

# **KADALEKUM KANIVUKAL**

**(Bounties of the Sea)**

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# MARINE ENVIRONMENT AND POLLUTION

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Marine pollution and its impact on the living resources is one of the topics discussed all over the world today. In the broadest sense, the term pollution refers to any change in the natural quality of the environment brought about by chemical, physical or biological agents. In practice however, pollution is the result of human activity, either direct, indirect or incidental.

About 71% of the earth's surface is covered with water area of 3,62,000 km<sup>2</sup> with average depth of about 3800 m. The nearshore waters of India along the 8041 km coastline supports lucrative fisheries and contributes to about 90% of the total of 2.6 million tonnes of marine fish production of the country. Water quality is an essential factor for the increased production of all the living resources. The problem of marine pollution affecting the fish resources in the coastal marine waters should be viewed in this context.

## **Causes of marine pollution**

The vast marine environment as well as the estuaries and rivers have long been used as a site for the disposal of waste. It is true that these water bodies can, to a certain extent, withstand such pollutants. After a certain limit, the ability of the sea to self purify is lost and the water resource succumbs to pollution.

The marine environment is a very dynamic and complex ecosystem containing a delicately balanced fluid medium, the salt water. When chemical pollutants are dumped into the ocean, they are not only diluted and dispersed by storms, winds, tides and currents but become intimately involved in the complexities of the biological food web of the sea. These toxic pollutants are not merely diluted, but may be reconcentrated by the marine biomass. When persistent and carcinogenic pollutants enter the food web, the pollution may become extremely serious and lethal to plants, animals and

humans. Most of these toxic agents affect all living things and nutritional, communicative, reproductive, respiratory, genetic and a variety of other metabolic activities of the organisms may be seriously altered or destroyed. This may result in annihilation of some populations of organisms and increase in other groups creating an imbalance in the ecosystem.

Since the fishery resource is very important as human food, the pollutants affecting fish need serious considerations. Severe pollution kills the fish and other animals. If the impact is less and slow, the fish may not die immediately but the pollutants will enter their body and accumulate in the tissues causing considerable damage to their health. In such a situation, the animals which can withstand the effect may survive and since there is less competition, will multiply in large numbers which is detrimental to the environment.

### **Important groups of pollutants and their effects**

The materials polluting the sea can be classified into categories such as (1) domestic sewage flushed into the sea directly or through the rivers, (2) pesticides and insecticides from agricultural fields carried by streams, rivers and estuaries (3) the industrial effluents of diverse types discharged directly or along with domestic sewage (4) oil substances from submarine seeps, land drainage, oil tankers and refinery wastes (5) radio active wastes discharged from thermal power stations (6) solid wastes (7) military wastes and (8) debris from ocean bed exploitation for oil and minerals.

### ***Industrial effluents***

The major pollutants which can pose serious threat to water quality are from pulp and paper, fertilizer and chemical industries. These effluents contain a variety of toxic substances such as mercury, zinc, fluorides, ammonia, urea, chlorine, oil and grease. Some of these substances are directly toxic while others indirectly affect chemical or biological action. It is estimated that in the paper industry 2,50,000 to 3,50,000 litres of waste water will be discharged for every tonne of paper produced. Most of the large industries have facility to treat the effluents and after reducing the effects they are discharged into the rivers or coastal waters. However, a certain quantity of effluents do reach the aquatic environment. Huge industries such as thermal power stations

located on the sea coast release some quantity of effluents directly into the coastal sea.

### ***Sewage***

The discharge of untreated or partly treated sewage into the coastal water bodies is a serious problem. Besides the organic load which can cause depletion of oxygen in water leading to fish mortality, the sewage also carries a number of toxic chemicals and considerable load of bacteria. It is estimated that on an average the quantity of sewage produced in India is 120 litres/day/person and the total quantity produced is about 35 km<sup>3</sup> per year.

### ***Heavy metals***

Pollution from metals is an important problem affecting the estuaries and inshore regions. These pollutants released into air, water or soil are eventually carried into estuarine and coastal water systems. The concentration of metals in the organisms living in such environment is found to be higher than the concentration of pollutants in the surrounding media. Some of these metallic elements have no apparent biological function but affect uptake or excretion. Metals such as zinc or copper in oysters may not be toxic to the host organisms, but they may be passed up the food chain to higher organisms and ultimately to human beings.

The instance of mercury pollution reported from Minamata Bay in Japan in 1960s is a typical example of metal pollution affecting the human beings. The effluent discharged from a PVC manufacturing industry in Japan contained mercury. The bivalves growing in the vicinity accumulated the mercury in their body tissues. The fishermen who consumed the bivalves were affected by a disease named Minamata disease. Severe body pain and inability to stand erect were the main symptoms. The disease affected the brain and central nervous system and several people died. It is reported that the disease was transferred from the affected generations to their offsprings involving a genetic factor. This instance is recorded in the history as one of the biggest disasters affecting human beings due to metal pollution.

### ***Oil pollution***

Apart from the chronic low level contamination of estuaries and coastal waters, accidental spillage from tankers

and oil drilling platforms and discharges of ballast water contribute to oil pollution. Although the higher animals including free swimming fish can escape oil spillage, the effect on the sedentary animals especially bivalves such as oysters can be alarming. The chronic effect of oil on the eggs and larvae of pelagic resources can be considerable in areas such as an oil well.

Considering the biological effect of pollution, it can be seen that all but the most volatile products can have a mechanical effect. Large organisms immersed in water may escape unaffected from the contact because they have surfaces which oils will not wet. However, sea birds are most affected in this respect because their buoyancy and thermal insulation depend on feathers whose microstructure repels water but attracts oil. Thus, oil can rapidly penetrate the plumage permitting the entry of water while the residues stick to the feathers and weigh the bird down. The bird drowns or dies due to starvation. In all major oil spills sea birds are major victims of pollution. In the normal course the effect of an oil spill is considerably reduced by the effect of wind and wave action. But certain compounds such as benzene can penetrate into the cell walls of animals and cause considerable damage. Although the bigger animals can swim away from the affected area and escape, the coral reefs and animals living attached to substratum are usually severely affected by oil spills.

#### ***Pollution from pesticides***

Pesticides are used in agriculture to protect the crop from pests and insects. About forty varieties of pesticides are now in use and their application increases every year. It is estimated that about 25% of pesticides applied end up as residues in the rivers and lakes and finally reach the marine environment. The pesticides destroy the smaller animals which form the food of fishes. Some pesticides enter the body tissues of fish and cause considerable damage to tissue. Although DDT was banned 10-20 years ago due to long biological half life, its residues are found in the sediments of rivers and lakes. The benthic animals like bivalves are found to be affected by these residues.

Heated water discharged from thermal power stations is one other important source of pollution. The power stations, both based on coal as well as nuclear power, use large quantities of water as a coolant to reduce the heat generated in the process

of power generation. The water used as a coolant when discharged will be hotter than the ambient water. As per the rule, the discharged water should not have more than 5°C than the ambient water at the discharge point. The body temperature of the animals and fishes living in the area is adjusted to the ambient temperature and they may be able to tolerate the increase in temperature to some extent. But the increase beyond a limit will be harmful to the organisms. In countries located in the sub-tropical areas, the water available from thermal stations is used to culture fishes and bivalves. This is not possible in tropical areas since the animals are already living in an optimum ambient temperature. Certain group of algae which can withstand the increased water temperature are found in abundance in the vicinity of thermal stations and their presence is considered as an indication of thermal pollution.

As a rule, the water discharged from nuclear power stations should not contain any radioactive material. However, sometimes a small quantity of radioactive substance reaches the marine environment and gets accumulated in the body tissues of bivalves, certain groups of algae and sponges. In such areas, frequent monitoring of the activity dose is recommended. When compared to the level of pollution in the marine coastal waters in other countries of the world the situation in the coastal waters of India is better. In certain locations, especially in the vicinity of metropolitan cities and nearby industrial areas, the level of pollution is higher. These locations are considered as hot spots of pollution. In such hot spots, regular monitoring is required.

#### **Control and regulation of pollution**

It is only appropriate to mention here about the pollution control regulations followed by the government. There are restrictions regarding dumping of waste material in the sea. Each country has separate laws for pollution control in the territorial waters. In India, there is a Central Pollution Control Board at the national level and a State Pollution Control Board in each maritime state. The boards have statutory powers to take legal action against industries violating the regulations. Apart from these, the research institutes and universities are involved in research related to marine pollution. Since marine pollution affects the living resources, especially the fishery resources, and since the level of pollution is on the increase, further research on the subject is very essential.