

# Marine Litter: A Threat for Northern Gannet Breeding Success in Highly Anthropized Environment



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## Abstract

This paper documents the damage caused by Anthropogenic Marine debris (AMDs), and especially by aquaculture waste, on rare breeding case of Atlantic seabirds (Northern Gannets) in the Mediterranean Area. Highlighting briefly about the environmental dangers implicit in AMDs dispersion, it points out measures that can be undertaken in order to face this growing problem.

**Keywords:** Anthropogenic Marine debris; Northern Gannets; Sea birds; Marine pollution; Aquaculture waste

## Introduction

Anthropogenic litter, i.e. any manufactured or processed solid waste material that enters the environment from any source, represents one of the main threats for the natural ecosystems. It is listed in the IUCN threat taxonomy as “Rubbish and other solid materials including those that entangle wildlife”, with the type of impact on biota depending on intrinsic morphological and ethological traits of the species, and on the extrinsic characteristics of litters (i.e. size, abundance, composition, shape, density, etc., IUCN-CMP, 2012, code 9.4). The marine component of litter (Anthropogenic Marine debris - AMDs, or marine litter - ML), which represents an important proportion of the total anthropogenic litter, is included in the European Marine Strategy Framework Directive (2008/56/ECMSFD; EEC, 2008: descriptor 10; [1]). Birds are well known to be especially susceptible to the ubiquitous and increasing presence of plastic contamination [2- 5]. Seabirds represent a very high proportion (about 80%) of all the species worldwide interacting with anthropogenic litter. A recent global review focused on this topic [6] reports that for 82 (i.e. 31.8%) of the 206-seabird's species investigated there is evidence for interaction both by ingestion and entanglement, while other species (only 5, three Suliformes and two Charadriiformes, the 2.43% of the sample) can also incorporate litter in their nests. This is a relatively new studied type of interaction of birds with ML, that show important eco-behavioral implications [7-9].

Sea-based sources of litter were found to be significantly related to the main economic sectors, such as fisheries and

aquaculture (i.e. mussel farms) in certain European countries like Italy and Greece [9,10]. Mussel farmers use nets made in polypropylene (or in polyethylene) that are used to contain the mussel from the very beginning of their life to the moment of their withdrawal for the sale. When the nets are replaced, they are cut and cannot be used any more, thus contributing to the ML if the waste disposal is not properly managed. This fact implies a large availability of plastic objects that are flexible, light and eye-catching and particularly suitable to be used by seabirds for the construction of their nests. Mediterranean breeding behavior of Northern Gannets (*Morus bassanus*), a pelagic bird that generally nests in Atlantic colonies ranged on cliffs, is very peculiar. Only two nesting cases in the Mediterranean area are currently known: one in Italy (in the little harbor of Portovenere, inside the La Spezia Gulf [11] and another in France in Carry-Le-Rouet, a small harbor in South France [12].

They represent the southernmost cases of Gannet's breeding (43°N), and both are in close association with harbors and man-made structures such as floating docks and boats, in a highly anthropized environment. A recent study [13] highlights the high percentage of polymeric material present in the nest content for both breeding sites, and detects differences concerning object typologies, related to the productive environment of the two nests. In Carry-Le-Rouet' nest are especially represented ropes, laces and strings, connected with the port activities (both fishing or pleasure boats), while in the Portovenere' nest the 90% of used objects are mussel nets, related to the presence of aquaculture activities, an important source of income for local

workers. For both cases, the predilection shown by birds for these “new” nest materials caused harmful consequences to newborns or even to adults (including the death), as these string-shapes and indestructible objects can easily twist around the body, the neck or the legs, or to get caught in the beak. Since the beginning of Mediterranean Northern Gannet breeding, in 2006, 14 chick/young birds have been undamaged by anthropogenic pressure and plastic presence in the nest, over a total of 30 newborns in 13 years.

Therefore, it is important to assess which types of anthropogenic objects are preferentially used by birds for nest construction (as it can affect their health and reproductive success) and if this preference is due to the availability of such objects in the studied area. At this regard, monitoring actions undertaken in the same zone where Italian Gannets breed evidenced a narrow range of dominant litter categories, including the mussel nets [9]. This fact, which would lead to easily propose removal strategies focused on the more representative waste typologies, finds instead a stumbling block in the current waste management regulations, which does not provide clear indications on waste classification and on their correct disposal and differentiation. In particular, it is not clear which type of code C.E.R. (European Code Catalogue) is applicable to waste collected, even unintentionally, at sea during fishing or aquaculture activities, and there is no regulation governing the transport of waste by water, while a similar regulation exists for road and railway transport. In some cases, these objects have been considered as “special and dangerous waste” (as evidenced in (DeFish Gear project, [www.defishgear.net](http://www.defishgear.net)), with the subsequent complication of disposal management and costs when they are brought to the ground. These ambiguities in regulation for this kind of waste allow inappropriate and not punishable behavior by the mussel farmers, with the consequence that a correct disposal of these objects is only dependent on their good will.

## Conclusion

Seabirds inhabit oceans, seas and coastal contexts that represent the ‘sink’ ecosystems more interested by ML, so making seabirds extremely vulnerable to this threat. In some cases, some species are on the verge of becoming endangered by the rising diffusion of polymeric material in their environment. Northern Gannets currently nesting in Mediterranean coasts represent the rare and southernmost breeding case for their species. Unfortunately, being them subject to a highly anthropogenic pressure, they have had several problems, even caused by the excessive presence, in their nests, of polymeric material mostly proceeding from aquaculture and fishing productive activities. It is advisable to better assess the link between the preferred types of AMDs used by birds for nest construction and how they can affect their health and reproductive success. Assessing selectivity for certain AMDs types is also important because it might introduce a bias [14] in methods based on the analysis of nest composition, today considered suitable for monitoring debris abundance in the marine environment [8].

The evidence that several monitored areas show significant differences in the detected prevalent categories of ML [9,10,15] supports the approach of concentrating on the implementation of measures to tackle a set of priority litter items, thus attaining greater impact towards achieving good environmental status. Finally, we would stress the need to prevent the dispersion of anthropogenic material in the marine environment, especially in areas with a high presence of productive activities. This goal can be achieved by means of different and parallel strategies: awareness campaigns aimed at involving local fishermen, port users, aquaculture producers and pleasure boat users to adopt correct behaviors; commitment of local authorities to disseminate and incentivize best practices; support the efforts of the scientific community engaged in the development of alternative biodegradable materials for aquaculture and fishery; promotion of blue process chain for collecting and recycling the polypropylene/polyethylene nets once used; establishment of appropriate and strict guideline for waste disposal, to obtain zero or minimal discharge by aquaculture/fishing activities, and the application of severe punitive measures in the case of violation of norms.

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