Impact of litter on sea turtles and marine fauna: an evaluation of ingestion and entanglement at the European and Regional Sea Convention scales.

Marine litter affects marine species at all trophic levels, mainly through ingestion or entanglement. These interactions with marine litter often result in fatal or sub-lethal effects which decrease individuals’ chances of survival and reproduction. Sea turtles are of particular concern, since they are prone to ingest marine debris. The loggerhead turtle Caretta caretta is proposed as a relevant bioindicator species of the marine litter impacts on biota in the framework of marine environmental policies which have to monitor the efficiency of conservation and restoration measures.

In this perspective, a global standardized methodological approach and thresholds of marine Good Environmental Status (GES) are urgently needed. Besides, the relevance of other indicators of litter impact on biota need to be evaluated.

Several C. caretta (D.oceanus) which frequents the Northern Atlantic side of the area, was also considered. Other impact of litter on marine fauna (entanglement) and specifically on fish and macroplastic (< 5 mm ingestion) was evaluated at this area.

In order to support the implementation of the indicator “Litter ingested by sea turtles” and define the feasibility of the implementation of an “Entanglement” and “macro-debris ingestion” indicators in the waters of the European Community and RSCs (Fig. 2), the INDICIT consortium carried out:
1) a literature review, 2) an evaluation of the GES and criteria of the indicator “Litter ingested by sea turtles,
3) the calculation of the averaged prevalence and quantities of ingested litter and 4) the development of a standardized procedure for live and dead individuals, from the Marine Strategy Framework Directive (MSFD) guidelines.

Entanglement, a new indicator?

Our literature analysis and survey stressed the emergency of improving the knowledge about this harm (Table 5). Two approaches are relevant for an Entanglement indicator (Table 1). However, several factors influencing this impact of litter need to be further investigated, particularly in megafauna and invertebrates. The main methodological constraint is related to the difficulty to determine the material responsible for the entanglement due to a possible confusion between litter from fisheries and material from active bycatch (Fig. 5), especially for sea turtles and marine mammals. In birds, “entanglement in nest” overcomes this issue in certain species (Phalacrocorax aristotelis and Morus bassanus), where this interaction is clearly due to debris. At sea, misdetection is also a key issue, since entangled specimens floating at the surface or in the water column are not detected as well as the specimen sinking towards the sea floor or being predated. Entanglement of corals on the sea floor is a promising indicator, because the monitoring cannot miss specimens. However, this kind of monitoring requires heavy logistics (e.g. ROV and imaging means), which may be mutualized during oceanographic campaigns.

Relicence of a Micro-Debris Indicator?

A specific indicator for micro-litter ingestion appeared relevant. In sea turtles, authors generally did not differentiate such items, preventing to define the criteria for such an indicator. However, networks could be equipped to collect standardized data specifically on the 1-5 mm ingested litter.

Figure 1: By using the simplified column of the harp and the periscope marine compartments, sea turtles can reflect litter items in numerous marine compartments.

Figure 2: Besides C. caretta (D.oceanus) which frequents the Northern Atlantic side of the area, was also considered. Other impact of litter on marine fauna (entanglement) and specifically on fish and macroplastic (< 5 mm ingestion) was evaluated at this area.

Figure 3: Averaged percentages of individuals having ingested litter in C. caretta (% in red compared to 100% in green) calculated from the literature between 1967 and 2016 (respectively: %30 and 0% respectively).

Table 1: Taux possibly relevant for an Entanglement indicator in the INDICIT project area, and criteria for feasibility. *: P. aristotelis; **: M. bassanus; D.oceanus: stranding network; I*: nesting monitoring network; ASC: dedicated survey; ASC*: aerial survey; ASC*: multi-operated vehicles; method: *methodological; **= biological; #log: logistical.

Figure 4: Sheet-like plastics, Infragrane and polystyrene plastics, generally white or transparent, are the most commonly ingested debris by sea turtles, found either in digestive tract or in faeces (Photo: G. Damron).