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MARINE POLLUTION AND ITS EFFECT TO THE BIO-DIVERSITY

***Dr. Dina Krishna Joshi**

Post Doctoral Scholar, Gayatrinagar, New Bus Stand, Junagarh, Kalahandi, Odisha, 766 014

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ABSTRACT

Coastal and estuarine ecosystems have been, and still are, heavily influenced by the human species through pollution and habitat loss throughout the world. This coastal pollution and its impacts have resulted in a number of environmental issues including the enrichment of enclosed waters with organic matter leading to eutrophication, pollution by chemicals such as oil, and sedimentation due to land-based activities. Over Eighty per cent of all marine pollution originates from land-based sources which are primarily industrial, agricultural and urban. Pollution accompanies most kinds of human activities, including offshore oil and gas production and marine oil transportation. Most marine animals, particularly marine mammals and fish, are very sensitive to pollution. Decreased species diversity in whales and dolphins was related to an increase in heavy pollution. Many marine species have been shown to be impacted by various pollution to some degree. So, oceanic pollution must be managed both nationally and internationally in a precautionary way before irreversible damage to biodiversity and the marine ecosystem occurs.

INTRODUCTION

Nearly Seventy-one per cent of earth's surface is covered by ocean covering $1.37x10^{39}$ litre weighing $1.40x10^{36}$ metric tons. The geographic distribution of organisms in the sea depends on their responses to currents, temperature, waves and tides, type of bottom, salinity, depth, etc. The organisms of the sea are bore, excrete, move, grow, mate, reproduce, and die within a single concentrated medium. The interactions among the marine organisms and interactions of the organisms with the chemical and physical processes of the sea range across the entire spectrum. The cycle of life in the sea is fueled by sun's visible light acting on green plants. It is seen that animals are relatively more conspicuous than plants. Marine bio-cycle is considered to be two types such as benthic (bottom) and pelagic (outer water). Some organic material is carried to the sea by rivers and some is manufactured in shallow water by attached plants. The oceans are not dead from pollutants. Strictly speaking, marine pollution may also be of natural origin. For example, it may be caused by underwater gas and oil eruptions, or by the intensive growth and subsequent death of certain micro-organisms. However, natural processes like this are not regarded as pollution. Ecological studies of marine pollution fall into three principal categories:

Corresponding author: Dr. Dina Krishna Joshi
Post Doctoral Scholar, Gayatrinagar, New Bus Stand, Junagarh, Kalahandi, Odisha, 766 014

1. Biogeochemistry of pollutants,
2. Marine ezcotoxicology,
3. Biological principles of anti-pollution measures.

The first type that is the Biogeochemistry of pollutants includes the investigation of the sources of the pollutants, the pathways along which they enter the marine environment, patterns of accumulation in the biotic and abiotic components of ecosystems, mechanisms and rates of migration of pollutants, their transformation and other processes which determine the fate of toxicants in the sea. The second type of research work that is ezcotoxicology involves the study of biological effects and consequences of human interference with the composition of the marine environment. Solutions of the immediate practical problems concerning pollution of the sea must be based on the results of closely interlinked ecotoxicological and biogeochemical studies.

Marine pollutants

The global pollutants in the zone of the marine environment may be enlisted as Pathogens, Sediments, Solid wastes, Heat, Fresh water, Brine, Toxic inorganics, Toxic organics, Petroleum, Nutrients, Radioactive materials, Oxygen dement materials, Acids and bases, Aesthetically displeasing materials, etc. The management of these marine pollutant is

quite complex. The reason for this is that the marine environment is used by man in many different ways and thus multiuse is having a number of ramifications. For example, a moving ship may not only discharge pollutants in the form of waste products from the people living abroad, oil from pumping its bilges, and heat from the discharge of its condensers, it may also need depending of a harbor channel. This may generate a salinity change in addition to sedimentation problems associated with the maintenance dredging required.

Pathogens

The pathogenic materials are the living organisms that can produce sickness or biological unbalance in either plants or animals within the ocean itself or in humans who either come into contact with oceanic waters or eat the organisms caught in the water. These include a variety of bacteria, protozoa, viruses, and fungi. The most common of these are normally found in sewage. However, other pathogens may occur in non-waste disposal areas where environmental conditions are such that the proper conditions exist for growth and reproduction.

Sediments

Sediments are always present to some extent in the marine environment. These sediments have a marked effect on plant growth because they block out a large portion of the light normally reaching greater depths and therefore decrease photosynthetic activity. In some case rooted plants get completely destroyed by this process. As sediments are deposited on the bottom they will cover up bottom dwelling organisms such as oysters and may even smother them under extreme conditions. The deposited sediments tend to make the water shallower so that, in regions traversed by ships, periodic dredging is needed.

Solid wastes

The disposal of solid waste has been a critical urban problem because areas suitable for the dumping of these voluminous materials are becoming scarcer. Due to this reason the ocean has been used as a dumping ground for solid waste. The solid waste most frequently marine dumped is sludge material left over as a bio-product from domestic sewage treatment. However, the unused products of industry and the used up products of society are also put into the sea. If the product discharged at sea contains material which may be leached into the oceanic environment, a serious problem could arise especially when the materials are toxic. However, when the solid materials are inert, a little forethought may result in some benefit to the marine environment. Artificial fishing reefs, for example, have been found to be very successful in certain areas, serving to enhance the habitat area, especially for small fish.

Excess Heat

Excess heat, if added to the marine environment, alters ambient conditions, and these changes may be detrimental to the organisms present. The amount of heat that is detrimental and the extent of the degradation are determined by a number of factors. The primary source of this heat has been of course, from electrical generating plants, whether they are fossil fuel or nuclear powered.

Fresh water and Brine

Although fresh water may be in great demand ashore, too much of it in the ocean obviously will produce a marked environmental change within a small area. This change ay occur due to poorly designed storm drainage systems, wear diversion networks associated with dams, and affluent of some industrial processes. Excessive fresh water usually is not a critical problem. The introduction of brine into the marine environment is similar in its effect to that of fresh water except in the opposite direction. The organisms acclimated to a particular salinity now find themselves in a more saline environment which could make permanent damage. Brine is a byproduct of desalination plants.

Toxics

Toxic inorganic material is commonly used in industry, many of them are relatively harmless; however, in larger quantities they may be quite destructive. There are perhaps, 35 to 40 commonly used toxic inorganic and these should be very closely controlled by the user. The toxic organics have been the most disturbing of the modern day chemicals commonly discharged either purposefully or accidentally into the marine environment. These include the biocides such as fungicides, herbicides, insecticides, rodenticides and also the additional organics including halogenated hydrocarbons, petroleums and industrial chemicals. The most did turbing toxic organics have been the pesticides such as DDT and ketone which has the unfortunate, characteristic of being more soluble in oil than in water so that they tend to collect within the fatty tissues of marine organisms. They have been also very stable compounds which do not deteriorate very easily over a long period of time. These find their way into the ocean both as manufacturing effluent and as run off after utilization. Their long term effects are unknown up to this line.

Petroleum

Although petroleum may be classed as a toxic organic, it is a naturally occurring material and is biodegradable, given enough time. Its effects are not too well known. Petroleum enter into the marine environment due to accidents such as tanker damage or transfer loss, natural seepage, offshore production losses, losses associated with refineries, from run off originating as drippings or disposal of used automobile lubricants, and unburned hydrocarbons emitted into the atmosphere as internal combustion exhaust.

Nutrients

Nutrients are those chemicals which are required by plants. The activities of man have added to the total nutrient load of almost all coastal areas. When nutrient levels becomes out of hand, plants grow unchecked so that decaying plants exist in such great numbers that the oxygen supply becomes rapidly depleted. These nutrients are present in domestic sewage effluents, agricultural runoff, and the little understood but apparently important non-point source run off from urban areas.

Radioactive materials

Radioactive material have been not only discharged to the marine environment by nuclear power plants, nuclear power plant fuel production and reprocessing plants, and uranium activities of all sorts, but also result from more common activities of burning of coal. When coal is burned it gives out radioactive particles to the atmosphere which are then washed into the sea at a greater rate than any known nuclear power plant at this time. Other sources of radioactivity include the natural back-ground, weapons testing, mine drainage, accidental spillage, and a few isolated industries. One of the partially unsolved problems associated with the use of nuclear energy for electrical power has been the long term storage or the disposal of spent fuels. This storage must be in an area such there have been no pathways back to man, and the deep oceans have been suggested as meeting this criterion.

Oxygen demand materials

Oxygen demand materials have been those which need oxygen for degeneration and therefore steal oxygen which would normally be utilized by marine animals. Thus if too many oxygen demand materials are kept in the marine environment, the animal population will be markedly decreased due to the lack of oxygen. Sewage sludge and any other organic waste material, even that resulting from excessive plant growth due to an oversupply of nutrients have examples of common oxygen demand materials.

Acids and bases

The discharge of Acid and bases to the marine environment is quite disturbing to the natural ecological balance of the system. The normal pH of oceanic water has been somewhere around 8.0, slightly basic. This is maintained by carbonate system. If a large amount of acid or base is introduced into the system, the carbonate reactions will be offset and an important element of the environment will get affected. In addition, there are large synergistic effects associated with pH. Most toxic materials, for example, increase their toxicity under conditions of low pH. The sources of acidic or basic material have been primarily industrial with some of this material reaching the marine environment from accidental discharges and the rupturing of tankers.

Aesthetically displeasing materials

Aesthetically, displeasing materials include all the stuff one finds in the ocean which is unpleasant to look at or to smell. Tar balls, floatables, gas (often hydrogen sulphide) producing materials, and colouring agents are some examples, of pollutants offending the senses. Although in some cases these materials do not pose any real threat to the ecology of an area, when the area is being used for recreation, the quality of the surroundings becomes somewhat important.

Effects of Marine Pollution

There have been three basic type of pollutants; the pathogenic, the aesthetic, and the ecomorphic. Pathogenic pollutants have been those which cause disease. This disease may be fatal if the pollutant is a fetal poison. Aesthetic pollutants have been those pollutants causing a change in the environment displeasing to the eye, ear or nose of man. Ecomorphic pollutants, on the other hand, have been those pollutants which produce a change in the physical characteristics of the environment in such a way that there may be drastic changes in the structure or composition of the biosphere. Obviously these three types of pollutants have been not of equal importance. Pathogenic pollutants have been certainly much more serious than the other two; however ecomorphic pollutants are often an indicator of more serious types of pollution to follow. Furthermore, since pollution has been man-produced and the effects have been suffered by man, aesthetic problems are certainly of interest. The pathogenic pollutants have been obviously most important. The effects of pathogenic pollutants are either acute or chronic.

Acute effects

The acute effects have been the easiest to determine because of the short time between administration and affliction. The easiest way of measuring acute effect has been by feeding the pollutant in question to test organisms, such as mice or selected fish, and observing the dosage required killing 50% of the organisms involve. This is usually carried out by feeding a population of test organisms increasing amounts of the pollutants, and for each dosage the number of individuals that succumb is noted. When these datas are plotted, an S-shaped curve results. Another way of examining acute effect is to observe the effect of a given pollutant concentration on organisms over a somewhat longer period of time, nothing how long it takes for a given dosage to produce mortalities. This may be done by giving a predetermined concentration of the pollutant to the test animals and observing how long it takes to kill half of them. When data from an experiment such as this are plotted, a curve will be obtained which will be similar to vertical results.

Chronic effects

There appears to be a dose size for each pathogen below which the pollutant does not have any effect. The concern with threshold values for various pollutants has been one aspect of the study of chronic effects. Chronic effects are the most difficult to measure because of the time involved; in some cases concerns have developed as long as 25 years after initial exposure to the carcinogenic agent. Nevertheless, measurements are made and for many materials, a threshold value seems to describe the data reasonably well. Most experiments require some measure of the effect on the organism other than death, so that many different measures are used. There are, deformity in the growth of organisms, damage to particular organs, change in heartbeat or breathing rate, genetic damage to individuals, change in the rate of increased of a population, and fecundity females within the population. Unfortunately, an index may be very descriptive of a pollutant on a particular species, but it may be completely in effecting in describing what happens when this pollutant comes in contact with other species.

Conclusion

The effects of contaminants on coastal ecosystems are very difficult to assess. In the estimation of possible effects, the

actual concentrations are compared with the levels that can cause effects. Results of laboratory experiments give only limited information in relation to the field situation, due to the complexity of natural systems and the co-occurrence of a multitude of contaminants in the field. Actual changes in the sea are often very difficult to discern from the large variability, which occurs naturally. Measurement of marine pollution using biological indicators provides information on the bio-availability of contaminants and the integration of the effects of multiple exposures and exposure over time. Multiple exposures are the combined action of all chemical contaminants. Even if the contaminants are present at concentrations too low to cause gross harmful effects, they can cause a suite of biochemical reactions in marine organisms generally called stress. Amongst the result of prolonged stress is the suppression of the immune system, thus increasing sensitivity towards the impact of infectious agents and parasites. Natural factors such as temperature extremes and fluctuations of salinity or anthropogenic activities, such as fisheries, can aggravate these reactions. A suite of biochemical reactions in marine organisms may occur as a response increasing sensitivity towards the impact of infectious agents and parasites. Pollution has a severe impact onto the livelihoods of coastal communities, influencing natural habitats and marine biodiversity. This can have serious consequences for food security and the sustainable use of marine coastal ecosystems. Seafood can also be naturally affected by marine biota, such as parasitic organisms and other pathogens. There is an urgent need to explore and quantify the negative effects of anthropogenic pollution on coastal and marine resources, including the identification of problematic organisms affecting food quality. This also requires an understanding of the use and importance of marine living resources for local communities and the international markets.

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