-cost primary material;
- Develop mandatory recycling policies and schemes, including the establishment of plastic inventory and Standard Operations and Procedures (SOPs) for inactive and damaged equipment stored on the sea cages and along the shorelines for long periods;
- Establish mandatory recycling schemes for aquaculture sites/firms that are closing.

d) Recover:
- Locate and assess hotspot areas where aquaculture gear is accumulating on the seafloor and propose environment sound ways to remove them (e.g., Fishing-for-litter based schemes, campaigns with scuba divers);
- Recover lost or damaged equipment right after extreme weather events;
- Introduce GPS tracking systems for heavy material (e.g., plastic cage rings, cage nets, etc.);
-

e) Refuse:
- Reduce to the extent possible the use of single-use plastics and establish relevant policies;
- Minimize the use of plastic types with low levels of recyclability;
- Reduce to the extent possible the use of equipment consisting of different types of plastic (i.e., different lifespan and different approach for collection and recycling).

50. Moreover, aquaculture should ideally apply a circular approach planning considering the whole life cycle of the used equipment. High procurement standards should be introduced, especially when dealing with purchasing of equipment, packaging, polystyrene boxes and other types of consumables and equipment.

51. With regards to plastic pollution, the updated Regional Plan on Marine Litter Management calls for:

a) Innovative business practices to prevent plastic waste generation in line with the Extended Producer Responsibility approach through the establishment of Deposit/Refund System for expandable polystyrene boxes in the commercial and recreational fishing and aquaculture sectors; and
b) Prevention measures aiming to achieve, to the extent possible, a circular economy for plastics (Regulate the use of primary microplastics, Implement Sustainable Procurement Policies, Establish voluntary agreements, Establish procedures and manufacturing methodologies, Identify single-use plastic products, Set targets to phase out production and use, increase the reuse and recycling, Phase-out chemical additives used in plastic products, Promote the use of recycled plastics, substitute plastics, Implement standards for product labelling, Establish

[5] https://www.helmepa.gr/en/maritime-section/training-program

dedicated collection and recycling schemes, minimize the amount of marine litter associated with fishing/aquaculture, Scale-up and replicate sustainable models).

52. During the 21st Meeting of the Contracting Parties to the Barcelona Convention, Decision IG.24/14 was adopted. It provides a clear mandate for the development/update of technical guidelines addressing estimation techniques for pollutant releases from agriculture, catchments runoff and aquaculture in the Mediterranean. The proposed techniques and guidelines constitute effective tools that would enable the generation of compatible data to evaluate the effectiveness of adopted measures in the National Action Plans (NAPs) and in the Regional Plan for Aquaculture Management in the Mediterranean.

4.4 Shipping

53. The London Protocol on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter is one of the first global conventions to protect the marine environment from human activities. The objective is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter.

54. While the international maritime organization IMO adopted in 1973 the International Convention for the Prevention of Pollution from Ships (MARPOL) which is the main international convention covering the prevention of pollution of the marine environment by ships from operational and accidental causes. The MARPOL convention under its Annex IV Prevention of pollution by sewage from ships present requirement to control the pollution of sewage into the sea.

55. MARPOL Annex V seeks to eliminate and reduce the amount of garbage being discharged into the sea from ships, which means all ships operating in the marine environment, from merchant ships to fixed or floating platforms to non-commercial ships like pleasure crafts and yachts must follow the same regulation.

56. The IMO’s Marine Environment Protection Committee (MEPC) recently adopted its strategy to address marine plastic litter from ships with substantial actions to reduce marine plastic litter from, fishing vessels; shipping, and improve the effectiveness of port reception and facilities and treatment in reducing marine plastic litter. The strategy also aims to achieve further outcomes, including: enhanced public awareness, education and seafarer training; improved understanding of the contribution of ships to marine plastic litter; improve the understanding of the regulatory framework associated with marine plastic litter from ships; strengthened international cooperation; targeted technical cooperation and capacity-building.

57. Under the Mediterranean Strategy for the Prevention of, Preparedness, and Response to Marine Pollution from Ships (2022-2031) in its common strategy also addresses the prevention and reduction of litter, in particular plastics entering the marine environment from ships thought the fully implementation of the IMO Action Plan and the UNEP/MAP Regional Plan on Marine Litter Management in the Mediterranean.

58. Although most of the marine litter in the Mediterranean region originates from land-based sources, studies confirmed that ship-originated litter are found at sites under major shipping routes and lost fishing gear are also recognized as an important source of marine litter in the region (UNEP/MAP 2015).

59. Through the Regional Plan on Marine Litter Management in the Mediterranean, the Contracting Parties of the Barcelona Convention have set measures and a timetable to be implemented in relation to sea-based sources of marine litter, especially related to the establishment of best practices to create incentives for fishing vessels to retrieve derelict fishing gear, collect other items of marine litter, and deliver it to port reception facilities. It also presents incentives to the delivering of waste in port reception facilities such as the non-special fee system.

60. Under the Prevention and Emergency Protocol of the Barcelona Convention in its article 14 relevant to the provision of adequate Port Reception Facilities, the Contracting Parties to the Barcelona Convention are invited to explore ways to charge reasonable costs for the use of Port facilities.

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