
MARINE LITTER –IMPACTS ON THE MARINE HABITATS AND BIOTA

V.Kripa

Principal Scientist and Head, Fishery Environment Management Division
Central Marine Fisheries Research Institute
P.Box 1603, Ernakulam-682018

Introduction

Centuries ago, when man used only natural products for his use, the oceans were safe and clean. Whatever entered the oceans through manmade activities got decomposed and went back to the nature in a harmless manner. With urbanization and development non-biodegradable waste from human activities which can be categorized as Marine Litter began to enter the coastal ecosystems and has turned out to be a threat to sustainability. The United Nations Environment Programme (UNEP) has defined Marine litter as - any man made object intentionally or unintentionally discarded, disposed of, or abandoned that enters the marine environment. Approximately 80% of litter originates onshore and 20% from offshore sources. Among marine litter plastics are the major component and these are identified as one of the nine source categories of the Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities (GPA, 1995).

Types of Marine Litter

Marine litter includes all objects found in the marine and coastal environment that do not naturally occur there. Any object which is discarded, disposed of or abandoned that enters the coastal or marine environment can also be classified as marine litter. Some of the commonly occurring items are plastics (broken pieces, foamed plastic pieces, food bags, bottles, wrappers, etc) electronic material (eg CDs, tapes etc) glass pieces (cups, bottles etc), metals (beverage cans, fast food cans etc) rubber (foot wear, caps etc) and many such objects.

Plastic has been used since 1855 and estimates indicate an annual production of plastic to the tune of 300 million tons in 2010. (Thompson et al, 2009). The typical character of marine litter is that they are non-degradable (or decompose at a very slow rate). They are mostly buoyant (i.e they will float). These two characters make them enter different realms of the marine environment where they remain for a very long period interfering with the life of biota. The residence period of these materials in the marine ecosystem is



very high ranging from decades to nearly 600 years and the direct and indirect effects on the ecosystem and its resources are grave. Large pieces or products made of plastics take time to degrade, but there are micro plastics which enter food chain..and pose threat to marine and human health

Micro - Plastics

In the BBC News, 27th January 2012 Mark Kinver Environment reporter made a report on micro plastics It was announced that a study has warned that microscopic plastic litter from washing clothes is accumulating in the marine environment and there are chances that this could enter the food chain. Researchers traced the "micro plastic" back to synthetic clothes, which released up to 1,900 tiny fibres per garment every time they were washed. Research has indicated that plastic smaller than 1mm were being eaten by animals and getting into the food chain. Micro plastics are those plastic particles which are smaller than 1 mm ; in some cases they are also defined as those items smaller than 5mm

Sources of Microplastics

Micro plastics are produced either for direct use, such as for industrial abrasives, or for indirect use as precursors (so called resin pellets or nurdles) for the production of diverse consumer products ("primary micro plastics"). They can also occur due to breakdown of larger plastic material, especially marine litter, into smaller and smaller fragments (so called "secondary micro plastics"). The breakdown is caused by mechanical forces (e.g. waves) and/or photochemical processes triggered by sunlight (especially UVB)

Potential impacts on the Marine Environment

Micro plastics have been shown to be ingested by deposit-feeding lugworms (*Arenicola marina*) and filter-feeding mussels and they may be transferred across trophic levels. Possible effects of micro plastics on marine organisms after ingestion are threefold 1) physical blockage or damage of feeding appendages or digestive tract, 2) leaching of plastic component chemicals into organisms after digestion, and 3) ingestion and accumulation of sorbed chemicals by the organism.

Studies have shown that birds are affected by micro plastics in the environment. One report has indicated that of the 1.5 million albatross (birds) that inhabit Midway, nearly all were found to have plastic in their digestive system. Approximately one-third of the chicks die mostly due to being fed plastic from their parents.

Nurdles

Nurdles are pre-production plastic resin pellet typically under 5 mm (0.20 in) in diameter found outside of the typical plastics manufacturing stream. Pellets are an intermediate good used to produce plastic final products. Approximately 27 million tonnes of nurdles are manufactured annually in the United States. Nurdles in the digestive



system cause physiological damage by leaching plasticizers such as phthalates. Nurdles can carry two types of micro pollutants in the marine environment: native plastic additives and hydrophobic pollutants absorbed from seawater. For example, concentrations of PCBs and DDE on nurdles collected from Japanese coastal waters were found to be up to 1 million times higher than the levels detected in surrounding seawater.

Impacts of Marine Litter

Marine litter can affect important fish habitats such as the nursery and breeding grounds. The two main problems which marine litter pose to marine life are entanglement and ingestion.

Entanglement results when an animal becomes encircled or ensnared by litter. Entanglement can occur accidentally, or when the animal is attracted to the litter as part of its normal behavior or out of curiosity. Derelict fishing gear can entangle nekton. This problem is increasingly affecting turtles, sea birds and other large biota. This is called ghost fishing.

Entanglement is harmful to wildlife for several reasons. They can cause wounds which can lead to infections, can cause strangulation or suffocation and can impair ability to swim, which can become fatal. Most seabirds feed on fish, they are often attracted to fish that have been caught or entangled in nets and fishing line. The thin plastic /nylon threads and other entangling material can harm larvae and juveniles of many species especially jelly fishes and polychaete worms.

In the Pacific Ocean, one 1,500-meter long section of net was found that contained 99 seabirds, 2 sharks, and 75 salmon. The net was estimated to have been adrift for about a month and to have traveled over 60 miles.

Marine Litter Ingested by Animals

Fishes and other marine animals may ingest (or swallow) marine litter accidentally or they may feed on litter mistaking it for food. Ingestion can lead to starvation or malnutrition if the ingested items block the intestinal tract and prevent digestion, or accumulate in the digestive track and make the animal feel "full" lessening its desire to feed. Ingestion of sharp objects can damage the digestive tract or stomach lining and cause infection or pain. Ingested items may also block air passages and prevent breathing thereby causing death. Of the different types of marine mammals, seals and sea lions are the most affected because of their natural curiosity and tendency to investigate unusual objects in the environment.

Effects on Ocean Ecosystems

Litter can pollute and clog channels opening to the sea and can adversely affecting water quality and habitat. Abandoned plastic covers and other litter can smother and crush sensitive ecosystems, many of which are essential fish habitats. They can also create anoxic conditions and lead to change in benthic community structures.



Effects on Human Population

Medical and personal hygiene litter can enter waterways. These items often contain harmful bacteria and pathogens. Syringes, broken glass and other hazardous items are threat to children and other barefooted beachgoers. Bags, nets etc can wrap around boat propellers and clog seawater intake systems, causing costly damage

Chemicals from Plastic

Latest research suggests that plastic is also a source of dissolved substances that can easily become widely dispersed in the marine environment. Many of these chemicals are believed to toxic to humans and animals. They release a range of chemicals, such as bisphenol A and substances known as polystyrene-based (PS) oligomers, which are not found naturally. Bisphenol A has been implicated in disrupting the hormonal system of animals.

In September 2010, Canada became the first country to declare BPA a toxic substance. The EU, Canada, and recently the US have banned BPA use in baby bottles. Bisphenol A is an endocrine disruptor which can mimic estrogen and may lead to negative health effects. A 2011 study that investigated the number of chemicals pregnant women are exposed to in the U.S. found BPA in 96% of women. Higher bisphenol A levels were significantly associated with heart disease, diabetes, and abnormally high levels of certain liver enzymes.

Management

The main reason as to why this problem persists is because of the 1) deficiencies in the implementation and enforcement of existing international, regional, national regulations 2) lack of standards that could improve the situation, and 3) lack of awareness among main stakeholders and the general public,

The problem of increased marine litter in the ecosystem can be managed by the following measures

- Create awareness about the harmful effects of marine litter in coastal areas
- Prevent the fishermen from dumping back the NBW back to the sea
- Convince the governing bodies on the importance of placing garbage bins at several locations in the coastal villages so that the waste can be effectively disposed off on land

Most nations have started creating awareness by motivating local people in coastal clean-ups, reducing the waste produced, reusing and recycling whenever possible.

MARINE LITTER - A THREAT TO MARINE ECOSYSTEM

