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Assessment of costs of implementation of the main measures proposed in the Regional Plans of Agriculture, Aquaculture and Stormwater Management and associated socioeconomic benefits

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Agenda item 6: Cost estimates for the implementation of the key measures of the three Regional Plans with evaluation of related socio-economic benefits

Cost estimates for the implementation of key measures of the Regional Plans on Agriculture, Aquaculture and Stormwater Management and their socio-economic benefits

UNEP/MAP
Athens, 2023

Note by the Secretariat

In accordance with Decision IG.25/19 (COP22, Antalya, Türkiye, 7-10 December 2021) on the Programme of Work and Budget (2022-2023) mandating MED POL to develop new regulatory measures in line with Article 15 of the LBS Protocol, and in line with Decision IG.24/10 (COP21, Naples, Italy, 2-5 December 2019) which called for developing six new Regional Plans, the Secretariat-MED POL Programme developed in the biennium 2022-2023 three draft Regional Plans on Agriculture, Aquaculture and Stormwater Management. The draft Regional Plans were submitted for the consideration of the corresponding Working Groups of Designated Experts for their review and discussion.

As the draft Regional Plans comprise a comprehensive set of legally binding measures referring to regulatory, institutional and technical matters, processes and techniques, implementation of these legally binding measures will entail potential investment/operational costs on the Contracting Parties. These costs are expected to be borne by public and/or private entities with economic implications and social benefits. Determination of the cost implications and associated benefits is crucial for factual decision-making by the Contracting Parties aiming to adopt these Regional Plans.

The present report "**Cost estimates for the implementation of key measures of the Regional Plans on Agriculture, Aquaculture and Stormwater Management and their socio-economic benefits**" is prepared by the Secretariat for the consideration of the 2nd Meeting of the Working Group of Designated Experts for the Regional Plans on Agriculture, Aquaculture and Stormwater Management. It is expected that members of the Working Groups would review and discuss the cost implications and associated benefits of the proposed measures with the aim to recommend the approval of these measures from an economic perspective by the Meeting of the MED POL Focal Points to be held back-to-back with this Meeting.

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List of Abbreviations / Acronyms

AZA	Allocated Zones for Aquaculture
BC	Barcelona Convention
BMP	Best Management Practices
CP	Contracting Parties
CSA	Climate Smart Aquaculture
EAA	Ecosystem Approach to Aquaculture
EBIT	Earnings Before Interest and Tax
EC	European Commission
EIA	Environmental Impact Assessment
EMFF/ EMFAF	European Maritime and Fisheries Fund/ European Maritime, Fisheries and Aquaculture Fund
EMP	Environmental Monitoring Programme
EU	European Union
EUMOFA	European Market Observatory for fisheries and aquaculture
FAO	Food and Agriculture Organization
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
GI	Green Infrastructure
GVA	Gross Value Added
ICZM	Integrated Coastal Zone Management
IMAP	Integrated Monitoring and Assessment Programme
IMTA	Integrated Multi-trophic Aquaculture
LBS	Land Based Sources
MSFD	Marine Strategy Framework Directive
MSP	Maritime Spatial Planning
RAS	Recirculating Aquaculture Systems
RoI	Return on Investment
SCM	Stormwater Control Measures
SEA	Strategic Environmental Assessment
STECF	Scientific, Technical and Economic Committee for Fisheries
SUDS	Sustainable Urban Drainage System
UNEP/MAP	United Nations Environment Programme / Mediterranean Action Plan
USWM	Urban Stormwater Management
WFD	Water Framework Directive

1 Introduction

1. The analysis of costs and main socio-economic benefits associated with implementation of the new Regional Plans on Agriculture, Aquaculture and Stormwater Management was undertaken in order to support the process of development and adoption of these plans, mandated by the COP 21 Decision IG.24/10. The starting point of the analysis were the draft Regional Plans adopted by the First Meeting of the Working Group of Experts and the assessments of the current practices in the respective areas in the Mediterranean region, including their impacts on the marine environment and proposed measures for the three Regional Plans.[1] Available information on economic performance and costs in, for example, aquaculture production and stormwater management were also used alongside with other sources of information.

2. The draft Regional Plans comprise a comprehensive set of measures referring to various issues, processes and techniques. Implementation of a range of established and novel policy instruments, approaches and technologies is sought and/ or promoted, including, for example, Extended Producer Responsibility, Green Infrastructure, Integrated Multi-trophic Aquaculture and many others.

3. Experiences with implementation of some of these measures and approaches in the Mediterranean countries are still quite limited, which affects availability of information on their economic performance. Moreover, baseline data on the type and scope of the activities that would be affected by the adoption of the three Regional Plans was only available at a general level, whereas country specific data that would allow for a detailed identification of gaps between the current state and the Regional Plans requirements was missing. Coupled with the fact that the costs of implementing the proposed measures are characterized by a high spatial and temporal variability, accurate estimation of the levels of the main cost elements linked to the Regional Plans implementation was not possible.

4. Instead, socio-economic ramifications of the implementation of the Regional Plans are mapped and discussed in this report with a focus on the key measures and their implications for the public and private sectors. Available information on the actual costs linked to the implementation of key Regional Plans measures (in the Mediterranean and/ or other regions) were retrieved and are presented herewith. Attention was also paid to the relationship between the measures proposed under Agriculture, Aquaculture and Stormwater Regional Plans with other policy instruments of the UNEP/MAP Barcelona Convention system and other relevant policy frameworks, identifying at the same time opportunities for the optimization of costs and intensification of benefits.

2 Agriculture Regional Plan

2.1 Agriculture in the Mediterranean region: significance and environmental issues

5. Agriculture plays a very important role in the Mediterranean, contributing to national GDPs by 10 or more percent in several countries (Tunisia, Egypt, Algeria, Morocco, Albania, Syria). A variety of agroecosystems is found across the region, including traditional and technologically intensive irrigated agriculture, rainfed agriculture (in particular permanent crops), pastoral and agro-sylvo-pastoral systems, and other. Permanent crops, which are most typical of the Mediterranean agroecosystems, include olives, grapes, citruses and nuts. In addition, legumes, vegetables and wheat are widespread, often complemented with extensive livestock, mostly sheep and goats. France, Turkey, Egypt, Spain and Italy are the main cereals producers; as for fruits and vegetables, the highest quantities (15-22 million tonnes for fruit, and

[1] As presented in UNEP/MED WG.509/38, UNEP/MED WG.509/39 and UNEP/MED WG.509/40.

13-24 million tonnes for vegetables) come from Egypt, Italy, Spain and Turkey (UNEP/MED WG.509/38).

6. Total arable land is around 92 million hectares, almost a quarter (23%) of which is found in Turkey; 20% in France; 13% in Spain; and 7% in Italy. Countries with the least arable land are Malta and Montenegro. In around half the Contracting Parities (CPs), arable land per capita is in the range of 0.2-0.3 ha; in Cyprus, Egypt, Israel, Lebanon, Malta, Montenegro, Palestine and Slovenia, less than 0.1 ha of arable land is available per person.

7. On average, more than 16% of total agricultural lands are irrigated, but the situation varies widely from country to country: more than 25% of usable arable lands are irrigated in Albania, Cyprus, Greece, Israel, Italy, Malta and Palestine, while Egypt irrigates 99% of land available for crop production. On the other hand, land irrigation rates are low (below 5%) in Slovenia, Croatia, Bosnia and Herzegovina and Montenegro, as well as in Libya, Tunisia and Algeria.

8. The main challenges for the development of agriculture include: loss of arable land (an average decrease of 13% has been recorded between 1995 and 2015), in particular in the Eastern Mediterranean; low average rainfall and scarcity of water resources, affecting especially southern Mediterranean countries; unsustainable farming practices and intensive use of water leading to groundwater depletion and soil salinisation; land fragmentation; and others.

9. The main impacts of agriculture on the Mediterranean marine environment are linked to inputs of nutrients (causing eutrophication) and agro-chemicals from agricultural runoff, as well as to extensive use of water resources for irrigation. Intensification of livestock farming during the past few decades led to an increase in the amounts of manure in specific areas, giving rise to manure management issues and related impacts.

10. Use of fertilisers has increased by 10% between 2002 and 2016, whereas consumption of fertilizers above the global average of 141 kg per hectare of arable land has been recorded in about one third of the Mediterranean counties. The main Mediterranean coastal areas historically affected by the inputs of nutrients (from various sources, including agriculture) are the Gulf of Lion, the Gulf of Gabès, the Adriatic, the Northern Aegean and the South East Mediterranean (UNEP/ MAP and Plan Bleu, 2020). In 2016, the average use of pesticides was below or around the world average in most Mediterranean countries (*Ibid.*). In general, regulations to control the use of fertilizers and pesticides are in place in the EU and non-EU countries; however, some regulatory and implementation gaps remain, resulting with instances of fertilizers overuse and occurrence of pesticide residues in fruits and vegetables.

11. Agriculture is the largest consumer of water in the Mediterranean countries. Irrigation water accounts for an average 64% of total water consumption, varying from 50% in the north to up to 90% in some southern Mediterranean countries. Expansion of irrigation has created salinity build-up problems and contributed to water resources depletion and erosion in many countries. Over the last two decades, for example, about 1 million hectares in Egypt have been affected by soil salinity due to inadequate irrigation water (UNEP/MED WG.509/38). There is a strong need to improve water use efficiency and reduce irrigation-related pollution.

12. In view of the growing demand for food in the context of climate change, there is also a need to enhance sustainable soil management together with nutrient management and optimization of crops production plans to sustain soil fertility and increase yields.

2.2 Measures and cost implications of the Regional Plan on Agriculture Management

13. The Regional Plan on Agriculture Management foresees:

a. Establishment of a regulatory framework [by 2026] to reduce and further prevent pollution caused by agricultural activities addressing: discharges of nutrients from fertilizers and manure; irrigation water runoff and water percolation to limit excess nutrients, pesticides and wastes (in particular plastics) reaching the marine environment; Integrated Pest Management; and good management practices to reduce plastic waste generation from agricultural activities.

b. Establishment [by 2028] of extension/ advisory services, training and awareness campaigns for farmers to promote implementation of the appropriate measures in line with the established regulatory framework.

c. Setting up of support mechanisms [by 2028] to enable farmers to implement the appropriate measures in line with the established regulatory framework.

d. Designation [by 2028] of "vulnerable zones" i.e. areas of agricultural land that have an impact on eutrophication of coastal waters (including their notification to the Secretariat, monitoring of nutrient concentrations and trends, setting up of pollution reduction targets, implementation of measures to reach them, and periodic – every [five] years – evaluation/ revision of designated zones);

e. Implementation of measures based on Good Agricultural Practices [by 2030] that contribute to preservation of the health of the natural systems, and enhance water, energy and food nexus (while considering opportunities and synergies of all systems) by providing conditions to support farmers to apply: i) integrated approaches for nutrient supply, ii) conservation tillage, iii) climate-smart agricultural practices to ensure food security and optimal use of resources in a changing climate, and iv) renewable energy technologies and increased efficiency processes in food production, processing and distribution.

14. The implementation of the Agriculture Regional Plan will thus require development and implementation of a set of regulatory, administrative, institutional, financial and technical measures that will work in conjunction with the existing agricultural, circular economy, sustainable consumption and production, climate mitigation and adaptation, and waste management/ recycling policies at regional and national levels, while addressing specificities of the sector. Farmers and/ or food processing and distribution industries will be assisted and incentivised to employ practices and technologies that are good for the environment but also help ensure sustainability of food production systems in the long run.

15. Financial and institutional development and capacity building measures (such as establishment of support mechanism for farmers, establishment/ strengthening of extension services, trainings) are expected to be the costliest measures for the public sector; regulatory and administrative measures (such as adoption of new or upgrading of the existing legislation, designation of vulnerable zones) are likely to have low costs. Significant reductions in the public sectors costs can be achieved through coordination with other policies and complementary processes.[2] For the EU Mediterranean and countries in the accession process, for example, implementation of the Regional Plan measures on nutrients will be facilitated (or even made redundant) due to implementation of Water Framework and Nitrates Directives.

[2] The assessment prepared in the process of drafting the Regional Plan on Agriculture Management, presented in UNEP/MED WG.509/38, found out, for example, that regulations (related to the use of fertilizers) in line with EU directives have already been adopted not only by the EU Member States but also by Turkey and the Balkan countries.

16. Overall, countries with weaker agricultural practices where overuse or improper use of fertilizers and pesticides is present, as well as those with high shares of irrigated land but less developed irrigation techniques, will face higher costs to bring performance of their agricultural systems up to the standards promoted by the Regional Plan. However, the cost-effectiveness of implementing the measures envisaged under the Regional Plan is likely to be high as they will help resolve some of the vital issues and concerns such as soil productivity, food safety, sustainability and others. Multiple international knowledge and funding sources can be tapped to support the process of the Regional Plan implementation.

17. A wide range of measures is envisaged under the Regional Plan that will give rise to costs for private sector, primarily food producers (farmers, food processing industries). These include investment-heavy technical measures (such as instalment of efficient irrigation systems, energy efficiency and renewable energy measures), but more so knowledge-intensive measures (such as Integrated Pest Management, conservation tillage, nature-based solutions to minimize unnecessary use and pollution of water resources, and others) that will be beneficial not only for improving the environmental but also economic performance.

18. An interesting example of the existing application of good agricultural practices is the AgriCaptureCO_2 project that aims to promote regenerative agriculture as a solution in the fight against climate change while providing agronomic and economic benefits for farmers. The project *inter alia* supports pilot activities on 10 small (0.2 ha) family-owned farms on Crete (Greece), two of which are rainfed and eight irrigated, and have mostly applied traditional practices prior to the project. Under the pilot, work is done to: i) advance a new regenerative approach to cultivating olives and protect soil while ensuring efficient use of water and other inputs;[3] and ii) develop and market low-emission olive oil brand, rewarding regenerative farmers and encouraging wider uptake. The project results will include information on costs and profitability of the farms.

19. Like with public sector costs, there are many opportunities to capitalise on the implementation of related policies and synergetic actions. Support provided to farmers should be sufficient to offset the additional costs they could have due to implementation of the Regional Plan measures so they would not have net losses over time. Measures addressing efficiency matters (e.g. water and energy savings) are likely to reduce operating costs thus contributing to profitability.

3 Aquaculture Regional Plan

3.1 Aquaculture in the Mediterranean region: significance and environmental issues

20. Total aquaculture production in the Mediterranean States, considering all species and all environments (marine, brackish and freshwater), has increased substantially over the past decades: it more than doubled between 1996 and 2006, and continued to grow until 2016 at an average annual rate of more than 7% (UNEP/MAP and Plan Bleu, 2020). The sector contributes to food security, job creation and economic growth, while reducing dependence on naturally occurring fish stocks.

21. Marine aquaculture production in the Mediterranean[4] exhibited strong growth over the period 2010-2020, with average annual growth rates of 6.8% and a cumulative increase of around 90%. For the

[3] Regenerative practices applied include cover crops, no weed mowing during winter, no tillage, weed mowing in spring and summer (soil mulching), winter and summer pruning (and shredding of pruning), irrigation according to meteorological and soil moisture data, fertigation, plant protection for minimizing the risk of pathogens and others. Information available from https://agricaptureco2.eu/pilot-farms/

[4] Figures refer to the FAO 'Mediterranean and Black Sea' fishing area, and marine and brackish water environments, as reported in the FishStatJ database (FAO, 2022); the figures exclude freshwater aquaculture and include, for example, Turkey's Black Sea production.

period 2016-2018, the average annual marine aquaculture output exceeded 761,000 tonnes, approaching the average capture fisheries output of around 788,000 tonnes. In 2020, total aquaculture production came close to one million (994,623) tonnes. No negative impact of COVID-19 pandemic was recorded as the 2020 production exceeded the 2019 level by 13.2%.

22. The top five aquaculture sector producers are Egypt, Turkey, Greece, Italy and Spain (making up 90% of the total production), followed by Tunisia, Malta and Croatia. France is also a significant producer, with shellfish (mainly oyster and mussels) accounting for more than 80% of the total output; only a small share of the overall production is based in the Mediterranean region (around 6% in 2020).[5] As of 2016, particularly high growth rates were recorded in Egypt and Turkey, with the two countries accounting for nearly two thirds of the total production in 2020 (35.4% in Egypt and 29.5% in Turkey). Stable output trends were recorded in Greece and Spain, while in Italy production dropped by a quarter in 2020 compared to 2010 (mainly due to reduced shellfish production). Even though their contribution to the overall production is low (below 1%), very high growth rates were recorded in Algeria and Albania; production in Tunisia also grew at a very high rate during the past decade.

23. Value of production of the Mediterranean marine aquaculture increased from USD 2.3 billion in 2010 to USD 4.3 billion in 2020. Countries with the highest production value were Turkey (around USD 1.2 billion, 28% of the region's total), Egypt (USD 1.1 billion or 26% of the total), Greece, Italy, Spain and Malta. Maltese aquaculture generated a value of USD 246 million with a relatively low output (below 20,000 tonnes) due to a high share of Bluefin tuna in the overall production.

24. Egypt is a globally significant producer, where total aquaculture output[6] grew from less than half a million tonnes in early 2000s, to 1.6 million tonnes in 2019, making more than 80% of the total – capture fisheries and aquaculture – production in the country (FAO, 2022a). In 2020, around 60% of the total production was Nile tilapia, predominantly grown in brackish waters. Additionally, three species/ groups of species produced in brackish waters in the Mediterranean fishing area accounted for 22% of the country's total aquaculture output; in this segment, production of mullets prevails.

25. Finfish farming accounts for 83% of the total Mediterranean aquaculture production, while molluscs make up 16% of the overall output. Gilthead seabream (*Sparus aurata*) and European seabass (*Dicentrarchus labrax*) are the most commonly farmed species, at 464,000 tonnes and USD 2.24 billion in 2019. In terms of quantity, other important farmed species are mullets and mussels. With production of 99,200 tonnes in 2019, Mediterranean mussel (*Mytilus galloprovincialis*) is the fourth most farmed species in the region; the main producers are Italy (62% of the region's production) and Greece (24%) (Carvalho and Guillen, 2021).

26. Besides direct aquaculture jobs, fish/ shellfish farming generates additional employment through spinoff and support industries that deal with processing, packaging, product distribution, marketing, etc. It is reported that for each person employed in aquaculture production, about three others are employed in secondary and related activities (Buck et al., 2018). One of the recent estimates suggest that Mediterranean aquaculture offers employment to 313,000 persons, taking into account both direct and indirect jobs (Bolognini et al., 2019). Shellfish farming is more labour intensive hence wages/ salaries represent the main cost category for this aquaculture segment; depending on the species and applied technologies, the most significant cost categories in finfish farming are the costs of feed and livestock, as well as repair and maintenance and/ or energy.

[5] Data for France based on FAO, 2022, and STECF, 2023.
[6] Including, in addition to marine and brackish environments, the freshwater production and the FAO 'Africa – inland waters' fishing area.

Examples of issues linked to aquaculture development in the EU and the Mediterranean

27. Aquaculture is a viable economic sector of high socio-economic significance at the Mediterranean, EU and global scales. On the other hand, concerns over its environmental impacts and social acceptance have been increasingly shaping the industry's development conditions. Climate change is another concern due to its impacts on water systems and thus on aquaculture production.

28. Growth in aquaculture production in the Mediterranean is accompanied with high dependency on fish meal from sea catches, large nitrate and phosphorus effluents, and to genetic modification of natural fish stocks (UNEP/ MAP and Plan Bleu, 2020). Some of the priority issues related to sustainable aquaculture development in the Mediterranean and Black Sea (as identified by Massa et al., 2017) include integration of aquaculture into coastal zone management and sea use planning, improvements in site selection and licensing procedures, enhancement of aquaculture-environment interactions and implementation of environmental monitoring, and similar. The main environmental impacts of aquaculture are linked to feeding practices, uneaten feeds and excreta (i.e. to high loads of organic matter), use of medicines/ antibiotics, impacts of heavy metals, cage cleaning and antifouling agents, impacts of cage locations, as well as to escapes of non-indigenous species (UNEP/MED WG.509/39).

29. Denmark is one of the forerunners in aquaculture development and is currently implementing transition from a feed quota system to individual emissions rights for nitrogen, in line with 2012 regulation aiming to incentivise farmers to reduce pollution. This is expected to lead to further development and adoption of new environmentally friendly production methods and technologies. So far, 20 large farms in the group of recirculated land-based farms have moved to the new regulatory system (STECF, 2023). Moreover, a moratorium for sea cage farming has been imposed.

30. The Swedish aquaculture industry faced some setbacks in 2019 and 2020 as several farms were denied new or were issued more stringent environmental licenses compelling the largest production segment (freshwater fish in cages) to move to more environmentally friendly techniques. Difficulties have been experienced with implementation of new production techniques on a commercial scale, despite ambition to increase sustainable aquaculture production and available support (e.g. from the European Maritime, Fisheries and Aquaculture Fund – EMFAF).

31. Mediterranean production of shellfish decreased by nearly a quarter (-23%) between 2000 and 2010, mainly due to the loss of space suitable for shellfish farming, along with important changes in Mediterranean coastal waters as regards nutrient availability, extreme events, marine pollution and biotoxins. Most of these changes were due to anthropogenic pressures and climate change (Bolognini et al., 2019). In France, for example, one of the main obstacles to further development of shellfish farming is access to new space with adequate water quality; social acceptability is also an issue (STECF, 2023). Unusually high temperatures of water over an extended period of time (exceeding 29°C over eight consecutive days) combined with no wind conditions led to high mortality of farmed shellfish in the Thau lagoon (close to Montpellier on the French Mediterranean coast) in August 2018. Mortality rates reached from 30% to over 60% for oysters, and 100% for mussels, leading to a loss of 2,703 tonnes of oysters and 1,218 tonnes of mussels worth nearly EUR 6 million (UNEP/ MAP and Plan Bleu, 2020).[7] On the Spanish Mediterranean coast, the natural banks and shellfish farms alike have seen a significant reduction of clams and other shellfish due to the presence of the blue crab (*Callinectes sapidus*) – a voracious invasive species (STECF, 2023).

32. Aquaculture in Egypt is the largest source of fish, the least expensive animal food source (especially tilapia) and is crucial to the food security of the poor and vulnerable. At the same time, the sector faces major constraints including inefficient policies, lack of access to modern technologies, high

[7] Based on information from Prefecture of the Hérault Department, France, 2018.

production costs, and the decreasing water quality of the Nile, its tributaries and the Mediterranean's coastal waters due to municipal and industrial effluents, agricultural drainage, and decreasing flow (World Bank, 2019).

33. Cyprus has recently made progress with maritime spatial planning, securing marine areas for the operation of aquaculture units and future development. A stable zoning framework will provide legal certainty and predictability and will have a positive impact for promotion of investments. Moreover, Cyprus is using European Structural Funds (EMFF, EMFAF) for modernization of the existing capacities and the application of more advanced technologies. On the other hand, increasing operational costs, especially the rise in energy prices, and a very competitive market represent the main challenges.

34. There is a clear need for the development of a more sustainable and resilient aquaculture in the Mediterranean to address the challenges (including environmental issues, allocation of space, market competition and others) and ensure sustained delivery of marine ecosystem services while increasing the scale of benefits it provides for the economy and society.

Relevant strategies and policy frameworks

35. Global aquatic food production is forecast to grow by further 15% until 2030 while the increase will mainly come from aquaculture (FAO, 2022a). The FAO's Blue Transformation programme area (part of its Strategic Framework 2022-2031) *inter alia* aims to increase development and adoption of sustainable aquaculture systems, and to improve capacities at all levels to develop and adopt innovative technology and management practices for a more efficient and resilient aquaculture. A number of other FAO/ GFCM strategies and guidelines are also relevant, including Code of Conduct for Responsible Fisheries (CCRF), Ecosystem Approach to Aquaculture (EAA), Marine Spatial Planning (MSP) and Allocated Zones for Aquaculture (AZAs).

36. The UNEP/ MAP Barcelona Convention policies relevant for aquaculture are primarily laid down in the LBS and ICZM Protocols,[8] as well as in the Decision IG.20/4 on Ecosystem Approach and Decision IG.22/7 on Integrated Monitoring and Assessment Programme. The Regional Plan on Marine Litter Management (Decision IG. 21/7) is also relevant, together with the Regional Action Plan on Sustainable Consumption and Production in the Mediterranean 2016–2027 (Decision IG.22/5).

37. The European Green Deal and the Farm to Fork Strategy underline the potential of farmed seafood as a source of protein for food and feed with a low-carbon footprint which has an important role to play in helping to build a sustainable food system (EC, 2021). Following the adoption of the Regulation (EU) No 1380/2013 (on the Common Fishery Policy) and with the support from EU funds, significant progress was made, nevertheless it is assessed that the aquaculture sector is still far from reaching its full potential in terms of growth and meeting the increasing demand for more sustainable seafood while further improving its environmental performance.

38. The new Strategic Guidelines for a More Sustainable and Competitive EU aquaculture for the period 2021 to 2030 (COM(2021) 236 final) outline general courses of action needed to build aquaculture resilience and competitiveness, participate in the green transition, ensure social acceptance and consumer information, and increase knowledge and innovation. The Guidelines recommend establishment of a single national aquaculture entity whenever possible, to facilitate and coordinate the work of different authorities on planning, licensing and monitoring of aquaculture activities. The Aquaculture Assistance Mechanism has been set up to support implementation of the Guidelines through the provision of logistical, technical and administrative support. The EMFAF is to continue with financial assistance

[8] The Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and the Protocol on Integrated Coastal Zone Management in the Mediterranean.

towards the implementation of the Community's strategic vision and of the national aquaculture development plans.

39. Besides the Regulation on Common Fishery Policy and Regulation (EU) 304/2011 concerning use of alien and locally absent species in aquaculture, the EU policy framework of relevance for aquaculture comprises a range of Community legislation and plans on water and marine environment management, maritime spatial planning, biodiversity protection, invasive species, environmental assessments and other.[9]

3.2 Measures and cost implications of the Regional Plan on Aquaculture Management

40. The Regional Plan on Aquaculture Management envisages implementation of four groups of measures: i) setting up of regulatory and institutional frameworks (by 2026); ii) implementing good aquaculture management practices to control and reduce releases and minimise levels of pollutants in the water column and sediments (by 2028);[10] iii) adopting regulations and implementing measures to promote/ foster responsible, economically viable, environmentally sustainable and climate smart aquaculture;[11] and iv) reducing generation of plastic waste from aquaculture.[12]

41. Implementation of these measures will have different cost implications across countries and sectors (public, private). For the Contracting Parties (CPs) that have made progress with MSP, for example, costs of implementing the Regional Plan measure on the selection of aquaculture sites will be reduced or minimised. The same holds for the measures on reducing plastic wastes for the CPs that have tackled plastic pollution and recycling successfully. For the CPs members of the EU, setting up of an adequate institutional framework is already recommended under the Strategic guidelines (COM(2021) 236 final) hence the Regional Plan implementation is not expected to incur additional costs in this respect. Similar deductions are valid for, *inter alia*, enforcement, monitoring and measures to develop support mechanisms.

Public sector costs

42. Setting up of legal and institutional system to regulate aquaculture (or to strengthen the existing systems) is expected to give rise to low level costs for the development and adoption of necessary regulations. In contrast, moderate level costs are expected for new employments and technical and human capacity building needed to ensure that new regulations are implemented, and that environmental

[9] Water Framework Directive (Directive 2000/60/EC); River Basin Management Plans; the Marine Strategy Framework Directive (Directive 2008/56/EC); the Decision on Good Environmental Status (Decision 2017/848/EC); the Birds and Habitats Directives (Directive 2009/147/EC and Directive 92/43/EEC); Regulation (EU) 1143/2014 on invasive species; the Environmental Assessment Directive (Directive 2011/92/EU); and the Strategic Impact Assessment Directive (Directive 2001/42/EC).

[10] Specific measures include: wastewater filtration and treatment, [recycling/ reusing water from aquaculture activities], monitoring, and optimisation of effluent discharge systems for land-based, as well as implementation of the concept of mixing zones, monitoring, regular movement of cages (when needed), establishment of no-activity zone around the cages, and use of environmentally friendly antifouling agents for sea-based aquaculture.

[11] Including [employment of IMTA, biofloc and RAS technologies], improved feeding efficiency and feed quality, [controlled use of pharmaceuticals], [measures to avoid escapes] and monitoring for land-based, as well as selection of aquaculture sites on the basis of the Ecosystem Approach to Aquaculture (EEA) or Maritime Spatial Planning (MSP), facilitating the spread of IMTA, control the use of pharmaceuticals, reporting escapes and establishment of Environmental Monitoring Programmes to assess pollution in relation to IMAP EOs and CIs for sea-based aquaculture.

[12] Including replacement (to the extent possible) of plastic infrastructure; use of higher density plastics; plans and actions to reduce intentional and unintentional dumping; reduction of single-use plastics; increase recycling, etc.

performance of aquaculture facilities is monitored. The main cost categories include salaries, monitoring and training costs. Total costs will depend on the size of institutional structures, proportionally to the scales of aquaculture industries in different countries (ranging widely both in terms of the number of operating enterprises and production levels).

43. The institutional structures set up in line with the Aquaculture Regional Plan will also need to work on creation of favourable conditions (knowledge, market, access to finance and support mechanisms) for aquaculture development, which will incur significant costs. Regulators should, for example, develop and implement schemes to disincentivise harmful and incentives environmentally friendly aquaculture practices. Taxes or fees can be introduced to make the industry pay the external costs (externalities) imposed on the society due to pollution of the aquatic environment. A straightforward approach would be for authorities to charge the producers through taxes or fees according to their quantity of emissions, harmful inputs or production (FAO et al., 2022). On the other hand, a range of instruments – subsidies, tax alleviations, mechanism to support access to funding – can be used to ensure uptake of advanced technologies and innovations towards development of responsible, economically viable, environmentally sustainable and climate smart aquaculture (CSA). In addition to economic incentives, organisational, knowledge and information sharing, and administrative support also needs to be provided, especially for small-scale aquaculture producers.

44. Taxes, subsidies and similar instruments are based on market principles and behaviours of economic actors and consumers. According to available sources (e.g. EUMOFA, 2020), there are not many surveys of consumers' willingness to pay extra for fish produced by using environmentally friendly technologies for the EU aquaculture. On the other hand, a recent study by Xuan and Sandorf (2020) assessing: a) the public's willingness to pay to reduce the environmental impact of conventional shrimp aquaculture in Vietnam; and b) the farmers' willingness to accept a credit subsidy to invest in high-tech production methods, showed the public's willingness to pay exceeded producer's willingness to accept a subsidy under most scenarios, thus implying a potential for development of a more sustainable production.

Costs for producers/ private sector

45. Current aquaculture production across the Mediterranean employs a range of practices and technologies. Moreover, the Aquaculture Regional Plan measures refer to the use of various equipment, techniques and processes aiming to provide for good management and improvements in sustainability of aquaculture production. The bulk of the private sector cost is thus expected to refer to investments in new or upgrading of technologies, and to monitoring and reporting costs; for the operating costs, depending on measures implemented, both increases and savings are possible relative to conventional production. Due to limited availability of data on the costs of various technologies and baseline conditions (structure, technical characteristics, etc.) for the Mediterranean aquaculture (except, to some extent, for the countries members of the EU), this part of the analysis focuses on the Recirculating Aquaculture Systems (RAS) and Integrated Multi-trophic Aquaculture (IMTA). Available data on economic performance of various segments of aquaculture production is also presented as contextual information.

46. The STECF report (2023) shows the EU aquaculture has expanded over recent years and maintained profitability (with some exceptions). The overall economic performance of marine aquaculture was greatly improved in 2020, mainly due to the rise in operating subsidies (by more than three times compared to 2019) and the reduction in livestock costs (by approximately 30%). Both Gross Value Added (GVA) and Earnings Before Interest and Tax (EBIT) increased significantly; Return on Investment (RoI) in the Mediterranean countries ranged from 0.3% in Greece to 9.3% in Croatia and 46.4% in Italy, indicating, especially in Italy, high investment attractiveness of the sector. The average wage was EUR 24,000 but with significant variations (e.g. EUR 19,500 in Croatia; EUR 87,900 in

Denmark), reflecting differences in labour productivity and the capital and production intensity of the different techniques. High growth rates recorded in the non-EU Mediterranean countries (most notably in Tunisia, Albania, Turkey and Egypt) testify of the sector's economic viability in these countries too.

47. The seabass and seabream production segment in Greece recorded significant net losses in 2019-2020, affecting the overall profitability in a negative way. The key reasons include restructuring of some of the major producers and long administrative procedures, but mainly strong competition from Turkish aquaculture companies resulting in lower prices. In 2020, signs of recovery were visible with near doubling of capital productivity and improvement of the RoI rate. The net profit margin rates for seabass and seabream cages segment (in 2020) ranged from -2.1% in Greece to +7.2% in Italy and 28% in Croatia; for mussels longline, net profit margin rates were 30% in Greece and 32% in Italy.

48. Implementation of the Aquaculture Regional Plan requires producers to procure monitoring equipment and perform monitoring of their operations. In case this is not already done, this will incur additional costs for the private sector. The additional cost burden is not likely to be high except, potentially, for small-scale farms; for the medium and large farms this should be a low expenditure, without major implications for their profitability.

49. Implementation of new, innovative and environmentally friendly technologies and processes will have significant cost implications for the producers. On the other hand, circular economy and efficiency approaches integrated in these new technologies have potential to achieve significant savings and thus offset part of the higher investment and/ or operational costs.

50. Recirculating aquaculture systems (RAS) have numerous advantages over conventional production methods: they provide for a fully controlled environment for fish, low water use, full disease control, efficient land use, optimal feeding strategies, and proximity to markets. The main disadvantages are the need for large investments, use of a lot of technology, and the need for technically skilled staff. Problems with the taste of the product are also stated as a disadvantage in some sources (e.g. EC, 2021). RAS farms are in particular affected by the higher energy costs due to their design and need for continuous water recirculation with electric pumps, which affects their profitability. The RAS trout production in Denmark in 2020, for example, had lower net profit margin rate (of 4.7%) compared to pond (6.1%) and cage production (8.9%). Total operational costs of EUR 2.82 per kg of trout produced in RAS were lower than the costs from traditional production, but so was the product's market value (STECF, 2023).

51. Building and constructing RAS facilities requires significant capital expenditure (capex). The operating costs (opex) vary with the different local conditions of the water source but are generally considered higher to traditional farming methods, mainly due to the energy-demanding process of treating and transporting the water. Collection and disposal of sludge (or fish manure) adds to the operational costs (EUMOFA, 2020).

52. The RAS technology is promising in terms of sustainability, as it may reduce both water consumption and adverse effects on the local ecosystems. However, RAS still needs to be proven successful in commercial large-scale production, and especially with respect to finfish in saline water environments. Despite technologies still being under development, several new projects manage to get financing even in their early planning stages, before obtaining the necessary permits and licenses (EUMOFA, 2020). Despite the important potential of RAS, its profitability for the time being seems to be primarily secured for 'niche markets' for high-value products (EC, 2021).

53. The EUMOFA report (2020) concludes that enabling increased aquaculture production requires a multifaceted approach, including both regulatory and financial support. A case study on trout production in Denmark showed that transition from traditional farms to different types of RAS farms would not have

been possible without new regulations (on biomass density) and government subsidies on construction. Availability of incentive schemes is likely to be more important for low-value species.

54. Integrated Multi-trophic Aquaculture (IMTA) is based on the integrated cultivation of aquatic organisms belonging to different and complementary trophic levels. Inorganic and organic wastes from fed aquaculture organisms (e.g. finfish) are assimilated by respectively, autotrophs (phytoplankton, macroalgae, plants) and heterotroph species (oysters, mussels, sea cucumbers) that are co-cultured with the fed organisms (UNEP/MED WG.509/39). IMTA systems are designed to increase efficiency by optimising the use of nutrients, decrease the waste effluent and bio-deposit impacts, diversify products and contribute to/ enhance ecosystem services.

55. IMTA can take many forms and encompass various species combinations. In addition to provision of food and feed (marine plants, bivalves, finfish), it contributes to carbon sequestration and bio-remediation through removal of wastes generated by higher trophic organisms. IMTA can help increase productivity, employment and provide for a more sustainable, circular economy products. It is often seen as an important tool to facilitate the sustainable growth of aquaculture in marine and freshwater environments. There are also views that in order for IMTA to be economically viable, each of the individual components must be marketable or adding value through accounting for the ecosystem services that extractive species provide (Buck at al., 2018). The available analyses suggest that economic viability of offshore IMTA could be improved if it is developed in combination with other offshore structures.

56. Experience with coastal and offshore IMTA in the Mediterranean (and Europe in general) is rather limited and mainly linked to research-focused and pilot projects in Italy, France, Spain and Turkey, as well as in a number of other EU countries. Commercial uptake has not yet happened on a significant scale, and the data on production costs and revenues is limited.

57. A review by Hossain et al. (2022) found out that the existing socio-economic and cost-effectiveness analyses reveal positive prospects for IMTA systems, through product diversification, faster production cycles, and IMTA product prices. Moreover, a divergence between financial returns at the level of the entrepreneurial units and economic returns at the macro level was identified, inhibiting the uptake of IMTA. This calls for appropriate regulatory and institutional responses and capacity strengthening at all levels to allow for a full utilisation of IMTA potential and further development of technologies.

4 Regional Plan on Stormwater Management

4.1 Stormwater management in the Mediterranean region: significance and environmental issues

58. Demographic changes and urbanisation lead to conversion of vegetated “green” areas to developed, impervious, “grey” landscapes that disrupt natural hydrology and result in larger shares of precipitation being converted into runoff water. Population growth in the Mediterranean has been identified as one of the main drivers of coastal areas development and related environmental change (UNEP/MAP and Plan Bleu, 2020; MedECC, 2020). During the past two decades alone, population of the Mediterranean region increased by nearly a quarter: from 427.8 million in 2001, to 531.7 million in 2021 (UN DESA, 2022). Shares of urban population increased steadily across the region, standing at or above 70% in over half the countries (Algeria, France, Greece, Israel, Italy, Lebanon, Libya, Spain, Malta, Palestine, Tunisia, Turkey) in 2021 (World Bank, 2022).

59. The existing analyses suggest that approximately one third of the total Mediterranean countries’ population (170 – 180 million in 2021) lives in coastal areas. Shares of coastal population range from 5% in Slovenia to 100% in island countries (Cyprus, Malta) and Monaco; highest population density

(inhabitants per km^2) in the Mediterranean coastal regions is found in Monaco, Palestine, Malta, Lebanon, Syria, Israel, and Algeria (UNEP/ MAP and Plan Bleu, 2020).

60. In the process of preparation of the Regional Plan, a survey was conducted in 2020/ 2021 to collect information on the state of play of stormwater management in the Mediterranean. Results of the survey (encompassing 16 countries) are presented in UNEP/MED WG.505/8 and UNEP/MED WG.509/40. The key findings are recapped below to highlight baseline conditions of relevance for implementation of the Regional Plan.

61. Urban stormwater management (USWM) plans have been developed in Spain, Italy and France, but mainly for large cities. Situation is different in the Adriatic region where plans rarely exist; in some cases, elements of the USWM plans are incorporated into urban development plans, even though to a limited extent. In Israel, Palestine, Turkey, Egypt and Tunisia, USWM plans were under development for major cities,[13] mainly focusing on flood control segment (not on pollution). Across the Mediterranean, management of stormwater is typically the responsibility of municipal water utilities and is mainly considered as a technical problem dealt with exclusively by engineers. On the other hand, there is a need to integrate urban stormwater management into wider planning processes by involving other municipal departments and experts (urban planners, ecologists, landscape architects) and the public.

62. Most major urban centres in Spain, France, Italy and Greece have combined (for municipal wastewater and stormwater) collection systems in city centres and old districts, and separate collection systems in new or recently re-developed areas. Separate systems are very limited in coverage and have only been implemented in recent years in Slovenia and Croatia, while in other Adriatic countries combined systems are predominant. Separate collection systems are commonly implemented in industrial and commercial areas. In the eastern and southern Mediterranean, coastal cities predominantly have combined sewer systems. An important shortcoming of combined systems is that they are designed to overflow in case of heavy rainfall; in such circumstances, a mix of pollutants is released posing a significant threat to aquatic environment.

63. Application of alternative control measures (often referred to as sustainable urban drainage systems or SUDS) designed to mimic the natural functions of pre-development hydrology is still not widespread in European countries where it is typically limited to small-scale and pilot projects. As regards eastern and southern Mediterranean, SUDS is widely applied in Israel (where aquifer recharging and rainwater harvesting are particularly popular stormwater management practice); in Egypt, Lebanon and Turkey, application of SUDS is on the rise.

4.2 Measures and cost implications of the Regional Plan on Stormwater Management

64. The Regional Plan on Stormwater Management calls for the implementation of three groups of measures referring to: i) establishment of a regulatory framework by [2026-2029] to reduce stormwater runoff and peak flows, and address related pollution issues; ii) implementation [by 2029-2032] of urban stormwater control measures (non-structural and structural); and iii) implementation [by 2026-2029] of adequate maintenance to ensure efficient functioning of stormwater collection systems.

65. The key measure of the first group is development of stormwater management plans for the respective drainage areas. The Regional Plan also envisages regulation of further land use developments in a way as to maintain (to the extent possible) natural hydrology, identification and control of products and sources contributing to stormwater pollution, and monitoring of recipient waters.

[13] At the time the survey was conducted.

66. Implementation of stormwater control measures (the second group) refers to:

a. construction of separate collection systems in newly developed areas;

b. green infrastructure (GI) to complement infrastructure in the existing urban areas with separate stormwater collection systems, and Best Management Practices (BMPs) for newly developed areas;

c. for the existing areas with combined collection systems: i) installation of stormwater treatment units to ensure adequate capacity of the system for absorption of the peak loads, ii) de-connection of impervious areas from combined sewer systems, and iii) applying GI where possible to reduce stormwater flows.

67. Finally, the third group of measures refers to adequate maintenance of stormwater collection systems to ensure their efficient functioning and prevent overflow/ pollution (including an inventory on the functional conditions of overflow structures and sewage storage capacity; regular road maintenance, street sweeping and storm drain maintenance etc; and stormwater monitoring at key urban stormwater structures.

68. The Regional Plan measures with most significant cost implications for public sector and developers include construction of new collection systems, installation of stormwater treatment units, development and implementation of USWM plans together with capacity building, systems maintenance, and application of GI and BMPs. For the construction of new collection system, unit costs used for the assessment of costs of the Regional Plan on Urban Wastewater Treatment and Sewage Sludge Management (UNEP/MED WG.509/40) can be considered as indicative,[14] whereas the lower end of the range (of around EUR 190,000 per km) would be appropriate given the fact that construction requirements refer to newly developed areas (while construction in the already developed urban areas, especially the old ones, is much more cost-intensive). There is a limited availability of information on the actual costs of installation of stormwater treatment units, maintenance, application of GI and other measures in the Mediterranean and Europe, therefore benchmark costs could not be derived.

69. In the Mediterranean region, evacuation of stormwater via the sewerage network is usually financed by public utilities, with cost recovery being provided (albeit to a different extent) through wastewater collection and treatment charges. For alternative stormwater management techniques, the costs often have to be borne by developers. Despite the arguments in favour of alternative techniques and the fact they are relatively inexpensive, their uptake is still quite limited, mainly because they require additional financial resources and larger land area compared to traditional solutions.

70. A 2020 study examined stormwater management costs in California, where communities fund stormwater management programmes to reduce flooding and improve water quality. Existing publicly-available data on reported stormwater expenditures (actual spending in a previous year) and budgets (apportioned funding or projected spending in a future year) were collected from multiple sources for a large number of communities. Based on these information, total costs of non-structural and structural stormwater control measures (SCMs) and Best Management Practices (BMPs) were estimated (EFC, 2020).

71. Annual expenditures ranged from USD 3.50 to 54 per person, while expenditures per square kilometre ranged from USD 5,400 to 243,000. The significant variation in expenditures on both per capita and per square kilometre basis is linked to population density, with higher values recorded for densely populated coastal areas (including large cities such as Los Angeles and San Francisco). The highest cost

[14] Costs will range significantly from country to country depending on local conditions.

category was pollution prevention,[15] accounting for around 35% of the total. Other significant categories were capital costs (design and construction of new infrastructure) and operation and maintenance, with around 11% of the total each. Around 7% of total costs was spent on public education and involvement, and 2% on water quality monitoring (*Ibid.*).

72. Like for the other Regional Plans, opportunities exist for the stormwater management measures to be implemented in synergy with other policies (for example, ICZM plans and strategies, Regional Plan on Urban Wastewater Treatment and Sewage Sludge Management), thus contributing to the overall cost-effectiveness. Implementation of the Stormwater Regional Plan measures gains importance in the changing climate context, with expected changes in precipitation patterns.

5 The main benefits from implementation of the Regional Plans

73. Socioeconomic benefits associated with the Regional Plans implementation will occur at different points in time and for different actors, and will typically encompass: i) direct benefits (such as increased productivity, improved yields and job creation, as well as benefits inherent to the circular economy approaches such as savings, resource efficiency and similar); ii) avoided losses (e.g. losses due to climate change, damages caused by pollution); and iii) indirect benefits stemming from environmental improvements and sustained provision of marine ecosystem services (such as food, climate regulation, recreation etc.).

74. As regards the Agriculture Regional Plan, the main agronomic benefits include increased yields, better quality of agricultural products and improved resilience of agriculture, which will all have a positive impact on food security and preservation of traditional Mediterranean agricultural practices. Another key benefit from the implementation of the Regional Plan will be improvement in the quality of marine environment and contribution to the achievement of Good Environmental Status (due to reduced nutrient inputs/ eutrophication) and contribution to food safety. Water efficiency will be enhanced, and conservation of scarce water resources augmented. Improved irrigation technologies (such as construction of raised growing beds) in the Nile Delta, for example, may reduce water inputs by 30%, while improving yield by 25% and efficiency by 72%. Both improvements in marine environment quality and water savings have strong positive impacts on the economy and society. Other benefits from the Agriculture Regional Plan implementation with positive socio-economic implications include reduction of plastic waste and climate change mitigation (due to uptake of renewable energy sources).

75. While implementation of measures of the Regional Plan on Aquaculture Management will have significant cost implications due to application of new technologies, sizeable benefits can be expected from providing for further increases in aquaculture production as an important food source and by improving social acceptability. The Regional Plans measures addressing feed efficiency, for example, will bring direct positive effects for producers in terms of reduced operational costs. The main benefits for the society as a whole are related to reduction of nutrients and other pollutants that degrade the quality and marine ecosystems, as a precondition for sustained provision of their services in a long-run. By adequate planning and allocation of spaces for aquaculture, competition with other marine sectors and users will be reduced.

[15] Encompassing, *inter alia*, maintenance of inventories and maps, development and implementation of stormwater pollution prevention plans, maintenance of high priority storm drain systems and components, development and implementation of landscape design and maintenance programme to reduce the amount of water, pesticides, herbicides, and fertilizers used, training for municipal staff and other measures.

76. Benefits from the implementation of the Regional Plan on Stormwater Management are manifold; the main ones include:

a. Avoidance of damages to public and private properties due to prevention of urban floods, minimisation of clean-up costs; improved public safety;

b. Reduction of erosion (with positive impacts for built environment and ecosystem);

c. Improved aesthetics and recreational experiences (due to prevention of dirty water, trash and debris from reaching the marine environment);

d. Positive impacts on aquatic life and fish;

e. Positive effects for public health (by preventing contamination of drinking water, fish and shellfish);

f. Reduction of losses for fisheries, aquaculture, tourism and recreation related businesses;

g. Reduced costs of wastewater treatment and improved treatment efficiency.

77. Cost of inaction are also important for the evaluation of overall benefits from the Regional Plans implementation. While it is difficult to estimate the economic value (for society) of the degradation of marine environment that could take place if the three Regional Plans (or other regulatory instruments) are not implemented, there is growing evidence suggesting that inaction could be costlier than taking action. Losses of shellfish production due to changing climatic conditions, damages to marine environment from eutrophication and destruction of habitats, reduced soil quality, depletion of water resources, higher costs and lower efficiency of wastewater treatment due to overloads caused by stormwater and other examples indicate that losses for the society could be much higher than the costs of implementation of the Regional Plans.

6 Conclusions

78. The three Regional Plans analysed in this document address important sectors of the Mediterranean economy and urban environments that are home to an increasing share of the Mediterranean population. Costs of implementing the Agriculture and Aquaculture Regional Plans' regulatory and institutional measures for the public sector are expected to be of moderate scale. High costs are expected for producers, whereas the additional private costs are likely to be offset to a significant extent through support mechanisms envisaged under the Plans. For the implementation of the Stormwater Regional Plan, high costs (for which the cost-recovery mechanisms should apply) will be incurred to public sector; a significant share of the overall costs is likely to be borne by the private sector/ developers.

79. Support for innovative technologies and best management practices is available from different sources and should be utilised to the greatest possible extent. Implementation of the Regional Plans can help access these sources. Exchange of experiences and dissemination of best practices is also an important tool for the implementation of the Regional Plans' measures. Available information suggest that costs of inaction could outweigh the implementation costs.

80. For the Aquaculture Regional Plan, the bulk of the private sector cost would be investments in new technologies and monitoring and reporting costs. As regards the operating costs, depending on specific measures, both increases and savings are possible compared to the costs of traditional practices. Majority of the measures aim at increasing the efficiency of aquaculture production (feed efficiency, IMTA, biofloc technologies) which is expected to lead to increases in productivity and profit margins sufficient to cover increased costs of investing in new technologies and improving monitoring and reporting at farm level. The rough analysis conducted for this report allows for a conclusion that transition

to environmentally friendly aquaculture would yield net (economic) benefits for producers as well as for the society in the long run. If environmental benefits are taken into account, significant public benefits could be expected. Regulators should intervene in the early years of the Regional Plan implementation to support the industry with knowledge and incentives (a range of instruments is available, including subsidies, facilitated access to finance, tax alleviations, etc.), as well as through creation of favourable market conditions. On the other hand, taxes and other instruments can be used to disincentives harmful practices.

81. The Regional Plans encompass measures that require circular economy approaches and improved efficiency that reduce the costs and bring a range of benefits for those implementing them. Capacity building and knowledge transfers are very important for the public sector, and incentives for private sector/ producers and developers to help them cope with new technologies and practices while maintaining profitability.

82. Other policies of the UNEP/MAP Barcelona Convention system (as well as of other actors) work for the same goals as the three Regional Plans. Combined efforts to implement such policies will lead to optimisation and increased cost-effectiveness, while delivering multiple significant benefits such as preservation of marine ecosystems and of services they provide, food security, employment, and others.

83. An overview of the key findings of the is presented in the tables below.

Regional Plan on Agriculture Management				
Measures	**Type of measure**	**Projected cost**	**Who bears the costs**	**Benefits**
Regulatory framework (addressing nutrient discharges, irrigation, pest management and plastic wastes)	Regulatory	Low	Public sector	- Increased yields; - Better quality of products; - Improved resilience; - Contribution to food security; - Reduced nutrient inputs/ eutrophication; - Soil protection; - Water efficiency/ conservation; - Reduction of plastic wastes; - Climate change mitigation.
Extension/ advisory services (training, awareness raising for farmers)	Institutional	Moderate	Public sector	
Support mechanism (to enable farmers to implement appropriate measures)	Financial, technical	High	Public sector	
− Designation of 'vulnerable zones' − Implementation of measures to eliminate excess nutrient discharges	− Regulatory − Technical	− Low − Moderate/ high	− Public sector − Famers/ producers	
Measures based on Good Agricultural Practices: − Integrated approaches to nutrients supply − Conservation tillage − Climate-smart practices − Renewable energy, efficiency	Technical	High (investment costs)	Farmers/ producers	

Regional Plan on Aquaculture Management				
Measures	**Type of measure**	**Projected cost**	**Who bears the costs**	**Benefits**
– Regulations on operational requirements for aquaculture; – Institutions to enforce regulations and provide support (market conditions, knowledge, support mechanisms, access to finance).	Regulatory Institutional, technical, financial	Low Moderate/ high	Public sector	– Sustained growth of production, contribution to food security and employment; – Diversification of production; – Improved social acceptability; – Improved welfare of farmed species; – Lowered operational costs due to measures addressing efficiency; – Reduction of nutrients and other pollutants that can cause ecosystem disruptions and loss of biodiversity; improved control of escapes and invasive species; – Sustained provision of ecosystem services; – Reduction of plastic wastes.
Control/ reduce releases of potentially detrimental substances (Annex I.C of the LBS Protocol); minimise levels of pollutants by: – For land-based aquaculture: wastewater filtration and treatment; [recycling/ reusing water from aquaculture]; monitoring of water quality; optimisation of effluent discharge systems; – For sea-based aquaculture: application of mixing zones; use of monitoring devices and remote sensing; no-activity zones; use of environmentally friendly antifouling.	Technical	High (high investment costs, possible savings on operational costs)	Private sector/ producers	
Regulate and promote/ foster sustainable aquaculture by: – For land-based aquaculture: [employing IMTA, biofloc, RAS technologies; improved feed efficiency and quality; [controlled use of pharmaceuticals]; [measures to avoid escapes]; monitoring; – For sea-based aquaculture: selection of sites based on EEA or MSP; facilitating spread of IMTA; controlled use of pharmaceuticals; reporting escapes; EMPs.	Technical	High (high investment costs, possible savings on operational costs)	Private sector/ producers	
Reducing generation of plastic wastes from aquaculture (replacement of plastic infrastructure components, use of high-density plastics, reduction of single-use plastics, mandatory recycling policies and schemes, etc.)	Technical	Moderate	Private sector/ producers	

Regional Plan on Stormwater Management				
Measures	**Type of measure**	**Projected cost**	**Who bears the costs**	**Benefits**
Plans and regulations to reduce stormwater runoff and peak flows, and address related pollution: development of urban stormwater management plans; regulations on new developments; identification of sources contributing to stormwater pollution; monitoring of recipient waters, etc.	Regulatory	Moderate	Public sector	− Avoided damages to public and private properties; improved public safety; − Improved erosion control; − Positive effects for public health; − Improved aesthetics and recreational experiences, positive effects for recreation-related businesses; − Positive effects for aquatic life; − Reduced costs for wastewater treatment, improved efficiency.
Non-structural and structural SCMs: separate collection systems for newly developed areas; GI to complement existing separate collection systems and BMPs for newly developed areas; de-connecting impervious areas from combined sewers; stormwater treatment units for combined collection systems; GI to reduce stormwater flows.	Technical	High (mainly investment costs)	Public sector, developers, population	
Maintenance to ensure efficient functioning of stormwater collection systems: inventories of the capacities and functional conditions of overflow structures; regular maintenance of roads, storm drains and landscape/ parks; regular monitoring of stormwater (quantity and quality).	Technical	Moderate/ high (mainly operational costs)	Public sector, population	

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