MARINE PLASTIC DEBRIS & MICROPLASTICS

GLOBAL LESSONS AND RESEARCH TO INSPIRE ACTION AND GUIDE POLICY CHANGE

Within the European Union a Framework Directive has been adopted, providing a Marine Strategy for European Seas (MSFD; EC 2008). Eleven descriptors have been agreed to describe the State of European Seas, with targets to define what is Good Environmental Status (GES) measured by a global indicator framework and associated SDG indicators. One of the Descriptors is marine litter. Detailed technical recommendations and guidelines have been published covering the selection of indicators and appropriate monitoring techniques (JRC 2011, 2013). A set of criteria has been developed to assist in the selection and implementation of appropriate indicators (Box 11.1). These have been applied to a series of indicators for macro and microplastics in seawater, seabed, shoreline and biotas compartments.

Setting realistic targets

Targets are usually set by an administration, so that they have a legal basis within which mitigation measures can be developed and implemented. However, it is only worth setting a target if there is a reasonable likelihood of achieving it. In the case of marine litter, a connection has to be made between the presence of particular items of litter and a specific source(s) that can be controlled. This may be very difficult to establish, as similar items may come from several different sources (land- and sea-based). A further complication is that items may originate from outside the jurisdiction of the administration. For example, a beach survey in the Netherlands indicated that only 42% of items collected had a local origin (van Franeker 2010). This phenomenon is even more marked in the case of mid-ocean islands and SIDS. If it is unsure whether a target can be met within the short- to medium-term then an aspirational target may be set. For example, the EC has adopted an aspirational target of 30% reduction by 2020 in the top 10 items found on beaches and fishing gear found at sea (EC 2014).

It may be considered desirable to call for 'standards' for the quantities of macro and microplastics in waste streams or particular environmental compartments. In some cases, it may be practical to do so. If wastewater is subject to tertiary treatment, then setting a standard of > 'x'% retention may be achievable. In the case of PCCPs, it would be possible to require zero added microplastic particles. However, in most cases targets are more likely to be related to achieving proportional reductions, with 'standards' set locally to take account of relevant sources, pathways and the social, ecological and economic context. Standards for contaminants in foodstuffs are already available through application of the Codex Alimentarius[86]. However, there are no standards for the quantities of nano- or microplastics. In order to develop standards, it will be necessary to establish the risk relationship between the number of particles and probable harm, accepting that this will depend on the size, shape, composition, number and exposure pathway. At present there are no accepted standards for measuring the concentration of nano- and microplastics in different media. This is an area requiring further investigation, based on pragmatic risk-based assessments, in order to focus resources on reducing the most significant risks.

Winners and losers

It is also important to consider that there may be 'winners' and losers' from the imposition of management measures. For example, a ruling could be introduced requiring that any litter picked up inadvertently during normal fishing operations be landed in the next port of call. The skipper may then be faced with a bill for waste treatment that affects profit. This does nothing to 'punish' those who allowed the litter to be introduced to the marine environment, possibly breaking a law in doing so, but effectively 'punishes' someone else who is following the law. Measures sometimes have unintended and undesirable consequences. Substituting glass bottles for plastic bottles in coastal resorts may bring about a decrease in the number of discarded plastic bottles. But, if littering continues, the social consequences may be worse as a result of injuries from broken glass.

Examples of indicators and trends

Establishing trends in plastic abundance requires a combination of selecting an appropriate indicator, developing a robust sampling and analysis strategy, and maintaining a monitoring programme over a sufficient period to establish a time-series to reveal a trend, taking account of any inherent variability in the dataset. Globally there are relatively few examples where these conditions have been met. However, there have been two exceptional studies, both described by van Franeker and Law (2015): i) surface concentrations of floating plastics in the North Atlantic gyre (towed plankton nets); and, ii) the incidence of ingested plastics by the northern fulmar in the greater North Sea.

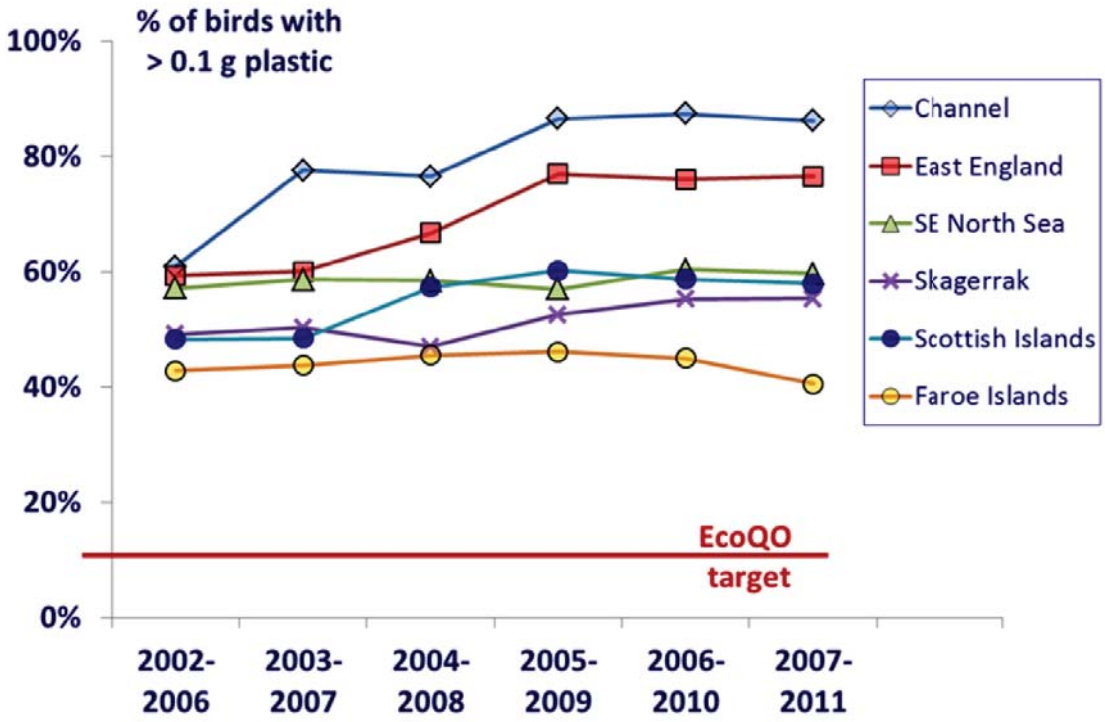
86 http://www.fao.org/fao-who-codexalimentarius/standards/en/

Biological indicators for plastics have tended to focus on common species with life traits that favour indiscriminate feeding, or those that might mistake plastic for food items. Samples are usually taken from animals found beached, to avoid unnecessary culling. Regional surveys will be species-specific, depending on the characteristic fauna. One of the longest-standing biological indicators was developed in the Netherlands, based on the quantities of plastic found in the stomach of the northern fulmar (Fulmarus glacialis). This approach has now become one of the ecological quality assessment markers used by OSPAR to assess both the abundance of plastic debris at sea and regional differences and trends over time (van Franeker et al. 2011). Clearly the selection of a biological indicator will be regionally-dependent. In the Mediterranean the loggerhead turtle (Caretta caretta) has been adopted as the most appropriate indicator species (JRC 2011).

The fulmar indicator clearly shows that the incidence of plastic has been relatively constant in recent years (Figure 11.3), with higher values occurring close to shipping lanes and areas of industrial development. One significant trend has been a steady decline in 'industrial' plastics (i.e. resin pellets). This trend is apparent also in the towed samples from the North Atlantic gyre. However, the overall incidence of plastics shows a high degree of variability, with no statistically significant trend (Figure 11.4).

Figure 11.4 Incidence of user plastics and industrial plastics in samples collected from the North Atlantic gyre, using towed plakton nets (van Franeker and Law 2015)

Figure 11.3



Incidence of plastic fragments in the stomachs of beached northern fulmars in different subregions of the North Sea, shown as a percentage of birds with > 0.1 g of ingested plastics in 5-year rolling means. The Ecological Quality Objective (EcoQO) target level is that no more than 10% of fulmars exceed the 0.1 g level. (van Franeker and Law 2015)

Figure 11.4

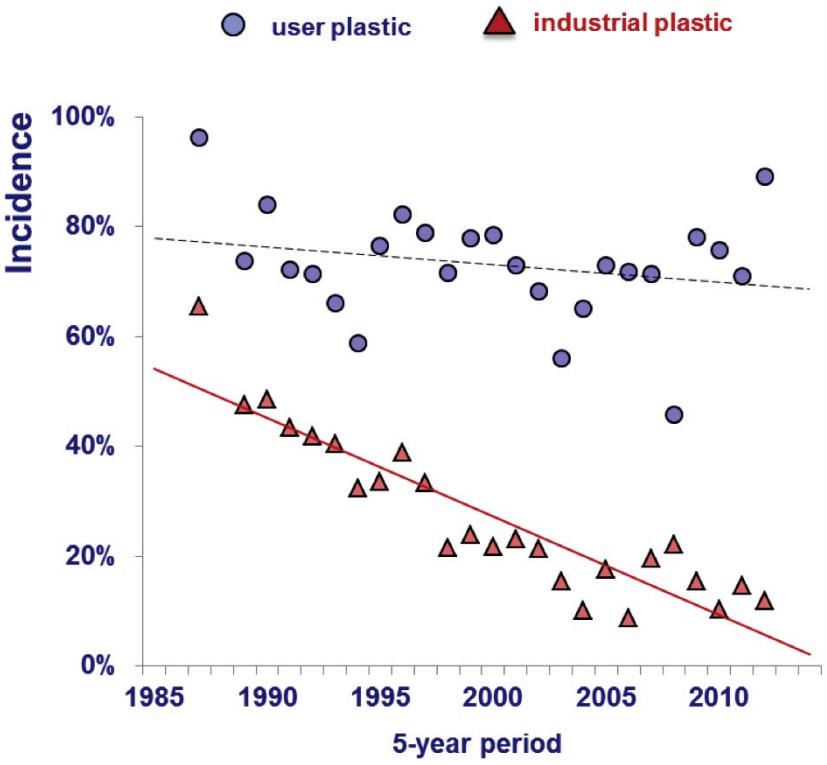


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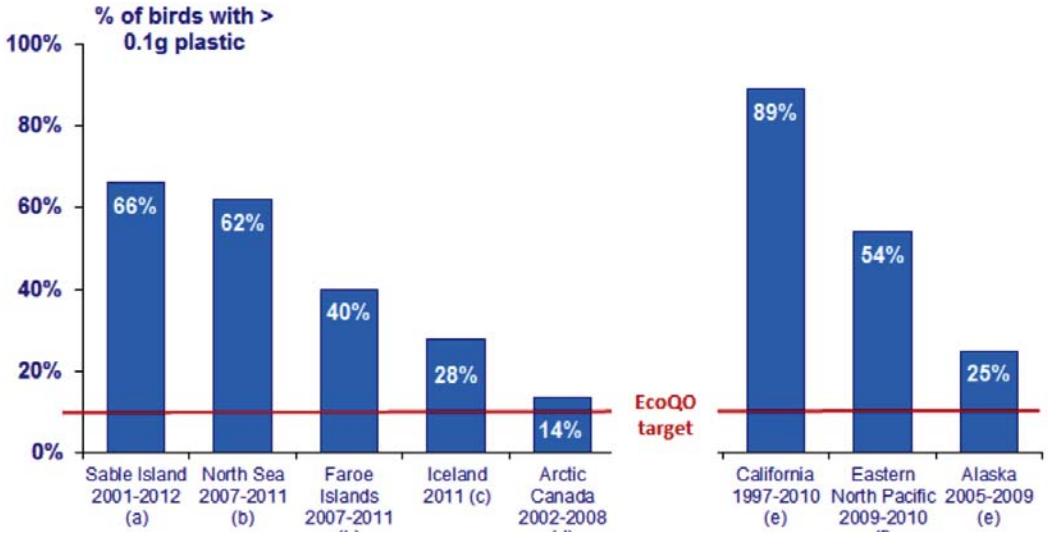
Figure 11.5



Latitudinal patterns in fulmar EcoQO performance (proportion of fulmars having >0.1 g plastic in the stomach) in North Atlantic and Pacific Oceans. (a) Bond et al. (2014), (b) van Franeker and Law (2015), (c) Kühn and Van Franeker (2012), (d) combined from Mallory et al. (2006), Mallory (2008) and Provencher et al. (2009) with additional information from the authors, (e) Nevins et al. (2011), (f) Avery-Gomm et al. (2012). (van Franeker and Law 2015)

Van Franker and Law (2015) compiled a dataset using published sources for the incidence of plastic in stomachs of the northern Fulmar from the Pacific and Atlantic. Both datasets showed a latitudinal dependence, lower incidences at higher latitudes (Figure 10.5).

Developing an indicator framework

The value of the indicator approach is enhanced if it takes place within a framework, in which issues such as the monitoring and assessment techniques to be used and the selection of appropriate indicators can be agreed and harmonised. Several frameworks have been developed under the auspices of regional seas bodies (NOWPAP, OSPAR, MAP, HELCOM) and within the EU (Chapter 2.3).

Meeting the UN Sustainable Development Goals

A framework for monitoring and assessment has been proposed to help address progress towards meeting the United Nations Sustainable Development Goals (Figure 11.7; SDSN 2015).

National monitoring is considered the most important level, with national ownership of the process and monitoring designed to meet national priorities and needs. National monitoring of the SDGs should "build on existing national and local mechanisms and processes, with broad, multi- stakeholder participation." (SDSN 2015). It is recognized that national monitoring can be augmented with more informal programmes, by NGOs and other organisations. Regional monitoring is seen as building on existing institutions where appropriate, such as regional seas bodies. Global SDG indicators are intended to be universal. Some are used to track global commons such as the oceans. Thematic SGD indicators are intended to cover cross-cutting issues such as technology gaps, consumption and production patterns, and the health sector, at a global scale.

Box 11.2

TEN PRINCIPLES FOR GLOBAL SDG MONITORING INDICES

Limited in number and globally harmonised
Simple, single-variable indicators, with straightforward policy implications
Allow for high frequency monitoring*
Consensus-based, in line with international standards and system-based information
Constructed from well-established data sources
Disaggregated
Universal
Mainly outcome-focussed
Science-based and forward-thinking
A proxy for broader issue or conditions
(SDSN 2015)

(*it may be appropriate to add the caveat 'monitoring frequency appropriate to meet needs')