

FACTSHEET 1

Date: 08. April 2013

Impact of marine litter

Litter in oceans and seas is an aesthetic problem, incurs considerable costs and can have severe impacts on marine organisms and habitats. The broadly documented impact of entanglement in and ingestion of litter can have negative effects on the physical condition of animals and even lead to death. Ingestion of microplastics is of particular concern as it can provide a pathway for transport of harmful chemicals into the food web.

Analyses of studies on the topic indicate that rope and netting account for 57 % of marine organisms' encounters with litter worldwide, followed by fragments (11%), packaging (10 %), other fishing related litter (8 %) and microplastics (6 %). Fishing gear accounts for about one-tenth of the waste in the world's oceans and is of particular concern because it can continue to 'fish' for decades, a process referred to as ghost fishing.

A current review of available data in 2012 reveals interaction with marine litter for 663 species. Over half of these reports documented entanglement in and ingestion of marine debris, representing a 40 % increase since the last review in 1997, which reported 247 species. Whereas the interactions pose a threat to entire populations in only a few cases, it is inevitable that the known impacts cause a deterioration of the physical condition of the affected individuals, and a far greater number of organisms are affected by as yet undocumented sublethal effects.

In the following the main negative impacts of marine litter are described in detail, followed by a brief consideration of economic and social impacts. The main focus is on current research findings on species that inhabit European seas and oceans. Another focal point is the issue of ingestion as a dedicated indicator under the Marine Strategy Framework Directive (MSFD).

Ingestion / uptake of marine litter

- A study found that 56 % of surface neustonic/planktonic samples in the Mediterranean contained microplastic particles. The greatest abundance (9.63 items/m³) was found in the Portofino marine protected area (Ligurian Sea). A further study on marine litter in the Mediterranean Seas showed that for the northwestern parts the rate between mesoplankton and microplastics is 2:1.
- An experimental study evaluated the consequences of microplastic accumulations in blue mussels and detected e.g. pathological transformations in cells of the digestive glands.
- Plastic contamination was found to be high in Norway lobsters (*Nephrops*) in the Firth of Clyde along the western coast of Scotland. 83 % of the animals sampled contained plastics (predominantly filaments) in their stomachs, some of which could be traced to fishing nets, and which were not excreted.



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- In the English Channel 504 fish of 10 species were examined and plastics were found in the gastrointestinal tracts of 36.5 %. All five pelagic and all five demersal species had ingested plastic.
- Ingested debris was found in 3.1 % of 862 elasmobranchs caught in the Eastern Ionian Sea during deep-water long-line surveys.
- The most comprehensive data set available is that on northern fulmars. An analysis of the stomach contents of beached fulmars in the southern North Sea showed that 95 % contain plastics, each with an average 35 pieces.
- A study evaluated intergenerational transfer of ingested plastic in Cory's Shearwaters while evaluating the gut content of stranded dead fledglings on the Canary Islands. 83 % of birds were affected, each containing an average of eight pieces of litter.
- In three of 12 analyses of the abdominal adipose tissue of oceanic seabirds (short-tailed shearwaters) higher-brominated congeners (PBDEs) were detected which are not present in their natural prey (pelagic fish).
- Results from 371 dissections of leatherback turtles (which also migrate through the Mediterranean Sea) show that more than one-third of the animals feed on plastics. The loggerhead, which is proposed as the most suitable indicator species for ingestion in the Mediterranean Sea, is known to regularly ingest e.g. fish hooks, rubber, aluminium, foil, tar, ropes and monofilament line.
- Samples taken from 107 stomachs, 100 intestines and 125 stool samples of harbor seals in the Netherlands were analyzed for the presence of plastics. Incidence of plastic was 11 % for stomachs, 1 % for intestines, and 0 % for stool samples. Younger animals up to 3 years of age were most affected.
- In each of the 19 analyzed stool samples from harbor and grey seals in the German Lower Saxony Wadden Sea microplastics mainly of granular origin and fibres were found, ranging in volume from a few milligrammes to a few grammes per sample.
- The concentrations of MEHP found in the blubber of stranded fin whales suggested that phthalates could serve as a tracer of microplastics intake.

Entanglement / strangulation in marine litter

- The decimation of deep water sharks in the North Atlantic has been linked to the 20,080 ghost fishing lines (total length: 1,254 kilometres) which are estimated to be lost there every year.
- A study investigated the use of plastics as nesting material by northern gannets for the years 1996-1997 and 2005-2010 in the third largest gannet colony in the world (Grassholm, Wales), where approximately 40,000 pairs of gannets breed. On average gannet nests contained 469.91 grammes of plastic, which is equal to an estimated 18.46 metric tonnes for the colony. The majority of nesting material was rope made from synthetic fibres (83 %), followed by netting (15 %), packaging (2 %) and a very small proportion of other plastics (< 1 %). On average, 63 +/- 27 birds were entangled each year, totaling 525 individuals over eight years, the majority of which were nesting.
- During the 2005 breeding season all sampled nets of the Helgoland colony's 200 breeding pairs of Northern Gannets contained plastic litter in the nest construction material.
- In 1992 plastic litter items were included in 39.4 % of 466 Kittiwake nests in the Bulbjerg colony of Jammerbugt in northwestern Denmark; 57.2 % of 311 nests contained plastic litter in 2005.

- Sightings records and a photo identification catalogue from a haul out site in southwest England were used to establish entanglement records for grey seals. Between 2004 and 2008 the annual mean entanglement rates ranged between 3.6 % and 5 %. Of the 58 entanglement cases, 64 % had injuries that were deemed serious. Of the 15 cases where the entangling debris was visible, 14 were entangled in fisheries materials.
- A recent study (2013) describes the death of a sperm whale associated with the ingestion of large amounts of litter in the Mediterranean Sea. The debris included several metres of plastic foil used as covering in greenhouses. The findings indicate that these animals hunt for food in waters that are near areas which typically have greenhouses. There is therefore a risk of ingestion of cover sheeting that has torn off or been improperly disposed.

Other impacts

Marine litter damages and degrades coral reefs and soft sediment. This can be due to derelict fishing gear or parts thereof which smother the sandy sediments and the organisms living in the intertidal zones. Furthermore, marine litter items can assist in alien species invasions as they drift on litter across great distances.

Economic / social impacts

Information on the economic impacts of marine debris is not readily available and consists of a few assessments which usually occur at municipal level. Municipalities in the United Kingdom report spending some 18 million euros per year for clean-up of beach litter, at a cost increase of 37 % over the past ten years. The district of Ostholstein at the Baltic coast of Schleswig-Holstein/Germany incurs costs of 750,000 - 1.2 million euros every year. One of the main economic motivations to continue clean-up work is to preserve the beauty of tourist beaches and to remove waste that might injure holiday-makers. Direct costs incurred to the fishing industry are also notable. They include loss of fish to ghost fishing, catch spoiled by contamination with debris, but also with paint and oil; damage to nets and to propellers entangled in litter, resulting in lost operating time and time spent cleaning nets.

There is an accumulation of litter along the east coast of Sweden whose clean-up costs about 1,125,000 euros per year. The costs incurred to fisheries because of litter - for example for cleaning and repair of nets - amount to nearly 800,000 euros. Analyses determined that 80 per cent of the litter found there did not originate in Sweden.

In addition to the impacts mentioned here, marine litter can also impact human health and safety:

- Medical wastes, syringes, glass and other sharp and/or dangerous (munitions) items that are washed up on beaches result in direct risks to beachgoers. Swimmers, divers and snorkelers may become entangled in submerged or floating debris;
- Solid waste associated with sewage such as sanitary towels, condoms and cotton buds degrades the quality of the bathing water and may present a health risk.
- Fish and shellfish meant for human consumption may contain (micro)plastics. There is no reliable information or data available up to now on whether or to what extent there is a human health risk.
- Marine litter poses a safety risk for sea vessels and their crews. Marine debris can block ship propellers or steering systems and do direct damage to vessels. A substantial number of marine rescues have resulted.

Further literature

- Conference *Issue Paper*, Chapter 2.1: <http://www.marine-litter-conference-berlin.info/downloads.php>
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IMPRINT

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Dessau-Roßlau, 8th April 2013