

PREVENTIVE MEASURES TO ADDRESS THE PROBLEM OF MARINE LITTER



Regional Activity Centre for Cleaner Production (CP/RAC)
Mediterranean Action Plan



Regional Activity Centre
for Cleaner Production



STOCKHOLM
CONVENTION



GOBIERNO
DE ESPAÑA

MINISTERIO
DE AGRICULTURA, ALIMENTACIÓN
Y MEDIOAMBIENTE



Generalitat de Catalunya
**Departament de Territori
i Sostenibilitat**

Note: This publication may be partially or completely reproduced for educational and non-profit purposes without express consent of the Regional Activity Centre for Cleaner Production (CP/RAC), always citing the source of the information. CP/RAC would appreciate receiving a copy of any publication where this material was used as a source. It is prohibited to use this information for commercial purposes or for sale without written consent from CP/RAC.

The denominations used in this publication and the presentation of material in the same do not imply the expression of any opinion by CAR/PL relating to legal status of a country, territory or area, or its authorities or respecting its borders and limits.

If there is any study point which can be improved or if there is any inaccuracy, please let us know.

The CP/RAC, based in Barcelona-Spain, was established in 1996. Its mission is to promote sustainable consumption and production in Mediterranean countries. The CP/RAC activities are approved by the Contracting Parties to the Barcelona Convention and by the Bilateral Monitoring Commission made up of representatives from the Spanish and Catalan Governments.

March 2013

Authors:

Mr. Frederic Gallo. CP/RAC Project Manager

Ms. Arianna Bongiolatti. Master in Waste Management. Scuola Superiore Sant'Anna di Pisa.

Regional Activity Centre for Cleaner Production (CAR/PL)

C/ Dr. Roux, 80

08017 Barcelona (Spain)

Tel +34 93 553 8790 Fax +34 93 553 8795

www.cprac.org

1- Introduction

Marine litter (ML) or debris consists of a range of materials including plastic, metal, wood, rubber, glass and paper. Although the relative proportions of these materials vary according to the regional sea concerned, plastics are by far the most abundant type of debris in terms of number of itemsⁿ: **Plastics amount up to 83 % of ML floating on the sea and on shorelines^{j,o}**. For this reason we will put the focus on plastics in this analysis.

Most of the Mediterranean ML is from Land Based Sources (LBS) rather than ships, specially from shorelines and activities of beachgoers (smoking related activities, packaging from food or drink consumption), as well as litter washed from streets, parking lots and storm drains, poor waste disposal schemes and illegal dumpingⁱ.

The type of plastics found are beverage bottles, bags, caps/lids, food wrappers and food containers, six-pack holders, straws, stirrers, sheeting/tarps, tobacco packaging, lighters, etc. The 3 top plastic items found in the Mediterranean are: plastic bottles (2 liters or less) 9.8%; plastic bags 8.5%; caps/lids 7.3%.^j

ML from **smoking related activities** accounts from 40% of collected items in different campaigns in the Mediterranean^j. This is considerably higher than the global average and constitutes a serious problem that has to be given priority in a Regional Strategy (Public awareness, Municipal ordinances and enforcement)¹

The worst environmental consequences of marine litter come from **plastics**: they can impact marine life in different ways, specifically through ingestion or entanglement in debris items by individuals, and through effects at an ecosystem level. **Microplastics²** -fragments with a diameter of less than 5 mm- are of great concern because it is demonstrated that marine organisms that form the base of the marine food web eat the microscopic pieces of plastic, and that the concentration of toxic chemicals might be magnified through the food chain^{3,4}. This is a risk for human health^{b,g}. Aside from its negative impacts on the environment and health, marine debris can also have substantial negative **socio-economic impacts**. It can cause economic losses to commercial fishing and shipping as well as industries such as recreation and tourism. ML from shoreline and recreational activities is highly connected to tourism: the Mediterranean is one of the biggest tourist attraction poles in the world, with a peak on summer season. This represents a problem for many municipalities due to the big increase of waste from population and services (Hotels, restaurants, camping sites, shipping companies...).

¹ Cigarettes filters take up to 5 years to decompose, mainly due to the foamed plastic and toxic chemicals.

² Microplastics come mainly from photodegradation or mechanical degradation from larger plastics, but also from resin pellets for industrial use and from the shredding of synthetic textile fibers produced by domestic clothes washing.^a

³ Most plastics contain additives in their polymer matrix like foaming agents, flame retardants (**POPs chemicals**), plasticizers, stabilizers or heavy metals

⁴ Plastic particles may concentrate and transport synthetic organic compounds (e.g. persistent organic pollutants, **POPs**) through adsorption.ⁱ

Finally, main gaps to consider are the lack of Programmes or international legal instruments (except for IMO/MARPOL); the application and enforcement of existing laws and regulations regarding waste; and the lack of effective penalties for offenders^j.

2- (UN)SUSTAINABILITY AND MARINE LITTER

Much of our current production and consumption patterns do not reflect principles of sustainability. From a life-cycle perspective, the use of resources for a short-lived single use product is a central underlying cause of the accumulation of waste^s. About 50% of plastic is used for single-use disposable applications. This means raw materials, primarily derived from oil are converted into products with an average lifetime of less than a year, after which they are disposed^h. It is clear that action towards sustainability is needed. Applied to plastics, this means increase recycling, recyclability, reuse and promoting reduction of plastics consumption; promote investments in recycling facilities, and support an enabling new regulations and standards.

The adoption of a **Sustainable Consumption and Production (SCP) approach** can turn the root cause of plastic pollution in the marine environment into an economic opportunity. Reducing raw materials usage through green design alternatives and improved options for re-use, recycling and prevention all support **green economy goals** and **help to reduce marine debris**^p. Thus marine litter prevention will offer multiple opportunities such as economic and environmental benefits, jobs creation, reductions in greenhouse gas (GHG) emissions, etc.

In this way, by applying adequate and relevant measures targeting to production, consumption and waste management of plastic packaging products (PPPs), the impact of plastics in marine litter could be minimized^e:

- **Production:** A large share of the packaging products is not appropriately managed by re-use, recycling or recovery. **PPPs producers** should be fully committed to environmental sound production by considering the basic aspects concerning eco-design, prevention, re-use and recyclability as well as the extended responsibility of producers (**ERP**) for the full life cycle of their products.
- **Consumer's behaviour:** The key to the problem of packaging contribution to marine litter is the high plastic demand from consumers (particularly for bottles and bags) due to their consumption habits and, in many cases, **unconcern** when getting rid of PPP waste.
- **Collection and waste treatment:** It must be assured that the **adequate infrastructure** for the collection, re-use and recycling of PPPs after their service life is available in order to achieve high rates of re-use, recycling and recovery. Uncontrolled and/or poorly managed landfills can significantly contribute to marine litter, particularly if they are located close to the coast or rivers. Therefore, it is also necessary to close uncontrolled dumpsites, to improve the

management of landfills and to increase the enforcement measures to prevent uncontrolled or illegal disposal.

A waste management system based on the principles of polluter pays, on best management practices, on public awareness and participation, and driven by effectiveness and efficiency objectives will increase the amount of waste diverted toward recovery and recycling. The adoption of an effective **Integrated Management System (IMS)**⁵ for packaging and other schemes as “**Deposit return and restoration (DRRS)**”⁶ programs are effective measures in preventing waste generation.

3- APPROACHES AND OPPORTUNITIES TO PROMOTE SCP INITIATIVES

3.1 Producer Responsibility

Traditionally waste management responsibilities rested with municipalities, financed through public funding. Under an extended producer responsibility (EPR) program the producers, manufacturers, brand owners and first importers of products and packaging are given the legal responsibility for collection, recycling and for end-of-life management.

EPR is built on the idea that producer make decision on types of packaging materials and have the most ability to redesign packaging to facilitate reduction, reuse and recycling. Packaging EPR programs can cover costs through fees applied per packaging unit and fees are commonly differentiated based on the costs to recycle particular packaging materials.

3.2 Engagement with business

Significant players in the international plastics and packaging industry have recognized that their public profile may be impacted by an increasing awareness of the marine debris issue. Many companies now see packaging and plastics sustainability as part of broader corporate social responsibility, and negative brand image is becoming a major driving force which is being harnessed in the interests of improving packaging materials and technologiesⁱ.

⁵ **Integrated management system (IMS):** The packing company pays an amount for the quantity in weight of the packaging placed on the domestic market to the managing company of the IMS. This money serves to finance the selective waste collection, and the transport and selection of the different materials. The IMS is the alternative most widely used by the packers of products intended for household consumption in many countries.

⁶ **Deposit, return and restoration system (DRRS):** In this case, the packager or the seller establishes a system to physically recover their packaging. To guarantee this recovery, the packager or the seller collects an amount by way of deposit from the customer, and this amount is returned when the packaging is effectively returned. This system cannot substitute an IMS, but can help increase rates of collection in specific cases.

3.3 Prevention of plastic production

This can be addressed legally through EPR and legislation like the obligation for packagers to draw up **Packaging waste Prevention Plans**.ⁱⁱ There can be incentives for manufacturers to increase the lifetime of products through redesign, replaceable parts, recycling and producing upgrades.

Alongside incentives for manufacturers, there will need to be **incentives** for consumers to *reuse and recycle*. Ecolabels, deposit schemes and reverse vending schemes that incentivize the reuse of plastic bottles can help encourage this^k.

Disincentives for consumers can also be applied to encourage reuse, for example, on plastic bags. The measures applied in the framework of a voluntary Plan set up by the Waste Agency of Catalonia with the main sectoral organizations have allowed reducing plastic bags consumption per capita by 45% in 4 years.ⁱⁱⁱ The measures of the Plan range from charging the client for the bags that are used, make a discount to the clients that don't use bags, reduction of grammage of the bags, elimination of chemical pigments (TiO₂), awareness raising to employees and consumers, etc.

Certain problematic products such as plastic food containers, fishing line, fishing floats can be taxed in order to discourage single-use consumption^q.

3.4 Incentives for collection and recycling

Providing incentives for collection and recycling could raise the diversion of plastics and packaging from waste stream and preventing littering or disposal. In all of these cases the incentives and the enhanced recovery rates that they entail are closely linked to the development of markets for the recovered materials. Beverage container *deposit return systems* are one example of such an approach with a long and proven track record of success^{iv}. Under these programs, consumers pay a deposit on the container which can be redeemed when the empty container is returned. This system has a long history and was originally employed to ensure the return of glass bottles for reuse. In recent times, with the increasing use of lightweight plastic containers, such returned containers are more commonly recycled than refilled.

3.5 Application of market instruments

There are several measures on the use of market based instruments to address the problem of marine litter^q. These include:

- Applying the *polluter pays principle* (PPP), in terms of fines for littering, dumping waste and illegal disposal.
- Applying the *user pays principle*, in terms of tourist taxes, car park fees, port reception and ship berthing fees. These can then contribute to beach cleaning and improving waste infrastructure.
- Applying the “pay as you throw” scheme. Instead of paying a fixed amount for the waste collection services independently of the waste generated, the user fees are charged on a per bag/bin basis or by weight.^v
- *Landfill taxes*. Taxes have been put on disposal at landfill sites to increase the cost to users, to better reflect the true life-cycle cost of disposal, and to drive waste materials into recycling systems. Such disposal surcharges have been often used to generate revenues which can then be

used to support a variety of waste management programs. It could happen that landfill taxes can lead to an increase in illegal dumping so they should be set at an affordable level.

- *Incentives for fisherman* on and removing debris, for example the “Fishing for Plastic” project in “Save our North Sea” programme, which pay fishermen to remove plastic.
- *Award based incentives* for coastal villages with integrated Waste Management systems, which incorporate all the policies, programmes and technologies that are necessary to manage the entire waste stream.

3.6 Waste diversion and secondary markets

Subsidies and grants to support the development of secondary markets for recyclable materials can be used, but ultimately such markets will succeed or fail on the economics of the market place, and on competition between secondary and virgin materials prices. One of the benefits of EPR programs is that producers are legally responsible for the recycling of their products and packaging, and as a result they have often invested in secondary materials research and development, and occasionally actively financed the start-up of processing and end market infrastructure for recyclables.

Conclusion

A combination of measures in a regionally coherent context is required, with a focus on reducing the rate at which waste is produced as well as ensuring that appropriate management measures are in place for the safe disposal of material that cannot be reused or recycled. Where feasible the debris already contaminating sea waters should be removed.

Some examples of proactive policies and programs that have been successfully used in waste management and recycling and which could be applied to reduce land-based sources of marine debris are:

- Engaging with corporations and industry associations on sustainability^{vi} and application of Extended producer responsibility (EPR) policies. This is a core task for better prevention policies (packaging and plastics reduction) and management of PPPs throughout the entire life cycle.
- Supporting ML awareness^{vii} and consumer education.
- Effective Integrated Management Systems for PPPs and Deposit Return Programs for items like single-use plastic beverage bottles and EPS fish boxes.
- Charging the single use plastic bags by retailers and supermarkets.

Annex: Different measures identified to address the problem of Marine Litter

Different kinds of measures can be contemplated to address marine litter. The **annex** contains a non-exhaustive catalog of different measures mainly from different pilot projects ^{c, d, e} grouped in 5 categories:

A.	Product and Packaging design measures which are implemented to prevent littering (preventive measures including technical, technological or research oriented measures) or to lowering the environmental impact of the disposal.
B.	Awareness measures which aim at changing the attitudes and perceptions that drive littering (i.e. beach users, fishermen...)
C.	Collection, waste treatment and cleaning up measures
D.	Regulatory measures, legally binding on or a voluntary basis. Enforcement measures of the legally binding regulations should be previously considered in order to have effective compliance.
E.	Economic or market-based instruments such as product taxes, subsidies, etc which aim at modifying the behaviour of the consumers or producers by affecting the price in the market.

Key actors

- *Producers*, because they must take increased responsibility over the full life cycle of its products.
- *Consumers*, because they can change their behaviour (consumption and disposal).
- *Retailers*, because they can directly influence consumer behaviour.
- *Competent authorities* (Ministries, Waste Management and Waste Water authorities, Municipalities, Ports...) because they should influence consumer behaviour and improve waste collection and treatment.

A- MEASURES TARGETING THE PRODUCTION STAGE: PRODUCT AND PACKAGING DESIGN

1. Support and enforce eco-design of PPPs
2. Establish or improve Extended Producer Responsibility (EPR) systems for PPPs (plastic packaging products)
3. Make mandatory Prevention Plans to minimize material and make products more environmental friendly to PPPs producers
4. Establish annual Environmental Award Scheme for the PPP industry

B- MEASURES TARGETING AWARENESS RAISING

1. Regular campaigns about cigarette's waste awareness on the beach and portable beach ashtrays campaigns.
2. Introduce system of environmental awards for municipalities which are front runners in use reduction and proper separate collection of plastic bags/bottle
3. Promote a commitment for the touristic sector to reduce use of plastic bottles and bags
4. Organize environmental awards for hotels and similar facilities
5. Provide guidelines, manuals on separate collection to different target groups according to their needs
6. A mixture of public awareness campaigns to persuade the public to change to the solid waste route

- for the disposal of their domestic sanitary waste.
7. Develop, promote and support community-based clean-up campaigns (awareness combined with effective clean-up actions)
 8. Sensitization of marine sectors (fishermen/ shipping industry) (sectoral level) to promote sustainable use and anti-littering
 9. Provide clearly visible information in fishing ports of correct use and disposal of EPS boxes; provide information to the fishermen and other actors involved in fish trade and transport (leaflets, meetings) on importance of correct disposal of EPS boxes; inform fishermen on measures to prevent EPS boxes
 10. Conduct education and outreach campaigns to promote the use of technologies that minimize loss of fishing gear and ghost fishing (incl. technical standards)

C- MEASURES TARGETING WASTE MANAGEMENT STAGE

1. Improve collection, treatment and disposal of domestic solid waste
2. Ensure that Waste Management Plan in the coastal areas (and in the river catchment areas) contain chapter on marine (river) litter reduction and prevention
3. Improved waste collection and cleaning of the streets
4. Storm drains: Increase capacity of rainwater tanks of the sewer system to hold up heavy rains spells to avoid the direct discharge of litter and waste water to rivers, beaches and sea. Regular dredging maintenance of the tanks.
5. Separate sewers for rain and domestic waste water (in case of renovation/new urbanizations)
6. Increased capacity of municipal waste services during top season including daily cleaning of touristic public beaches within bathing season
7. Provide enough waste (and recycling) receptacles in beach areas and ensure that the bin design/ container design on beaches prevents plastic packaging escape through strong winds
8. Support and promote commitment of retailers to introduce targets on reduction and optimization of use of plastic packaging materials
9. Supervise compliance and quality of service provided by waste management companies through inspections and control activities
10. Develop and promote joint action to reduce the input & impact of sanitary waste (e.g. cotton bud sticks, tampons (applicators), disposable nappies) into the marine environment
11. Maintenance of river beds, rieras (in dry periods)
12. Optimize logistics of merchant premises in fishing ports to avoid escape of EPS boxes during the trade, transport of fish; provide for intermediate storage facilities for waste collected in fishing ports which allow for waste separation and adequate storage, in particular of EPS boxes to foster recycling
13. Establish recycling management schemes for EPS fish boxes in ports and local markets close to the coast
14. Incentives to deliver ship-generated waste at the port reception facilities and to discourage dumping at sea; can be a penalty or reward system.
15. Improvement and extension of Fishing for litter campaigns
16. Identify and close non-compliant landfills and illegal dumpsites close to the coast (controls, penalties, closure)
17. Enforcement of the technical requirements of the Landfill regulations close to the coast and intensify inspections/implement fines
18. Long-term and well designed research and monitoring programmes and studies in order to detect and determine statistically significant trends in the composition, quantities and effects of ML

D- MEASURES TARGETING LEGISLATIVE ACTION AND MUNICIPAL AND PORTS ORDINANCES

1. Strengthen and support intra-governmental institutional arrangements consolidating regional activities on marine litter; support enforcement of the measures and actions of the Regional Strategic Action Plans via national policies
2. Enforce and improve Extended Producer Responsibility (EPR) scheme for Plastic Packaging Waste (PPW)
3. Enact appropriate penalties to beach littering, especially cigarette butts.
4. Introduction of plans for reduction of single use plastic bags
5. Introduce requirements for local management companies to control appropriate source separation of plastic packaging waste PPW by inhabitants
6. Provide for provisions in contracts issued in public procurement to achieve an increase of the number of bins/special bags for collection of municipal waste
7. Include requirements on density and proximity of collection points in the national legislation
8. Tougher municipal regulations for smoking on the beaches
9. Instruct the local police to sanction littering on the beach.
10. Enforcement of existing international waste regulations, like the revised MARPOL ANNEX V
11. Establish waste management plans in Ports
12. Include requirements on density and proximity of collection points (bins and container collection) in the settlements (near the shore greater density) in the national legislation
13. Identify and close non-compliant landfills and illegal dumpsites close to the coast (controls, penalties, closure
14. Enforcement of the technical requirements of the Landfill Directive close to the coast) and intensify inspections/implement fines
15. Provide adequate waste (and recycling) receptacles in beach areas. Including ensuring that the bin design/container design prevents plastic packaging escape (e.g. blown away, bottles taken away; bins with holes, or covered, sufficient container volume).

E- MEASURES TARGETING ECONOMIC INSTRUMENTS

Allocation of certain percent of touristic tax (s) to the environmental funds for the prevention of littering on the beaches and for preventive and mitigating actions; Inform tourists that a certain share of tourist tax is allocated to the maintaining the beaches clean.

Enact deposit refund system for single-use plastic beverage bottles

Promote mandatory or voluntary measures with supermarkets and retailers like charging the use of bags to minimize carrier bags consumption.

Promote small scale deposit refund systems

Introduce a deposit-refund system for EPS fish boxes

ⁱ The document “Catálogo para la prevención de residuos de envases” edited by Ecoembes includes examples of packaging reduction

<http://www.ecoembes.com/es/documentos-e-informacion/prevencion/Documents/Ecoembes%20catalogo%20PEP%202003-06%20DEFINITIVO.pdf>

ii Possible content of a mandatory Business Plan for Packaging Waste Prevention (reference Catalan waste Agency):

- Company administrative data.
- A brief description of the company's activity and the products marketed.
- A detailed description of the packaging used to market products (materials, weights, measurements, types, etc.)
- The total amount (tonnes/year) of packaged product placed on the market in the year prior to the submission of the Business Prevention Plan (Kp).
- The total amount (tonnes/year) of packaging waste generated by the placing on the market of packaged products (Kr) and the ratio Kr/Kp.
- The relationship between the measures taken prior to the submission of the Business Plan, with data demonstrating its effect on the reduction of the ratio Kr/Kp.
- Measures planned to introduce in order to reduce the ratio Kr/Kp.
- The global triennial reduction objective aimed to achieve through the measures proposed, in regard to the Kr/Kp ratio.
- The control mechanisms to be established in order to determine the degree of achievement of the objectives set in the Business Prevention Plan.
- Other data of interest referring to the reduction of packaging and packages.

<http://www20.gencat.cat/portal/site/arc/menuitem.d79bdb4ba0c86afd624a1d25b0c0e1a0/?vgnextoid=cd7feb359ea76210VgnVCM1000008d0c1e0aRCRD&vgnnextchannel=cd7feb359ea76210VgnVCM1000008d0c1e0aRCRD&vgnnextfmt=defauIt>

iii

<http://www20.gencat.cat/portal/site/arc/menuitem.ed59e7380cafa3dd624a1d25b0c0e1a0/?vgnextoid=f0e3a2f32fab5210VgnVCM1000008d0c1e0aRCRD&vgnnextchannel=f0e3a2f32fab5210VgnVCM1000008d0c1e0aRCRD&vgnnextfmt=detall&contentid=183e47406710d310VgnVCM2000009b0c1e0aRCRD>

iv A successful *deposit return systems* case: the German national deposit scheme for reusable packaging. <http://www.prewaste.eu/waste-prevention-good-practices/detailed-factsheets/item/download/627.html>

^vCatalan waste agency *Guide for the implementation of pay as you throw system for municipal solid waste* [http://www20.gencat.cat/docs/arc/Home/LAgencia/Publicacions/Centre%20cata%20del%20reciclatge%20\(CCR\)/Guia%20PXG.pdf](http://www20.gencat.cat/docs/arc/Home/LAgencia/Publicacions/Centre%20cata%20del%20reciclatge%20(CCR)/Guia%20PXG.pdf)

^{vi} The XirinGo! Del Prat de Llobregat (Barcelona) case shows how the involvement of touristic sector can improve consumer behavior. XirinGo! Is a beach bar raised as a social project, it won the first prize of "iniciativas creadoras" granted by the Spanish Ministry of Environment and Fundación Biodiversidad thanks to its various environmental initiatives, for example they set up an interchange initiative with the users of the beach: drinks in exchange for collecting cigarette butts.

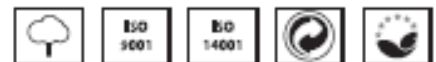
^{vii} See for example MARLISCO Project <http://www.marlisco.eu/en/> The main objective of this project is to increase the awareness of the consequences of societal behaviour in relation to waste production and management on marine socio-ecological systems, to promote co-responsibility among the different actors and to define a more sustainable vision on marine litter in European seas.

References

- a. *Accumulation of Microplastic on Shorelines Worldwide: Sources and Sinks*. Environmental Science & Technology 45 (21): 9175–9179.
- b. Barnes, D., Galgani, F., Thompson, R. & Barlaz, M., *Accumulation and fragmentation of plastic debris in global environments*, Philosophical Transactions of the Royal Society B, 2009
- c. European Commission, DG Environment, *Feasibility study of introducing instruments to prevent littering*, 2013
- d. European Commission, DG Environment, *Pilot project '4 Seas'– plastic recycling cycle and marine environmental impact, Case studies on the plastic cycle and its loopholes in the four European regional seas areas*, 2012a
- e. European Commission, DG Environment, *Study of the largest loopholes within the flow of packaging material*, 2012b
- f. European Commission, DG-Environment, *Plastic waste in the environment*, 2011
- g. GESAMP, *Proceedings of the GESAMP International Workshop on plastic particles as a vector in transporting persistent, bio-accumulating and toxic substances in the oceans*, 2010.
- h. IMSA, Wurpel, G., Van den Akker, J., Pors, J. & Ten Wolde, A., *Plastics do not belong in the ocean. Towards a roadmap for a clean North Sea*, 2011
- i. Mato, Y., et al. *Plastic resin pellets as a transport medium for toxic chemicals in the marine environment*, Environmental Science & Technology 35, 2001.
- j. MEDPOL, WHO, *Assessment of the Status of Marine Litter in the Mediterranean*, 2011
- k. Mouat, T., Lopez-Lozano, R. & Bateson, H., *Economic impacts of Marine litter*, KIMO (Kommunenenes Internasjonale Miljøorganisasjon), 2010
- l. OECD, Sustainable Materials Management workshop Mechelen, Belgium October 2010, Chair's Summary
- m. PlasticsEurope, *PlasticsEurope's Views on the Marine Litter Challenge*, 2010
- n. Ryan, P. G., Moore, C. J., van Franeker, J. A. & Moloney, C. L., *Monitoring the abundance of plastic debris in the marine environment*. Philosophical Transactions of the Royal Society, 2009
- o. Secretariat of the Convention on Biological Diversity and the Scientific and Technical Advisory Panel—GEF, *Marine Debris as a Global Environmental Problem: Introducing a solutions based framework focused on plastic*, 2011a
- p. Secretariat of the Convention on Biological Diversity and the Scientific and Technical Advisory Panel—GEF, *Marine Debris: Defining a global environmental challenge*, 2011b
- q. Ten Brink, P., Lutchman, I., Bassi, S., Speck, S., Sheavly, S., Register, K., and Woolaway, C., *Guidelines on the Use of Market-based Instruments to Address the Problem of Marine Litter*. Institute for European Environmental Policy (IEEP), 2009
- r. Teuten, E., et al. *Transport and release of chemicals from plastics to the environment and to wildlife*. Philosophical Transactions of the Royal Society B 364, 2009.
- s. Thompson, R. C., Moore, C., vom Saal, F. S. & Swan, S. H., *Plastics, the environment and human health. Philosophical transactions of the Royal Society*, 2009
- t. UNEP, *The Honolulu Strategy: A global framework for prevention and management of Marine Debris*, 2012

**Regional Activity Centre
for Cleaner Production (CP/RAC)**

Dr. Roux, 80 - 08017 Barcelona (Spain)
Tel.: +34 93 553 87 90 - Fax: +34 93 553 87 95
E-mail: cleanpro@cprac.org
<http://www.cprac.org>



Printed on 100% recycled, chlorine free paper