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INTRODUCTION

Managing coastal areas, from a sustainable development viewpoint, involves managing the conflictual situations that arise from the overlapping of economic and ecological interests, often with quite unethical results.

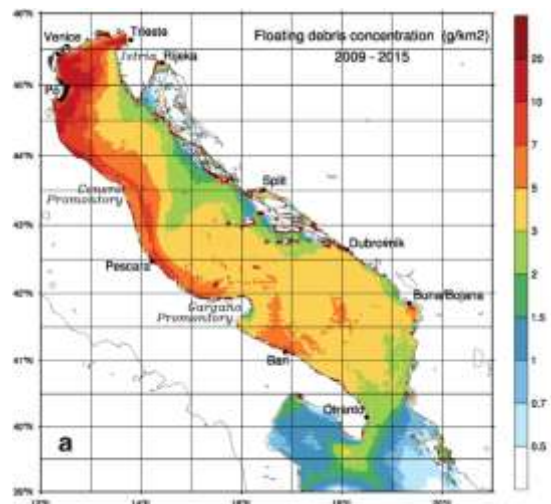
The European Commission has already set underway a Demonstration Program on Integrated Coastal Zone Management (ICZM) involving demonstration projects and thematic studies. The purpose of this program was to:

- provide technical information on ICZM;
- stimulate a broad debate among the players involved in the planning, management and use of European coastal zones.

Eight principles were established to be followed in national strategies, based on the experience developed in the Demonstration Programs:

1. a complete overview (thematic and geographical) which considers the interdependence and inequalities in natural systems and human activities and the impact on coastal areas;
2. a long-term view that considers the principle of precaution and the needs of today's and future generations;
3. a management adaptable during the process. This implies the need to manage and coordinate the scientific knowledge on the evolution of the coastal zones;
4. locally specific situations and the diversity of European coastal zones, the response to their practical need can be achieved by adopting specific solutions and flexible actions;
5. working within the natural processes and considering the carrying capacity of the ecosystems is achievable, but long term, if human activities become eco-sustainable, socially responsible and economically important;
6. consideration of all the partners (social and economic, organizations representing the residents of coastal areas, NGOs) in the management;
7. support and participation of national, regional and local government bodies, where collaboration should be encouraged in order to improve the coordination of existing policies;
8. use of suitable instruments to facilitate consistency between sector policies and management planning.

The Adriatic Sea is a semi-enclosed basin with slow currents and a long water retention time, making it very vulnerable to pollution related to marine litter, most of which is made up of plastic materials. Trans-national effects are very evident





with floating marine litter travelling across borders. Fisheries and aquaculture sectors are partly contributing to marine litter in the region, while other contributing factors are tourism, shipping, inadequate waste management at all stages, discharged industrial waste, illegal urban waste management, etc..

Enforcement of relevant policies is weak mostly because of the low awareness of the problem and poor coordination between different national and local administrations dealing with solid waste issues. Only a few countries have policies related specifically to marine litter. Local administrations and municipalities are ultimately responsible for the management of coastal litter in the region. The role of the relevant ministries is limited when it comes to controls and checks. The marine litter management issue gained momentum with the entering into force of the Barcelona Convention (BC) and its Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities (LBS), the ICZM Protocol and Special area under MARPOL Annex V. The need is to tackle the issue of marine litter with concrete initiatives.

This document is the result of a collaborative effort among different entities to find tools for a common governance and sustainable management in the framework of ICZM. The objective of this action is to foster collaborative policy frameworks in order to implement new shared guidelines based on the results of the aforementioned activities, involving scientists and stakeholders, in the Adriatic to integrate these results into each country's ICZM strategies and plans. The preparation of the document is made jointly by all the project partners, each bringing its own experiences and expertise.

LEGAL ASPECTS AND KEY PLAYERS

The Protocol on Integrated Coastal Zone Management in the Mediterranean (Madrid, 2008) (ICZM Protocol) is a binding international legal instrument that came into effect in March 2011. The Protocol is one of seven protocols of the Convention on the Protection of the Maritime Environment and Coastal Region of the Mediterranean (Barcelona, 1976, 1995). ICZM principles have been increasingly respected in defining the purpose of coastal areas of EU Member States. In order to promote the sustainable development of coastal areas, the European Commission, in March 2013 proposed a Directive establishing a Framework for Maritime Spatial Planning and Integrated Coastal Management. This Directive set the deadline for the development of national strategies by 2016. The implementation of the obligations of the Directive were harmonized with the objectives and obligations of the ICZM Protocol. The aim of this Strategy is to achieve and/or maintain a “good state of the marine environment” by 2020. Under the proposed Directive, EU Member States will be obliged to draw up national strategies for coastal zone management that will be bound to the Commission recommendation on integrated management of coastal areas from 2002 (2002/413/EC) and the ICZM Protocol.

The Protocol promotes cooperation and a comprehensive approach to analysing and solving various and often interdependent problems of coastal areas. The ICZM protocol also foresees the development of national ICZM strategies. In this paragraph, the most important national acts passed in each country concerning the application of the ICZM Protocol will be presented.

CROATIA

The Republic of Croatia is a signatory country of the ICZM Protocol. Croatia is also a signatory country of the Barcelona Convention. The Marine Strategy Framework Directive was also transposed into Croatian legislation. For the development of the Strategy in Croatia, the Ministry of the Environment and Nature Protection is responsible, in cooperation with different sectors; Spatial Planning, Maritime, Tourism, Transport, Regional Development, Agriculture, Fisheries, Forestry, Water Management, Nature, Science, Health and Culture.

In Croatia, the whole set of obligations arising from the ICZM Protocol has already been adopted into the existing legal framework:

- Law on Spatial Planning and Construction (Zakon o prostornom uređenju i gradnji, NN, 76/07, 38/09, 55/11, 90/11)
- Environmental Protection Act (Zakon o zaštiti okoliša, NN, 88/94)
- Law on the Protection of Nature (Zakon o zaštiti prirode, NN, 70/05, 139/08, 57/11)
- Water Law (Zakon o vodama, NN, 153/09, 63/11, 130/11)
- Law on Protection and Preservation of Cultural Heritage (Zakon o zaštiti i očuvanju kulturnih dobara, NN, 69/99, NN 151/03, NN, 157/03, NN, 87/09, NN, 88/10, NN, 61/11)

- Right to Information Act (Zakon o pravu na pristup informacijama, NN172/03, 144/10)
- Law on Maritime Domain and Sea Ports (Zakon o pomorskom dobru i morskim lukama, NN 158/03, 100/04, 141/06, 38/09)
- Maritime Law (Pomorski zakonik, NN 181/04, 76/07, 146/08, 61/11).

In accordance with the law, the underlying papers for sustainable development - the Sustainable Development Strategy of Croatia, Environmental Protection Plan of Croatia, Environmental Protection Program and Environment Status Report - are strategies, plans, programs and reports that have been adopted in specific sectors for specific environmental elements and loads. One of these papers is the Strategy for the Management of Marine Environment and Coastal Zones.

Strategic environmental assessment represents one of the management tools in integrated coastal area management. According to the legislation of the Republic of Croatia, strategic environmental assessment is obligatory for the majority of strategies, plans and programs. The principles of integrated management such as interdisciplinarity, compliance with sector interests and an ecosystem approach, can be achieved by means of a strategic environmental assessment, as well as by spatial plans of Adriatic countries.

In Croatia, the Sustainable Development Strategy (Strategija održivog razvitka) has been implemented. This strategy supports the protection of Adriatic Sea, its coastal areas and islands. The recent practice confirms that the strategy of sustainable development and strategic environmental impact assessment are closely linked tools that complement each other. The Strategy will be implemented through Action plans for each of the challenges. The Republic of Croatia, together with other members of the Mediterranean Action Plan (MAP), adopted the Mediterranean Strategy for Sustainable Development (UNEP/MAP Athens, 2005) which focus on the sustainable management of the sea, coastal areas and marine resources of Mediterranean.

GREECE

Currently in Greece there is no specific national legislation dealing with ICZM or MSP (Marine Spatial Planning) strategies. Greece has signed the Protocol concerning Special Protected Areas and Biodiversity in the Mediterranean (1995), as well as the Mediterranean Protocol on ICZM (2008) that refers among others to MSP and participates in activities to promote/facilitate its implementation. Greece's interest in Integrated Coastal Zone Management was expressed on many occasions. The country developed, among others, a Coastal Area Management Program (CAMP) for the island of Rhodes and a number of ICZM-related projects (e.g. LIFE 1999-2000 for integrated coastal management of the Cyclades Archipelago, TERRA 1998-2001 for integrated coastal zone management of the Kavala Prefecture, etc.). Coastal zones are included in the national legislation and regulated by general or special laws, presidential decrees, management plans and special protection measures.

The most important regulations/legislation for the management and protection of either the marine ecosystem or the coastal zones closely related to the ICZM and MSP are summarized below:

Legislation for Environment and Planning:

- L. 2742/1999 for Spatial Planning & Sustainable Development - this law envisages the issuing of national level guidelines ("Special Frameworks for Spatial Planning and Sustainable Development") for the development of sectors and/or areas of special interest, such as coastal zones, islands, mountain areas and, generally, areas with persisting environmental, urbanization and social problems;

- General Framework for Spatial Planning at a national level (Joint Ministerial Decision, 2008);
- Regional Spatial Plans (4 Ministerial Decisions, 2003) for the Northern Aegean, Southern Aegean, Crete and Ionian island regions; 8 more Regional Spatial Plans (8 Ministerial Decisions, 2003) for the other coastal regions;
- L. 2971/2001 on Coasts and Beaches (also referring to ports) and aimed at integrating European and International Regulations and Guidelines concerning coastal areas.
- National Framework for Spatial Planning of foreshores and beaches (Gov. Gazette 1138B/2009); Official approval of the Specific Framework for Spatial Planning for Sustainable Aquaculture and the related Strategic Environmental Impact Study. (Ministerial Decision, O.G.G.2505B'/04.11.2011).
- Law 3983/2011, "National strategy for the protection and the management of the marine environment. - Adoption of the Directive 2008/56/EC". (O.G.G.144A'/17.06.2011). The law's specific objectives focused on taking measures to achieve and maintain a good environmental status in the marine environment, up to 2020, application of measures, managing of human activities that should follow an ecosystem approach and achieving the cohesion of environmental parameters and ensuring the integration of the numerous policies.
- Official approval of the Specific Framework for Spatial Planning for Sustainable Aquaculture and the related Strategic Environmental Impact Study. (Ministerial Decision, O. Gov. Gazette, 2505B'/04.11.2011).
- P.D. 55/1998 (Gov. Gazette A' 58) for the Protection of the Marine Environment;
- Joint Ministerial Decision 33318/3028/1998 - Harmonisation with Directive 92/43/EC "On the Conservation of Natural Ecosystems as well as Wild Fauna and Flora";
- Law 3201/2003, "Re-establishment and Protection of the Natural and Builtup Environment on Islands, as regards the competence of the Ministry of the Aegean";
- Law 3199/2003, "Protection and Management of Waters - Harmonisation with Directive 2000/60/EC (European Parliament and Council, 23 October 2000)".

Legislation for Shipping:

- L. 2252/1994 (Law by which Greece has ratified the International Convention OPRC 1990);
- Presidential Decree 11/2002 (on Contingency Plans).

Legislation for Underwater Cultural Heritage:

- L. 3028/2002 and related Ministerial Decisions on the Protection of Underwater Cultural Heritage;
- Ministerial Decision of 2003 (OJ 1701/19-11-2003) characterizing ship wrecks as cultural goods;
- Joint Ministerial Decision of 2004 (OJ 336/11-2-2004) with restrictions for mooring and diving.

Special Framework for Tourism (Gov. Gazette, 3155 B/2013). The present framework is a third revision of previous ones, which were much criticized as favouring mass tourism (30% of building stock, holiday houses) and creating serious threats to the environment.

ITALY

The Ministry of Environment, Land and Sea, more specifically the Directorate for Nature Protection has activated a consultation process with the coastal regions in order to define a national ICZM strategy as well as related planning and implementing projects (such as a CAMP project). Moreover, the Ministry of Environment, Land and Sea is responsible for the protection of the marine biodiversity. Italy has started the procedure for the approval of a project "CAMP Italy" set up in 2007, also in order to fulfil the obligations related to the signing of the ICZM Protocol. It has contributed, through the testing of ICZM methodology in formulating and carrying out a national strategy for the integrated management of coastal zones, in order to promote and implement the protection of ecological and landscape interest areas, rational use of natural resources and sustainable development of coastal areas.

Recent changes in the Italian legislative framework involved a shift of the main coastal competences from the state to the regions. The regions are considered to be more competent to carry out planning policies and Integrated Coastal Zone Management. However, the situation with coastal planning is still characterized by a fragmentation between the different state authorities, the regions and the municipalities.

As previously mentioned, Italy has still no national ICZM strategy. The ICZM process, as defined in the EU Recommendation has not been completely implemented yet as there is no national framework and no national ICZM / MSP strategy. Further implementation of the ICZM process demands the participation and active support of all administrative levels. However, positive examples of ICZM can be found in regional and local efforts, with some regions drawing up ICZM guidelines (Emilia-Romagna, Marche, Liguria and Tuscany). These four regions have developed their own coastal plans, which include coastal protection, beach nourishment, marinas, coastal traffic issues and the development of public and tourist facilities in coastal areas. These plans were based on the awareness that the overall coastal governance required a methodological planning instrument, instead of the previously adopted "urgent measures".

Nevertheless, with regard to ICZM and MSP, the following legislation is of particular importance:

- Spatial planning legislation:
 - o The Urban Planning Law (N°1150/1942) regulates building and development in urban centres, as well as in the rural areas. Italy has three levels of spatial planning, namely the regions, the provinces and the municipalities.
- Marine legislation:
 - o General Rules for Sea Protection (N°979/1982) aim at the implementation of sea environmental protection policies and prevention of sea resource damage. The law foresees the creation of a sea and coastal defence plan for the whole national territory to be defined in an agreement with the regions. So far no national plan has been drawn up, however, some regions have adopted their own coastal plans regarding their territorial competences;
 - o Environmental Consolidated Act (N°152/06) foresees that the regions develop, in compliance with the European Water Framework Directive 2000/60, a Water Protection Plan as this is a necessary regional tool to achieve environmental targets regarding the environmental quality of land and sea water.

MONTENEGRO

For the integrated management of coastal zones in Montenegro, an extremely important set of laws have been passed referring to the problem of the arrangement of certain segments, distribution of competences in making decisions and regulation of activities which have a dominant impact on sustainable development and protection of this area. Therefore, the most important acts and documents from the legal and administrative Montenegrin system are presented here.

Before making a list of legal documents that are related to the management of coastal zones, it is important to mention that Montenegro was declared an ecological country by the Declaration of the Ecological State of Montenegro, adopted on 20th September 1991 by the Parliament of the Republic of Montenegro.

- Law on Public Maritime Domain („Official Gazette of the Republic of Montenegro“, no.14-92, 27794 and “Official Gazette of Montenegro“, no.51/2008, 21/2009 and 40/21011).
- Law on Spatial Planning and Construction of Objects (“Official Gazette of Montenegro“, no.28/05, 51/08 and 34/11, 35/13).
- Nature Protection Law (“Official Gazette of Social Republic of Montenegro“, No.51/08 and 21/09)
- Law on Protection of Cultural Monuments („Official Gazette of the Republic of Montenegro, No. 47/91)
- Law on the Protection of the Cultural Heritage (“Official Gazette of the Republic of Montenegro“, No. 49/10)
- Environment Law (“Official Gazette of the Republic of Montenegro“, No. 48/08)
- The Regulation on Environmental Impact Assessment (EIA)
- Law on Strategic Environmental Assessment (“Official Gazette of the Republic of Montenegro“, No. 80/05, 59/11)
- Law on Integrated Environmental Pollution Prevention and Control (“Official Gazette of the Republic of Montenegro“, No. 80/05, 54/09)
- Water Law (“Official Gazette of the Republic of Montenegro“, No. 27/07, 32/11, 47/11)
- Tourism Law (“Official Gazette of the Republic of Montenegro“, No. 61/10, 40/11, 53/11)
- Law of the Sea (“Official Gazette of the Republic of Montenegro“, No. 17/07, 06/08)
- Law on Ports (“Official Gazette of the Republic of Montenegro“, No. 51/08, 40/11, 27/13)
- Law on the Protection of the Sea from Pollution from Vessels (“Official Gazette of the Republic of Montenegro“, No. 20/11)
- Law on Sea Fishing and Mariculture (“Official Gazette of the Republic of Montenegro“, No. 56/09, 47/15)
- Special Purpose Spatial Plan for the Area of Public Maritime Domain (“Official Gazette of Montenegro“, No. 30/07)
- Draft of the Special Purpose Spatial Plan for Coastal Zone (2015)

The Government of Montenegro manages the development, spatial and protection policy, along with its relevant departments (Ministries), including the second-instance administrative procedure and, for the

public domain area and functions which are important for the state itself, it also carries out the first-instance administrative procedure. All other issues, which are of some importance for a local community development, are managed by local authorities and local government departments.

Legislative power (the Parliament of the Republic and local government parliaments) is responsible for adopting laws and spatial plans. Among government departments, there have been established other institutional organizations with managing and administrative responsibility for certain areas. To be in line with the newest regulations, 16 ministries have been set up in the Republic of Montenegro Government.

The Public Enterprise for the Management of the Maritime Domain protects and manages the public maritime domain and enhances its use, leases/contracts for the use of the public maritime domain and constructing and maintaining the necessary infrastructures. This public company is under the administrative control of the Ministry of Economic Development.

In the sector of tourism, the Ministry of Tourism and Environment, together with the National Tourism Organization are responsible for the tourism development strategy on a national level, while at a local level, there have been a number of local tourism organizations set up.

In the sector of scientific and educational institutions, the most significant for the IUOP are: Institute of Marine Biology (a scientific unit of the University of Montenegro) and the Public Institution Centre for Eco-toxicological Research of Montenegro.

The following ministries and departments are responsible for the protection of water – sea: Ministry of Agriculture and Rural Development – Water Directorate, Ministry of Maritime Affairs and Transport / Harbour Master’s Offices and Maritime Safety Directorate, and Ministry of Tourism and Environment Protection - Hydro-meteorological Institute.

SLOVENIA

Slovenia does not have a specific legislation for its coastal zones. Coastal zones are planned on the basis of national spatial planning legislation.

The most important acts in this respect are:

- Spatial Planning Act (“Zakon o prostorskem načrtovanju” (ZPNačrt) - Official Gazette of the Republic of Slovenia, nr. 33/07, amendments: Official Gazette of the Republic of Slovenia, nr.70/08-ZVO-1B, 108/09): Maritime Spatial Planning is not specifically regulated by this law; however, this law can be applied to the sea;
- Waters Act (“Zakon o vodah” (ZV-1) - Official Gazette of the Republic of Slovenia, nr.67/02, amendments: Official Gazette of the Republic of Slovenia, nr.110/02-ZGO-1, 2/04-ZZdrI-A,41/04-ZVO-1, and 57/08) - governs the management of marine, inland and ground waters, and the management of water and waterside land. This includes the protection of waters, the regulation of waters and decision-making on the use of waters;
- Environmental Protection Act (“Zakon o varstvu okolja” (ZVO-1 UPB1) - Official Gazette of the Republic of Slovenia, nr. 41/04, its amendments.
- Nature Conservation Act (“Zakon o ohranjanju narave” (ZON-UPB2) - Official Gazette of the Republic of Slovenia, nr. 56/99 (31/00) and its amendments. Provides the measures for the preservation of biotic diversity and the system of valuable natural features protection with the aim of contributing to the conservation of nature;

- Maritime Code (“Pomorski zakonik” (PZ- UPB2) – Official Gazette of the Republic of Slovenia, nr. 26/01, amendments: Official Gazette of the Republic of Slovenia, nr. 21/02, 110/02-ZGO-1, 2/04, 37/04-UPB1, 98/05, 49/06, 120/06-UPB2). Regulates the sovereignty, jurisdiction and control of the Republic of Slovenia over the sea, navigational safety in territorial waters and internal waters, protection of the sea against pollution from vessels and legal regime of ports;
- Marine Fisheries Act (“Zakon o morskem ribištvu” (ZMR-2) - Official Gazette of the Republic of Slovenia, nr. 115/06). Establishes objectives and measures in marine fishery.

INTEGRATED COASTAL ZONE MANAGEMENT

To manage coastal areas means harmonizing the integrity of eco-systems with the economic processes and activities which have become established in the marine coastal zones. This requires a multi-disciplinary approach, training and, especially, a human-marine relation that can find the right balance between the different human needs and environmental conservation.

The right program for organizing a region applies key and relevant measures based on modern ecology and, in particular, it applies the principle of contiguity within the regional mosaic of the area subjected to the exploitation of resources and protected zones.

Nowadays, the resolve is growing that a good use of this vital space must derive from an “integrated” approach.

In management, the integrated approach is an attempt to create the right relations among the different parties involved, removing those activities which cause more damage than real benefits, more costs than yield.

The “management” of the Adriatic coastal area has become an increasingly pressing and impelling need. Even if many different subjects have requested and hope for this, there are rarely any moves to start up any actions aimed at a rational use of the resources and the potential of the coastal zone and, as well, a self-regulation by those operating in the different productive sectors.

Therefore, a correct management of the coastal zone can be carried out only by having available as much information as possible on the interaction of the different elements, or on the fishing activities, the water quality, level of coastal anthropization, life on the seabed, the pollution sources, the protected zones, the urban-planning tools, the impact on tourism and on the mariculture practiced.

THE INTEGRATED MANAGEMENT PLAN

The studies, research and monitoring carried out in different areas, both national and European, have clearly highlighted the need to work using an integrated multi-sectoral approach.

The need to introduce a systematic and multi-disciplinary action leads to drawing up a specific Plan for the integrated management of coastal zones in order to consistently address the development of activities set up along the coast and which will positively influence all the factors which, from inland to the sea, impact these delicately balanced areas. Integrated Coastal Zone Management is quite complex, requiring scientific knowledge, important resources and a common commitment.

The Plan must tackle the many inter-related problems of the coastal areas of a biological, ecological, physical, economic and social nature. In accordance with some recent European Union recommendations concerning Integrated Coastal Zone Management, an integrated and participative approach must be guaranteed to result in the management of the Adriatic coastal zones being able to be economically and environmentally sustainable, but, at the same time, socially equitable and cohesive.

THE KEY ACTIONS

The management of coastal zones requires utilizing different tools – legal, economic, voluntary agreements, technological solutions, research and training. The right balance of these tools in specific cases will depend on the problems encountered.

Effective and open dialogue among the subjects involved underlies sustainable development. It is essential to recognize the synergies and contradictions of actions resulting from the different policies and to facilitate the acceptance of the necessary arbitration in making all equally responsible for their decisions and actions.

Effective dialogue can only be developed if there is a full knowledge and information on the environmental and regional situation, the causes for the changes that it is undergoing, the implications of the measures to be adopted and the options at play.

Effective dialogue must be carefully organized and followed up. Working means and methods are essential for the dialogue among the subjects of the different sectors, as well as an ongoing exchange of information among the different levels of regional competences, from the local to EU level and vice versa.

The work must be first preceded by a phase of data collection and analysis of the target area:

- **Description of the coastal zone:** gathering of available information concerning the environmental, historical, socio-economic, urbanistic and landscape aspects of the area. Therefore, if no data is available, every plan for Integrated Coastal Zone Management must begin with a thorough data collection and analysis, so that the data and context result in defining and providing the most detailed information possible to understand the problems and to establish the guidelines to support the policies and management of the area.

- **Data collection for the management of the coastal area:** identification of relevant data by means of integrating the research, identifying the relevant sites, analysing their features and defining the most efficient ways to organize the data collection campaigns and monitoring.

- **Definition of the criteria for the morphological and ecological balance:** the most important is the definition of the reference criteria for the “Quality” and “Health” of the Coastal System. Criteria which focuses on the short and long term geo-morphological and ecological evolution as well as on a local scale and wider scale, the sources of pollution and their quantification.

- **Activity analyses:** The regional elements can be put into relation using “Impact Matrices” and/or “Interaction Matrices” to establish the interaction among the activities, underway and planned, the socio-economic and the eco-system aspects and the morphological evolution. This part is fundamental to individuate the conflicts among the different uses and be able to support decisions regarding defining the different uses allowed for the whole area.

INTEGRATED MANAGEMENT OF MARINE WATER RESOURCES

Pollutants are substances which if released into the environment can cause damage to the biosphere and humans. They are by-products of human activity, which are released into the air, the water and the ground. As well as direct pollution involving the release into nature of extraneous substances, there is also indirect pollution resulting from the transformation of these composites into other, more harmful ones due to certain environmental conditions.

Marine pollution results from the introduction of inland polluted water and inadequately treated waste water coming from industry, urban and coastal settlements and by waste elimination from all types of vessels. The sea becomes polluted even at a considerable distance from the coast .

Pollution of natural waters, both at sea and inland, results from very complex reasons. For aquatic life, the presence of a sufficient quantity of dissolved oxygen is fundamental. If organic substances are introduced into the water in high doses, they are destroyed by aerobic bacteria which transforms them into simpler substances and this process involves the use of dissolved oxygen. If the pollutants are present in higher concentrations, all the dissolved oxygen and also that absorbed by the external environment will be consumed



by aerobic micro-organism activity. Subsequently, an anaerobic bacteria population will establish itself, able to destroy the organic substances and transform them into harmful substances, lethal for aquatic animal and plant species.

The increasingly indiscriminate discharge of waste carried out in surface waters (rivers and lakes) and in coastal marine waters has created over the decades problems of more serious and widespread pollution. This is because, apart from some exceptions, it was only towards the seventies that the political and administrative bodies of the different industrialized states began to systematically tackle the problem.

With the continual growth of urban populations, and even more so with increases in human consumption, the quantity of waste has increased dramatically and, this extremely serious problem has changed their quality. As far as quantity is concerned, it is especially important to consider the increase in bacterial and viral content of faecal origin, due to the urban population growth and the increase in the quantity of organic waste which is also linked to increased consumption and urban industrial activities. The pollution in rivers from the discharge of untreated urban waste water has become so high as to exceed the self-purifying capacity of water courses. These become sources of infection along their whole length, finally reaching and polluting coastal marine waters, often bathing areas.

Repeated phenomena which do partly compromise the water quality under a physico-chemical bacteriological profile, but which have a great visual impact and, therefore, a considerable effect on

public opinion regarding the presence of floating waste (plastic bottles, plastic bags, etc.) which sometimes accumulate or are channelled by coastal currents. The origin of this waste is quite different but seems separate from the waste water treatment system (sewers, water purifying plants, discharge pipes). In particular, the most important alternatives have often been individuated in the river and stream beds.

THE MARINE LITTER

Marine litter (ML) is defined as any solid, persistent, manufactured or transformed material which is dumped, abandoned or lost at sea or along the coast. Thus, marine litter are objects made and used daily and then abandoned or lost along the coastline or at sea, including those materials which, abandoned on land, eventually reach the sea by means of rivers, wind, runoff and urban waste water.

The problem of waste at sea is increasingly taking on the level of an emergency. The levels found along all the Adriatic beaches are considerable and continually increasing. To this can be added the waste present on marine seabed and that floating on the sea's surface.



The origin of this material, of different types but usually regarding different plastics and other petroleum derivatives, is various and always of anthropic origin. From waste transported by the rivers to that thrown into the sea by different kinds of ships, from that directly linked to activities carried out along the coastal areas to that caused by the illegal management of urban waste.

Individuating and monitoring the sources is a difficult task, but even more difficult is trying to reduce the quantity of waste in the sea because of the diversity of its sources,

sometimes far from the coast as in the case of river transported waste, and the objective difficulty of applying the rules of the legislation of each of the bordering states, which are often circumvented or not respected.

In some areas, the situation is aggravated by the circulation of currents that result in the build up of floating waste in certain marine areas and along some coastal zones. Mathematical models, confirmed from field observations, show the effects of marine currents in the Adriatic on the distribution and concentrations of this type of waste.

A good picture of the full economic significance of the impacts of marine litter still remains relatively limited. However it is well known that every year, marine litter results in economic costs and significant losses for the economic sectors involved, such as tourism and recreation, fisheries and aquaculture, maritime transport and navigation, and infrastructure and services for individuals, local communities and enterprises.

The diversity of marine litter results in it being extremely complicated to measure its total economic costs. Direct economic impacts are clearly easier to calculate than indirect economic and social costs such as ecosystem degradation or reduced quality of life. Moreover, establishing the economic costs of marine litter is complicated by the wide variety of approaches available for evaluating the environmental impacts, and the negative externalities created by marine litter.

A sector-based approach provides a basis for a socio-economic analysis of marine litter because it investigates the increased costs and potential losses of revenue associated with marine litter for vital economic sectors, such as tourism, fisheries, aquaculture and navigation.

This determines the need to launch actions in different ways and with different means to try to reduce the presence of ML and consequently the damage it causes.

Up to now, the most effective intervention system has shown to be that of organizing collection programs along the coasts involving voluntary work or more coordinated and widespread significant programs. As far as waste collection at sea is concerned, this has been carried out several times with the cooperation of fishers who voluntarily collect the waste which ends up in their nets during their normal fishing activities.

THE "GHOST NETS"

A very particular problem regards that linked to the presence of lost and discarded fishing nets on seabeds.

Based on observations gathered, in some fishing communities the problem appears to be greatly felt, in others, the fishers are aware of it but do not see it as an impediment to their fishing activities.

It cannot be excluded that there are situations involving the deliberate intention of abandoning the nets, as, for example, when there are particularly heavy storms which can damage or weigh down the nets making it more convenient to leave them at sea rather than try to recover them.



However, it can be confirmed that, beside the objectively possible and verifiable environmental damages caused by abandoned fishing gear, their presence in the sea is noted by professional fishers who generally understand the type of interaction that exists between their activity and the presence of this gear. The same fishers are affected by the damage caused by ghost nets, as seen in the reduction of their fishing grounds because of physical obstacles and also that resulting from passive catches.

Frequently, a gear recovery project is requested, not only by those who have declared themselves "damaged", but also by those more aware of the issues of safeguarding the environment, quite frequent also among the fishers themselves.

Therefore, it would be important to introduce this recovery action, both regionally and nationally, possibly including it in a "clean up the seabed" project, especially in those areas where "ghost nets" are concentrated because of the presence of rocks, natural or artificial reefs, etc..

MUSSEL FARMING "SOCKS"

A completely different, but no less important, problem concerning the "socks" used in bivalve mollusc farming, and mainly in mussel farming. These "mesh cells" made of polypropylene can often be found abandoned on the seabed and along beaches, usually lost due to sea storms or those no longer usable after mussel-socking being discarded at sea.

In coastal areas of high intensity mussel farming, the socks found on the beaches and seabed can cause environmental problems, along with the more usual waste such as plastic objects abandoned at sea. In these areas mussel socks can account for a percentage of even more than a third of the total amount of plastic refuse found on the beaches, with an important impact on all the coast and its related activities.

Due to the material (polypropylene) it is made of and the condition it arrives in at the disposal phase (the incrustation of salty biological elements – *fouling*) this refuse is not recyclable and therefore is a further amount of material that must be managed non-specifically, with the associated costs borne by the local authorities.



Currently, some municipalities have agreements with the mussel farmers to bring to shore the no longer usable socks and try to cover the costs of the waste disposal. However, the situation requires specific operations in terms of information and the involvement of the operators and, as well, how to collect the already abandoned socks.

Both these actions, as well as others identified zone by zone, must be a priority in any integrated coastal management plan, and reducing the dumping of these materials into the environment must become a priority along all the Adriatic coast.

PROPOSED TOOLS TO REDUCE/MITIGATE ML

Fishing for litter (FFL) (including abandoned or lost fishing gear and mussel socks) is an initiative that aims to reduce marine litter by involving the fishers and mussels-culture farmers. The initiative not only involves the direct removal of litter from the sea, but also raises awareness of the significance of the problem amongst the fishing community.

Marine litter collection can contribute to industry-wide changes so that fishers no longer routinely discard ML caught up in their nets at sea. This still widespread practice is mostly a result of the limited storage capacity on board as well as the potential additional costs for specific waste receptacles and fees for landing the litter in ports.

In the case of mussel socks, the use of biodegradable materials or compostable ones, will reduce costs arising from their disposal as well as CO₂ emissions and other pollutants with, undoubtedly, an economic return for farmers and environmental benefits.

The fishery sector is very diverse and the problems that fishers encounter in each port, are different depending on the local context. An in-depth understanding of the fishery sector is fundamental in drawing up effective measures, tailored to particular locations and fisheries. The setting up of an effective waste management system in fishing ports, allows fishers to discharge ML with no additional cost for themselves.



Marine litter is collected by fishers during fishing activities. From that point, the fisher is not the person responsible for its production but they are involved in its appropriate management and treatment.

Specific objectives of ML collection and management could be:

- generally improving the marine environment in the intervention area by reducing ML,
- promoting behavioural change in the fishing industry,
- achieving an effective disposal system for ML in the port area,
- raising awareness of ML issues and reducing the impact of ML on the tourism industry in the port area,
- improving understanding of the characteristics of the ML problem in the fishing area.

In order to organize a successful FFL activity, a plan should be developed, following specific information that has been developed under the activity. It's important to assess the specific local situation in order to define the implementation timing of the activity. Understanding the local situation should be the starting

point for the FFL plan. A situation analysis should give a clear understanding of the problem of the area, which is needed to develop the objectives and to select and design activities that fit well in the area and that will result in achieving objectives and identifying obstacles.

When planning a FFL activity the key stakeholders should be consulted to identify the best measures to respond to the needs of fishers. The plan should include information on location, types of ML that will be retrieved; methods and equipment that will be used; participants in the FFL activity; potential health and safety risks and how they are being addressed; notifications that must be given and all permits that must be obtained; arrangements for landing, disposal and/or recycling of nets and reporting arrangements that will be followed.



Identification and subsequent selection of the most appropriate areas at the port to manage FFL activity are essential to making activities efficient and effective. In order to guarantee marine environmental protection, every port must be equipped with the appropriate facilities for waste collection and storage. The site at port where collect ML, DFG and ghost nets must be in a port area under the jurisdiction of the relevant local authority (Coast Guard or Port Authority). The area must be equipped with the appropriate facilities

for waste collection and storage.

Directive 2008/98/EC concerning waste foresees that the site must be classified as a temporary/preliminary storage site or, in accordance with the legislation on waste, as R13 or D15, or ecological waste collection site or a private area of the fishing company. In both cases, the area must be fenced off and access permitted only to authorized people. The storage of waste pending an operation determines the end of waste, establishing the first step in material recovery and recycling.

The results of ML collection activities are not only about the number of tons of litter removed from the sea – they can also encourage changes to attitudes and working practices in the fishing industry. Have to be removed financial and practical obstacles that prevent fishermen from retaining ML on board and discharging it in an environmentally sound manner. It has to do this by setting up an effective waste management system in fishing ports, so that fishers can discharge ML at no additional charge for themselves.

Some examples of expected results, qualitative and quantitative indicators that the fishery manager or fishery port manager, as a activity coordinator could consider in a ML collection activity, are the following:

- better community awareness of the causes and impacts of the marine litter problem in the area.
- improved knowledge of the type and location of marine litter in the area



- ML is managed in an environmentally sound manner. Indicators could be: % of ML disposed of at a licensed engineered landfill, % of ML incinerated in a licensed facility with energy recovery or % of ML recycled.
- ML is recovered from the sea. Indicators could be the tons of ML collected.
- fishers collect marine litter. An Indicator could be the number of vessels participating in the activity by year.

The success of the FFL activity will depend on the daily management and on regular contact with participating fishers, either through individual contact with the vessels or through fishing organization. Appointing a fishery manager or fishery port manager as the ML activity coordinator will help to ensure the overall achievement of the objectives.

In general, this may require the following actions:

- developing an activity plan, including indicators and targets for monitoring and evaluation
- identifying and contacting other participants
- developing agreements with other participants
- sourcing and ordering supplies (bags, containers, etc.) and distributing them
- organizing meetings with fishers
- contacting the firms authorized to collect, manage and treat the waste for its eventual disposal, companies dealing with recycling
- contacting the firms authorized to transport waste and organize the transporting of the material, guaranteeing compliance with the correct procedures
- complying with the legal requirements regarding waste traceability
- recruiting fishers to participate
- monitoring and evaluating results.

A very specific type of ML are the nets lost or abandoned at sea, the so called "ghost nets".

Ghost nets are nets lost during fishing activities due to obstacles, grounding dangers or particularly adverse weather and sea conditions. As far as "ghost nets" are concerned, the actual number lost at sea over the years and their location still remains uncertain, as well as the time needed for them to become ineffective in catching fish.





Once recovered from the sea, the ghost nets are classified as waste where the producer and fishing company is not known, and the fishermen, the scuba-diving association or other subjects involved in their recovery become those responsible for their management and treatment.

Specific objectives could be:

- raising awareness of the ghost nets' problem and of the negative impacts of these nets on the environment and on the various stakeholders activities,
- increasing knowledge of the problem of ghost nets in the marine environment and of the negative impacts in the intervention area and on the various stakeholders' activities
- behavioural change among the various stakeholders. Is important to raise the awareness of fishermen on the measures that they can take to reduce the presence of ghost nets at sea.
- organization of recovery of ghost nets from fishing areas. This objective could be realized if fishermen are already aware of the consequences of the presence of ghost nets at sea for marine environment.

Possible activity indicators and targets could be:

- increased knowledge of the problem (causes and impacts of ghost nets; types, amounts and location) ,
- set up prevention, mitigation and remedial measures to the relevant stakeholders (fishermen, port authorities and policy makers), and encourage actions and changes to attitudes and working practices, to reduce the presence of ghost nets at sea,
- recovery of ghost nets (number of fishermen participating in ghost nets recovery operations; total amount of nets collected (tons, meters) by year.
- development of an effective waste management system, with adequate and affordable port reception facilities in all fishing ports so that fishermen can properly discharge their old nets. European law provides that fishing ports authority should ensure that convenient and 'friendly' reception facilities are available for the disposal of disused fishing gear and other wastes from vessels (DIRECTIVE 2000/59/EC).

SUGGESTIONS TO INCLUDE DFG AND ML MANAGEMENT IN THE FRAME OF ICZM

To further the work, foster political willingness and strengthen public opinion, support is needed to highlight each country's social responsibility related to ML prevention and reduction measures. In this respect awareness activities are very important, as well as marine litter education programs in addition to training and capacity building.

In this context the importance of environmental aspects of marine litter reduction measures in relation to impacts on economic sectors, such agriculture, aquaculture, shipping, tourism, etc., should be considered and strengthened at every level.

To involve the relevant key sectors and promote networking and partnerships, voluntary agreements with retailers, services, industries, fisheries, etc. must be promoted, including the use of incentive instruments so local players will be interested in contributing to ML prevention and recovery measures.

All countries are strongly encouraged to implement all the suggested measures, including them in their own strategies and plans.

Therefore, the drawing up of an integrated management plan for any coastal area would require including a specific reference to the problem of sea waste and to the eventual actions to reduce this problem. All those involved in the different economic activities in that particular area should be called upon so each of them may provide a contribution to reducing this common problem.

Specific references and measures should be included relative to the FFL and the collection of nets in strategies and plans for the ICZM if the effectiveness of the actions and the regulations already in force are to be improved, which, moreover, only marginally refer to the collection of sea waste and its management.

Following, can be found suggestions and hypotheses arising from the experience acquired during the DFG project, focusing on the collection of sea waste carried out with the involvement of the fishers and the recovery of nets and gear lost at sea, including the socks used in mussel farming.

Discarded nets are excluded from these considerations because they present different problems and characteristics as they can be either abandoned nets but stored by fishermen, or nets seized by the fishing authorities. These, if made of Nylon 6, can be recycled by companies specialized in being able to restore it to the original material so it can be newly woven. However, this involves a specific recycling program, not necessarily linked to reducing sea waste.

Differently to the above, is the situation of nets recovered at sea, which cannot be recycled, and the socks used in mollusk farming, which is also non-recyclable, both being a serious problem to be tackled.

There is an immediate need for suitable policies in communication/information and a collaboration with fishermen, underlining that any measures will not involve any additional costs for them. The fishing operators will also have to be involved, as they play a key role in the recovery of sea waste during their daily activities, to make sure that the waste is not fished out of the sea and then thrown back again due to there being no collection system on land, or because of costs they must bear.

For this reason, no distinction should be made between the different types of waste – that already on board the boat and waste abandoned at sea and accidentally collected by the fishermen during their fishing activities where a general urban solid waste assimilation would be more correct, the waste not



being produced by the fishermen but from an unknown source. Instead, the case of socks used in aquaculture is different as the producers are known and must bear the costs of waste disposal.

From the above, there emerges the need to define a system to receive and manage the waste on land, as well as to identify who should be responsible for the waste disposal and the associated costs. This involves decisions that should be taken by each member state, as each has a different sub-division for the tasks and competences required among the different local authorities, resulting in the need to meet the added costs.

It would require identifying types of compensation for the "producers" of waste found at sea which can be used to compensate the costs of those overseeing the collection of the waste in the port. In fact, it is not logical that the local government with the "misfortune" of having a large fishing fleet should be responsible for the disposal of waste originating to only a minimal degree in the coastal zone under its responsibility.

These and other considerations, besides the transversal involvement of all the economic sectors linked to the sea, must provide the basis for an appropriate inclusion in FFL activities and, more generally, the collection of waste at sea and on the beaches, in national and regional ICZM programs.

Determinant is the recognition of fishers such "Guardians of the Sea" or "Take care of the sea": their voluntary participation in FFL activities should be enhanced through acknowledging the FFL activity gratifying individual fishermen but even better improving the collective image of the category.

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