Oceans and the Law of the Sea

Report of the Secretary-General

Contribution from the Intergovernmental Oceanographic Commission of UNESCO (IOC)

January 2016

Summary

The UNESCO's Intergovernmental Oceanographic Commission (IOC) promotes international cooperation and coordinates programmes in marine research, services, observation systems, hazard mitigation, and capacity development in order to understand and effectively manage the resources of the ocean and coastal areas. By applying this knowledge, IOC aims to foster sustainable development of the marine environment, in particular in developing countries. IOC has been promoting its activities dealing with matters relating to marine debris, plastics and microplastics through: (i) Working Group 40 of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) and (ii) Open Ocean and Large Marine Ecosystem components of the Transboundary Waters Assessment Programme (TWAP):

1. Sources, fate and effects of micro-plastics in the environment – a global assessment (GESAMP WG 40)
The GESAMP Working Group 40, entitled 'Sources, fate and effects of micro-plastics in the marine environment – a global assessment' has completed the first phase of its work programme under the leadership of the IOC and has started the second phase with a co-sponsorship shared by the IOC and UNEP. The new Terms of Reference were adopted in early 2015 and the first inception workshop was organized. It was attended by 25 WG members, three observers, and FAO, UNEP and IOC. The first WG 40 state-of-the-art assessment report (GESAMP Reports and Studies No. 90) was published on-line. One noteworthy aspect of the report is the inclusion of confidence levels. An immediate milestone for this group is to provide an interim assessment report, including the impact of microplastics on commercial fish and shellfish species, to inform the Second Meeting of the UN Environment Assembly, taking place in June 2016.

2. Transboundary Waters Assessment Programme (TWAP) Open Ocean and Large Marine Ecosystem components
In the context of the GEF Transboundary Water Assessment Programme (TWAP), the IOC in collaboration with UNEP has led the implementation of global comparative assessment of the world's Large Marine Ecosystems (LMEs), Open-Ocean areas, transboundary river basins, aquifers and lakes. The report to be published in 2016 provides an overview of marine pollution namely through floating micro- and macro-plastic debris, concentration of persistent organic pollutants (POPS) in beached plastic resin pellets, and nutrient input to coastal areas from watersheds. The TWAP report concludes that floating plastic is now ubiquitous in the global ocean, including the remotest parts of the Southern Ocean, as a result of the durability of plastic and the characteristic features of the general ocean circulation.

Introduction

Marine litter is any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment. Marine litter consists of items that have been made or used by people and deliberately discarded or unintentionally lost into the sea or coastline including such materials transported into the marine environment from land by rivers, drainage or sewage systems or wind. Marine litter is a serious and widespread problem. Impacts can be divided into three general categories: 1) ecological (mortality or sublethal impacts to plants and animals through entanglement, physical damage and ingestion including uptake of microplastics, accumulation of chemicals from plastics, facilitating the invasion of alien species, or altering the benthic community structure); 2) economic (e.g. cost to tourism, damage to vessels, fishing gear and facilities, losses to fishery operations, cleaning costs); and 3) social (reduction in aesthetic value and public safety).

Plastics form a large proportion of marine litter, and the widespread occurrence of macroscopic plastic debris and the direct impact this can have both on marine fauna and legitimate uses of the environment, sometimes remote from industrial or urban sources, has been well documented. In general, plastic debris comes in a wide variety of sizes and compositions and has been found throughout the world ocean, carried by ocean currents and biological vectors (e.g. stomach contents of fish, mammals and birds). Plastics degrade extremely slowly in the open ocean, partly due to UV absorption by seawater and relatively low temperatures. In recent years the existence of micro-plastics and their potential impact has received increasing attention. Micro-plastics have a range of compositions and can be demarcated by usage and source as: i) 'primary' micro-plastic resin pellets used in the plastics industry, and in certain applications such as industrial abrasives and skin-care products and ii) 'secondary' micro-plastics resulting from the degradation and breakdown of larger items, including so-called biodegradable plastics.[1]

The UNESCO's Intergovernmental Oceanographic Commission (IOC) promotes international cooperation and coordinates programmes in marine research, services, observation systems, hazard mitigation, and capacity development in order to understand and effectively manage the resources of the ocean and coastal areas. By applying this knowledge, the Commission aims to improve the governance, management, institutional capacity, and decision-making processes of its Member States with respect to marine resources and climate variability and to foster sustainable development of the marine environment, in particular in developing countries. In this context, IOC promotes the following activities concerning marine debris, plastics and microplastics: namely, (i) Working Group 40 of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), entitled 'Sources, fate and effects of micro-plastics in the environment – a global assessment', and (ii) the Open Ocean and Large Marine Ecosystem components of the Transboundary Waters Assessment Programme (TWAP).

1. Sources, fate and effects of micro-plastics in the environment – a global assessment (GESAMP WG 40)

The question of the degree to which micro-plastics and associated chemical loads present a risk to organisms was raised through the GESAMP emerging issues programme. Following the preparation of a scoping paper in 2009, a Workshop was held in June 2010, hosted by IOC in Paris, bringing together experts from industry, academia, NGOs and policy to examine plastic particles as a vector in transporting persistent, bio-accumulating and toxic substances in the oceans. The proceedings of this Workshop were subsequently published as GESAMP Reports and Studies No. 82 in 2010. One of the recommendations was that GESAMP should carry out a global assessment.[2] In light of the successful workshop, GESAMP at its 38th session (9-13 May 2011) decided to create the Working Group 40 entitled 'Sources, fate and effects of micro-plastics in the environment–a global assessment'.

[1] Source: GESAMP WG 40 webpage: http://www.gesamp.org/work-programme/workgroups/working-group-40

[2] ibid

The GESAMP WG 40 has completed the first phase of its work programme under the leadership of the IOC and has started the second phase with a co-sponsorship shared by the IOC and UNEP. The new Terms of Reference were adopted in early 2015 and the first inception workshop was held from 2 to 6 November 2015 at IOC/UNESCO in Paris. It was attended by 25 WG members, three observers (PlasticsEurope, the American Chemistry Council and the University of Copenhagen), and members of FAO, UNEP and IOC. The first WG 40 state-of-the-art assessment report (GESAMP Reports and Studies No. 90) was published on-line. One noteworthy aspect of the report is the inclusion of confidence levels. A wider discussion on risk, including perceived risk, focuses on the need for WG 40 to develop a risk assessment framework. There is a need to provide a range of options when describing potential solutions and to distinguish issues of ecological significance from those that are useful for awareness raising. Further funding will be required to carry out the full scope of the agreed work programme following the UN Environment Assembly (UNEA-2), when the Norwegian Government support to UNEP for the study expires.

An immediate milestone for this group is to provide an interim assessment report, including the impact of microplastics on commercial fish and shellfish species, to inform the Second Meeting of the UNEA-2, taking place in June 2016.

2. Transboundary Waters Assessment Programme (TWAP) Open Ocean and Large Marine Ecosystem components

In the context of the GEF Transboundary Water Assessment Programme (TWAP), the IOC in collaboration with UNEP has led the implementation of global comparative assessment of the world's Large Marine Ecosystems (LMEs), Open-Ocean areas, transboundary river basins, aquifers and lakes. Information on the status of the Large Marine Ecosystems (LMEs), based on the TWAP LMEs assessment, is represented through a series of indicators and indices, arranged according to the five modules: Productivity, Fish and Fisheries, Pollution and Ecosystem Health, Socio-economics and Governance. The report to be published in 2016 provides an overview of marine pollution namely through floating micro- and macro-plastic debris, concentration of persistent organic pollutants (POPS) in beached plastic resin pellets, and nutrient input to coastal areas from watersheds. The TWAP report concludes that floating plastic is now ubiquitous in the global ocean, including the remotest parts of the Southern Ocean, as a result of the durability of plastic and the characteristic features of the general ocean circulation. The occurrence of plastic in an LME may be due to sea and land-based activities. A proportion of the plastic entering an LME is likely to be transported by wind and currents into an adjoining LME or the Open Ocean, making plastic pollution a classical transboundary issue. Larger plastic debris can have a significant impact on marine organisms, mainly due to entanglement and ingestion. Plastic can also cause major economic loss and pose a threat to navigation and human safety. There are insufficient empirical estimates of abundances of floating micro- or macro-plastics for all LMEs. In the context of the TWAP LME assessment, the relative abundances of floating micro- (<4.75 mm in diameter) and macro-plastics (>4.75 mm) in each LME were estimated through a model that takes into account coastal population density, shipping density and the level of urbanization within major watersheds, to develop proxy sources of plastics.

Based on the results, LMEs were assigned to five colour-coded risk categories (lowest, low, medium, high and highest risk). The estimated abundances of both floating micro-plastics and macro-plastics vary by over four orders of magnitude between the lowest value (Antarctica) and the highest (Gulf of Thailand).

Key messages derived from the TWAP LME Assessment conclude that:

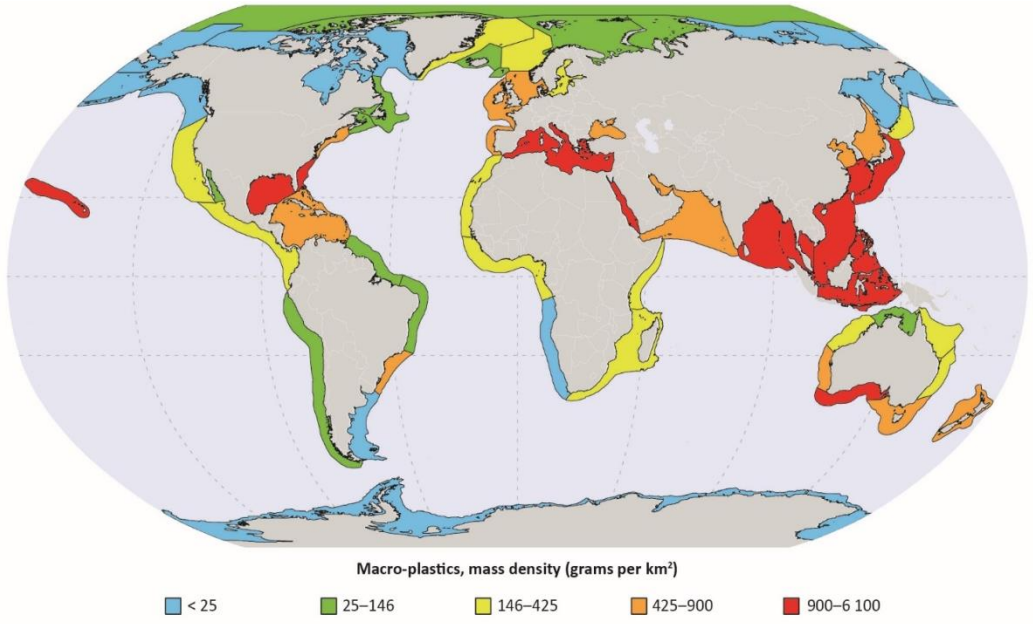
> *Very little is known about the actual effects of micro-plastics on marine organisms. Larger plastic debris has been shown to have a significant impact on many species of marine organisms, mainly due to entanglement and ingestion. Plastic can also cause major economic loss and may pose a threat to navigation and human safety. Once plastic enters the ocean it can become widely dispersed by ocean currents and winds and its impacts on the marine environment may occur at a considerable distance from*

the point(s) of entry.

Plastic enters the marine environment from a wide variety of land-based and sea-based activities, and there are no reliable estimates of the nature and quantities of material involved. The general lack of reliable and consistent observational monitoring data on floating plastics prevents reliable quantitative estimates of the amount of micro and macro-plastics in both space and time for most LMEs. This poses difficulties in designing and implementing cost-effective measures to reduce inputs. In most cases, solutions will need to be multi-agency, multi-sector and trans-national to be fully effective.

While model estimates of plastic concentration are imperfect, they do provide a means for focusing future efforts, to improve predictive capacity, assessing potential socio-economic consequences and targeting mitigation measures. Further improvement should be made if data become available on key sources of plastics such as fishing, aquaculture and coastal tourism as well as the actual quantities entering the ocean, and how this may be influenced by the state of economic development in different countries.

Figure 1 Spatial distribution of the relative abundance of floating macro-plastics in 66 LMEs, based on model estimates.



LMEs were separated into five categories of relative abundance, based on model estimates using proxy sources; based on Eriksen *et al.* (2014) and Lebreton *et al.* (2012).

Reference: IOC/UNESCO and UNEP, (2016). Large Marine Ecosystems: Status and Trends. United Nations Environment Programme, Nairobi.