

Habitat destruction: a case study on the evaluation of litter in the marine zone of north Vembanad Lake, Kerala

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The marine ecosystem has been facing impacts due to anthropogenic activities ever since urbanisation started. However, during the last few decades, the coastal population has increased tremendously and it is reported that 44% of the world's population lives within 150 km of the coast (Report of the 28th session of Joint Group of Experts on the Scientific Aspects of Marine Environment Protection, GESAMP). It is also presumed that this trend would continue and the population in the coastal region is expected to double by 2025. The technological advancements have definitely supported the coastal area development and more people depend on these regions for diverse activities like tourism, shipping, construction, health, education, small and large business ventures and so on.

Some of the negative impacts of these developments have been felt on the coastal marine ecosystems. During the last century, one of the main issues related to ecosystem health was the after-effects of industrialisation and related untreated effluent which degraded the water quality. When studies proved that bioaccumulation and biomagnification of metal and pesticide residues in the marine biota can also affect humans, policies were formulated to prevent environment degradation and effluent treatment plants (ETPs) became mandatory. Another form of waste that is impacting the natural habitats is the non-biodegradable litter (NBL) or marine litter generated in the mainland and entering the rivers, estuaries and finally the sea, which is being viewed with concern by environmentalists.

Vembanad Lake is one of the major coastal habitats along the south-west coast of India. The Cochin backwaters is part of this lake and the Kochi City is situated on the banks of this estuarine system. The rapid growth of Kochi (the largest urban agglomerate in the state of Kerala), has been felt on

the Cochin backwaters which has long been identified as the nursery ground of penaeid and non-penaeid shrimps and several commercially important fishes. 'A targeted study was conducted to evaluate the quantity of different types of litter entering the Arabian Sea through one of the bar mouths at the northern part of Vembanad Lake.

Methods used to assess different types of marine litter

The total area surveyed was 142 ha and the intertidal shore line was 8.88 km. In each intertidal site, visual grading was made based on the spread of marine litter. A detailed survey was done for litter in the main water body. Three types of marine litter were assessed, viz., i) floating litter; ii) bottom litter and iii) column litter.

Floating litter are those which float and these were visually assessed. In the subtidal regions, submerged samples (Quadrant) were collected by diving. The NBL at the bottom were collected and graded. Column litter which floats in the column, actually enters the estuaries from the land and flows through the estuary into the sea. With time, the floating litter can gain weight due to accumulation of silt and other particles and gradually sink down to form column litter and this can eventually become bottom litter. Due to the turbidity of coastal waters and constant flow, evaluation of marine litter is a difficult task. Fishermen were involved in collecting the data through a participatory approach.

Participatory approach and involvement of stake net fishers

Stake nets are special type of bag nets used for fishing in coastal areas. The length and width of each net is approximately 15 m and 4 m respectively (Fig. 1). These are tied to the stakes placed in different parts of the estuary and are operated according to tide.



Fig. 1. Stake net

A proforma for collecting information on the quantity of litter collected was prepared and the fishermen families of Moothakunnam area were involved in collecting the information. Daily records of marine litter collected in the stake net were made by the fishers and from this the quantity of marine litter accumulating in the stake net was estimated.

Salient observations

In the intertidal area, dense settlement of oysters was observed and in the crevices of these oyster beds, empty bottles were found stuck (Fig. 2). Along



Fig. 2. Marine litter in the intertidal area

with this, rubber foot wears, pieces of foam material, synthetic bags, tin cans, glass bottles *etc.* were also observed (Fig. 3). Empty plastic bottles, plastic bags and plastic sachets were the main floating items forming more than 90% of the litter and plastic sheets and bags were the main items recorded at the bottom. From the region near the bar mouth opening,



Fig. 3. Marine litter collected from the intertidal area



Fig. 4. "Ghost net" collected from the subtidal area

a "ghost net" *i.e.*, a discarded fish net was obtained (Fig. 4). This is a clear indication of the casual discarding of torn/damaged net by the fishermen in the fishing area. The lack of awareness of fishermen on the damages which a "ghost net" can do to the live nektonic and crawling biota is also evident.

From the stake net survey, the quantity of litter flowing into the coastal ecosystem was found to be considerably high during the fullmoon and newmoon period coinciding with the spring tides. This also indicates that when NBL generated in coastal areas is not properly disposed off in homesteads and public places, these can enter the coastal open waters when the high tide waters flush the shore line.

The quantity of litter ranged between 2 to 18 kg per day and consisted of rubber tyres, bottles, metal plates, tin cans *etc.* during the pre-monsoon period. In one instance, four metal boxes of 50 cm height and 30 cm width was collected along with the catch. Similarly tyres of cars and two wheelers were common.

It was estimated that during the pre-monsoon period (March - April) litter enters the Arabian Sea @ 6.8 kg per day (204 kg per month) through the bar mouth at Moothakunnam. This is estimated from the litter collected from stake nets (8 nos.) of mouth size 5 m x 4 m and length 15 m, placed near the bar mouth entrance at Moothakunnam.

Impacts of marine litter

Through interaction with fishermen, it was inferred that the stake nets get torn when metal litter gets entangled and it is expensive to repair the nets. Most often it is a tedious task to sort the litter and the catch collected in the net (Fig. 5 and 6). Usually in the nets, large plastic sheets like silpaulin and plastic bags are obtained. Most often the fishermen throw the litter collected in the nets back to the coastal waters



Fig. 5. Marine litter collected from stake net along with fish catch



Fig. 6. Fisherwomen sorting the catch and the litter collected during fishing

(Fig. 7), which again destroy the habitats. Observations on the spread of litter indicated degradation of habitats which are usually used by common resident species of fishes like *Etroplus* spp. for breeding. Though actual statistics are not available, there are clear indications that the backwaters and estuaries are polluted by marine litter thereby destroying the breeding and nursery habitats of fishes. This can definitely be a cause for the declining fishery resources of the coastal waters as evidenced by the poor fish catch.



Fig. 7. Fishermen throwing the litter collected during fishing, back to the coastal waters

Suggested measures for reduction of litter

- Create awareness about the harmful effects of marine litter in coastal areas
- Discourage casual littering of private and public places in coastal areas which will be inundated during high tide, flushing the non-biodegradable litter into the coastal waters
- Convince the governing bodies on the importance of placing garbage bins at several locations in coastal villages so that the waste can be effectively disposed off
- Educate fishermen not to dump the litter collected in the nets back to the sea
- Organise coastal clean-ups frequently involving local villagers including children
- Promote eco-watch groups of local residents and fishers
- Prohibit dumping of land waste in backwaters, coastal areas as well as in common open areas and penalise defaulters