The case of plastics in the complex marine ecosystem

Pier Francesco Moretti – 6 November 2018

As now in the public domain and after a series of widespread media campaigns, plastic is recognized, or rather perceived, as a pollutant harmful and dangerous for the survival of the marine ecosystem.
As already referred in the news "**The campaign for a plastic-free ocean: a cognitive bias?**" on 24 May 2018 (see http://www.pierfrancescomoretti.eu/), such a message of "emergency" does not come from a robust risk assessment based on scientifically proven data, but probably results from a mix of precautionary approaches, cognitive biases and opportunism of some groups that may be interested in an industrial transformation or access to research funding or cleaning of the oceans.
Given that the results of scientific research on plastics, microplastics and their impacts on the marine ecosystem are welcome to increase the knowledge on this topic, each risk assessment on a global scale are generally based on extrapolations and conjectures, currently very difficult to support with data or models able to provide high accuracy and robustness in estimates.
In brief: 1) we are realizing that plastic could consist of a dangerous pollutant present in the sea and especially in the food chain, and can affect the transformations, even irreversible, that can drastically damage the environment and economic activities (read tourism, fishing, aquaculture, etc.); 2) there are few data and robust models that currently allow to improve the estimate of the global impacts of this presence of plastic in the sea.
Thanks also to the media campaigns and the positions taken by organizations at high global political level (UN, EC, G7), this is convincing public funders (also concerned by environmental and social aspects) and private (worried about any regulatory consequences or interested to business opportunities), to ask the scientific research to tackle the problem either from the point of view of "understanding" impacts and of industrial solutions (both to the removal and transformation of plastics).

All this is reasonable.

Indeed, if the scientific community would ask for funding to acquire more data to understand the impacts of plastic or microplastic at global or regional scales, this could instead stimulate a reflection on the approach and the methodology.
It is all too well demonstrated that the "sea" system is complex, in the sense that the various variables that influence its dynamics are interconnected and any isolated analysis of individual aspects cannot provide any solution to the understanding of the system as a whole. The overall property of the system can be "emergent" and cannot be described by the sum of the descriptions of its parts. An example is some laws of chemistry which, although they depend on an ensemble of atoms, cannot be derived from the quantum description of the individual atoms. It is the famous dilemma of the so-called reductionism.

This being said, when a larger coverage in data and variables are asked, a method of analyzing and extracting knowledge should be added too: the partial understanding of the system does not hold up to sell as useful for the assessment of global impact!

There are new frontiers of research towards the identification of laws and the extraction of knowledge from data, as in the context of artificial intelligence and deep learning: these can guide strategic choices, both observational and analytical. But these aspects, at the moment, do not seem to be included in the scientific discussion in the marine community.

An alternative approach could be the identification of impact indicators that are not linked to the detailed monitoring of plastics and its weathering process at sea, that is, indicators of health of the oceans that may also be indirectly linked to the harmful influence of plastics. One wonders if there has ever been any damage reported as “unexplainable” and that could be associated or at least correlated with plastic (apart from birds or whales or turtles with macro-plastics). Plastics in fact has deployed in oceans for many years already. Timescales are important when comparing the recovery/resilience timescales of the system with those of the threat: dose could not constitute the poison.

In this reflection, we are not addressing specific damages on some particular aspects, such as the economic impact on some species or ecosystems (aquaculture, tourism).

although the cultural and industrial transformations towards a circular economy, the reduction of "non-necessary mono-use", and a greater attention to environmental protection are desirable and more and more needed at civil and political levels, the ostracism towards the plastics and the attribution of the role as “sea poison” is excessive, such as the lack of methodology in the request for data and effective funding to provide understanding and solutions to the foreseen problem. Last but not least, more transparency and intellectual integrity should support many justifications passed off as scientifically reliable.