

Biodiversity of Thane Creek.

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Abstract: Thane creek (Long 72° 55' to 73° 00'E and Lat 19° 00' to 19° 15' N) is 26 kms long. It is connected to the Mumbai harbour on its south and joins by minor connection with Ulhas River on its North near Thane city. The creek supported diverse life forms around 1960-1980 and earlier. A few decades back heavy industrialization and consequent urbanization have occurred along both the banks of the creek. The growing pollution in the creek has resulted in significantly low dissolved oxygen, high nutrients, siltation, declined fishery and biodiversity especially in the upstream part of the creek where pollution is higher. In the lower stretches of the creek the pollutants get diluted hence it supports relatively higher diversity. The creek supports good diversity of mangroves and birds including Flamingos. These observations suggest that in spite of the polluted status of the creek, it is possible to revive the creek ecosystem if remedial measures such as reduction of sewage and solid wastes at source, desiltation of the creek, plantation of mangroves, prevention of silt in runoff are implemented. The local fishermen can be encouraged to practice creek and mangrove based productive activities.

Introduction

Estuaries and creeks are coastal aquatic ecosystems which have connection with the open sea. Due to this reason they are influenced by the oceanic high and low tides. The tidal incursion of marine water produces brackish water conditions due to mixing of fresh and saline waters. This leads to formation of salinity gradient with high salinity on the seaward side and low salinity on the riverine end. Even at a station in the creeks and estuaries, the salinity varies with the tides, which is in fact the unique feature of these ecosystems. Many organisms that have physiological ability to tolerate the varying salinities take shelter in different zones and establish themselves. As there are many salinity zones, there are diverse faunal types in the creeks and estuaries.

In these ecosystems the sea water penetrates deeper and hence the wave force weakens to make the environment calm as compared to the sea. This facilitates settling of silt, clay and nutrient rich humus brought by the rivers leading to formation of mudflats. The soft sediment mudflats favor establishment and growth of specially adapted mangroves. The root system of mangroves enhances the mudflat formation, finally leading to development of dense mangrove vegetation.

Mangrove forests are very vital ecosystems as they provide support to a complex community assemblage, reduce coastal erosion and serve as sinks for macronutrients, micronutrients and heavy metals. The mangrove plants take nutrients from the tidal seawater and river water and in turn provide natural food to mangrove dwelling fauna (Odum *et al.*, 1982). The forest detritus comprising of fallen leaves and branches from the mangroves, provides nutrients to the marine environment and supports immense variety of sea life in intricate food webs associated directly through detritus and indirectly through planktonic and epiphytic algal food chain (Martinez *et al.*, 1982). As the creeks,

estuaries and mangroves along their banks are nutrient rich ecosystems, many marine and freshwater fishes visit them for laying their eggs. The young ones grow in these sheltered breeding grounds and then migrate to the sea. There are others which venture into these ecosystems with high tide to exploit them as feeding grounds. Thus, estuaries creeks and mangroves being the feeding and breeding grounds of many marine organisms play an important role in supporting the fishery.

Thane creek (Long 72° 55' to 73° 00'E and Lat 19° 00' to 19° 15' N) is 26 km. long. It is connected to the Mumbai harbour on its south and joins by minor connection with Ulhas River on its North near Thane city (Plate 1). The creek is narrow and shallow at the riverine end due the presence of geomorphic head near Thane city and is broader and deeper towards the sea. It is tidally influenced with dominance of neretic waters and negligible fresh water flow except during monsoon. The substratum of the creek is made up of consolidated and unconsolidated boulders intermingled with the loose rocks and rarely with sand and gravel. Extensive mudflats are formed along the banks of the creek which are characterized by growth of mangroves.

The creek supported diverse life forms around 1960-1980. Though there are no systematic studies on the phytoplankton, zooplanktons, benthos during that period, the creek was famous for its fishery. A variety of fish types, prawns, crabs, mudskippers, bivalves like (*Cardium*) spp., *Katalysia* spp. were available in the creek till 1980. But then this picture changed gradually due to various anthropogenic activities.

A few decades back heavy industrialization and consequent urbanization have occurred along both the banks of the creek. On the east bank exists Asia's largest industrialized zone namely Thane Belapur industrialized area along with the Navi Mumbai Urban area. The west bank has

highly urbanized Mumbai and Thane region along with a good number of industries. Not only the industrial effluents and domestic wastes are being released in the creek but since 1995 the creek is also being indiscriminately used as a dumping ground for huge quantity of solid wastes. In spite of these hazardous human activities the creek has still retained life in some areas and there are chances of its revival if we adopt certain remedial measures. This presentation is based on the work done in B. N. Bandodkar College since 1984. (Athalye, 1989; Gokhale and Athalye, 1995; Quadros Goldin, 2001; Athalye *et al.* 2003)

Materials and Methods:

For analysis of abiotic and biotic components standard methods (APHA, AWWA, WPCF., 1981) were used in all the studies. The study included the parameters of water, sediment, phytoplankton, zooplankton, benthos and fishery.

Discussion:

Following table shows the changes in the important water parameters that have occurred during period 1975 to 2002.

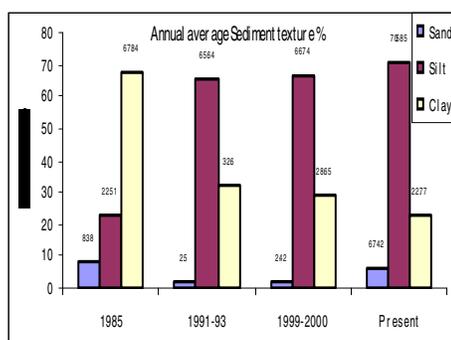
Table1. Comparison of the water parameters of Thane Creek during period 1975 -2002.

Sr. No.	Parameter	1975	1984-85	1991-93	1999-2000	2002	Remarks
1	Suspended solids g/l	--	0.731	0.953	6.12	2.017	Unpolluted water limits 1 gm/l
2	PH	--	7.83	7.49	7.71	7.82	
3	Salinity ppt	36.31	29.4	25.13	19.22	23.4	--
4	Dissolved Oxygen mg/l	6.79	5.21	4.09	2.4	2.1	Unpolluted water limits 2.4 mg/l
5	PO ₄ -P mg/l	0.127	0.178	0.24	0.26	0.1	Unpolluted water limits 0.09 mg/l
6	NO ₃ -N mg/l		0.35	0.38	0.9	0.98	Unpolluted water limits 0.014 mg/l
	lower stretch						Semi healthy 1.26 mg/l
7	NO ₃ -N mg/l		2.5	18	1.5	1.7	
	Upper stretch						As above
8	SiO ₃ -Si mg/l		4.08	8.76	15.3	21.3	Very high
9	Copper ppm		0.011			1.12	100 times increase
10	Zinc ppm		0.093			0.404	4 times increase

Metals in sediments and organisms have also shown significant increase.

The important changes to be noted include- significant decline in dissolved oxygen which is due the sewage and effluent load; increase in suspended solids due to various reasons such as reclamation, solid waste dumping, sewage and effluent load and growing construction activity in the urbanized area. The effluents and sewage have also increased the nutrient levels in general; they, along with hindrance in tidal movement (due to various anthropogenic factors such as dumping, constructions of roads, bridges, reclamation etc.) have also caused decline in average salinity. The growing metal pollution is not unexpected.

Fig.1. Comparison of the sediment texture of Thane Creek during period 1985-2002.



The above figure shows how the sediment texture changed in past two decades. The dominance of clay significantly changed to dominance of silt in 1991-93 which was reported by Gokhale and Athalye (1993). Thereafter, the siltation gradually increased. This had a major effect on biodiversity of the creek. Due to the reduction in clay, the mud flats did not remain hard and became silty, soft and sinking, which probably had adverse effect on the survival of the eggs affecting the breeding of prawns, crabs and fishes. The prawns got eliminated from the creek. The mud quality did not remain suitable for the burrows of the mudskippers especially, thus eliminating them from the creek. It was observed that as the pollution and siltation in the creek increased the mudskippers moved to relatively less polluted downstream and then finally got eliminated from the creek. Gokhale and Athalye (1993) have reported 67% decline in the fishery catch in the upstream part of the Thane creek.

In the study conducted during 2001 to 2003, the water and sediment parameters indicated growth in the pollution. In general, the upstream stations showed more pollution as compared to the downstream stations. There was eutrophication (Especially the phytoplankton) along the creek. The phytoplankton types recorded were 26 as against 36 recorded by Gokhale and Athalye in 1993, thus showing reduction in the diversity. The zooplankton types (11) were comparable with those observed by Gokhale and Athalye in 1993; however their density was low. The fishery showed further decline and in the upstream region no fish types were available except in monsoon. Towards the mouth of the Creek where there is more water mass and the pollutants get diluted, relatively better fish variety was reported (51 types). Interestingly, the creek fauna included 19 types of sea anemones of mud burrowing type, 8 types of polychaetes, 7 types of bivalves, the gastropods of 14 types. The bird variety had been good and there has been increase in the number of Flamingoes particularly. The study reported dominance of mangrove *Avicennia marina* along the creek but there were 11 true mangrove types, 12 types of mangroves associates and 5 types of non mangrove halophytes recorded during the study.

The above observations suggest that if the pollution is moderate the biodiversity can be good and maintained. The creek though is highly polluted presently, can be revived and its biodiversity can also be restored if proper remedial measures are applied. Following are some remedial measures recommended.

- Minimize the sewage load- a) use of septic tank method for treating excreta. b) reuse of water
- Minimizing the solid wastes- segregation of non-degradable and degradable wastes.
- Proper and frequent check on the industrial effluent.

- Dredging to clear accumulated silt.
- Education of masses regarding –
 1. Conservation of creeks and estuaries.
 2. Minimizing use of plastic.
 3. Plantation of mangroves.
 4. Mangrove based and creek/estuary based beneficial activities.
 5. Sustainable use of resources.

What can be done as an individual?

- Minimize the solid waste at source (i.e.at home) by separating the degradable and non degradable matter and convert the degradable matter into bio fertilizer by using bio compost techniques. Small Biogas plants to use vegetable garbage even at family level are available. This will reduce the solid waste load by at least 40 to 50 %.
- Educate others regarding the importance and need for conservation of our natural resources including Creeks, Estuaries and mangroves.

The following measures can be implemented at the community level.

- The water used for bathing and washing clothes can be collected in separate tank, and re-pumped so as to use it for flushing the toilets or even watering the gardens.
- Restart the septic tank method in which excreta is collected in the tanks; allowed to decompose to produce nutrient rich fertile water. This will significantly reduce the sewage load. Now a days, techniques are available to convert human excreta in to biogas.
- Sort the non-degradable solid wastes and recycle them in small scale industries set within the Corporation limits. The corporations can take initiative to do this.
- Treatment of industrial effluents and sewage before releasing them into the creek / estuary.
- Remove the accumulated debris from the creek / estuary by dredging so as to clear hindrance in tidal flow.
- As regards Thane creek, the siltation in many places has hampered the tidal flow and flushing ability of the creek. Dredging of the silt in certain regions of the creek is necessary. This however will have to be done carefully as it may cause large scale fish death due to clogging of gills, but the long term effects will be beneficial. The dredged silt can be dumped along the outer regions of the banks and mangrove plantation

should be done on it. This activity should be carried out in pre-monsoon months and experts from different fields need to be involved in such work.

- **Encourage mangrove plantation, mangrove based activities and creek / estuary based activities :** Presently cutting of mangroves for fuel and other purposes is a major damaging factor. By educating the local people, the mangrove plantation should be encouraged. The people should be taught to harvest mangroves in a cyclical manner (rotation). This will conserve the mangroves and at the same time fulfill the needs of the local people. It is necessary to educate the masses regarding benefits of the mangrove forests. Following occupations can be encouraged in mangrove forests and also in the creek / estuary.
- **Mangrove based activities.**
 - i) Apiculture - Mangroves and their associates flower in different seasons and hence they can support 'Bee keeping' (Apiculture) as a supplementary occupation.
 - ii) Experiments have proved that certain species of mangroves have refreshing property like tea. If further studies are conducted and if they give good results, people will be motivated to plant mangroves, however care should be taken to avoid monoculture.
 - iii) The coastal plant *Prosopis juliflora* grows rapidly and can be planted in the back mangrove region. This plant can provide certain protection to the mangroves and even be used as an alternate source of fuel.
 - iv) If proper education is done and guidance is provided many useful products can be obtained from the mangroves. The mangroves are known to have many medicinal properties, though the detail studies are lacking. Further, scientists have found insecticidal properties in some species of mangroves. Moreover mangroves also help in desalination of land.
- **Creek and estuary based activities.**
 - i) **Mussel Culture :** Mussels can grow very well in the creek. They can be grown in captivity in cages using floats and require some monitoring.
 - ii) **Growing protein rich algae:** In the creek waters protein rich algae such as *Ulva* spp., *Enteromorpha* spp., *Sargassum* spp. and other sea weeds can be grown. These weeds apart from their food value (protein rich) also form a good fuel source either in dry form or as biogas.
 - iii) **Crab pens:** In Malaysia, crab growing is a common practice in the mangrove swamps along creeks and

estuaries. For this purpose; a small area of mangrove is fenced with poles preferably of mangrove origin or bamboo and are stocked with crabs. The crabs are fed with trash fish, when the crabs have grown to marketable size they are separated and sold, thereby keeping a constant stock of the crabs and ensuring a minimum income.

- iv) **Fish cultivation in floating cages :** This has been practiced on a trial basis in Indonesia wherein fine mesh nylon net cages with floats on the top are kept in the creek / estuary,. In these cages suitable sturdy fish is cultivated by introducing seed. Fishes like *Tilapia* spp., *Mugil* spp., *Mystus* spp., etc., can be grown in this manner.
- v) **Brush pile fishery:** This is the traditional method practiced in Srilanka, wherein the basic property of mangroves providing food and shelter is put to optimum use. In this method an enclosure is made with poles and branches of mangroves preferably *Avicennia* spp. are left in the water. After a few weeks when the fish have gathered the region surrounding the mangrove branches is encircled with nylon net keeping the fishes entrapped. Later the branches are removed and the fish are allowed to grow and then harvested.
- vi) **Additional prospects**
 1. It will be possible to promote ecotourism in Thane creek because it is already attracting birds like Flamingoes, Pintail ducks, Avocets, Osprey, Kingfishers, Gulls, Terns, Coots, etc. and will attract more if properly managed.
 2. In Thane-Mumbai complex the creek can be useful for ferry transport, which will reduce the load on roads and trains.

With the initiative of NGO's, Environment Improvement societies, Social workers and with the support and encouragement of government such activities should be undertaken alongside of creeks and estuaries, which will protect the environment and provide livelihood to the locals. For the deterioration of our precious ecosystems we cannot simply blame population explosion and industrialization because this has mainly happened due to our lethargy, neglect and irresponsible attitude. If we change ourselves and implement the available techniques positively we can still maintain the balance in the nature and conserve biodiversity.

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