J. mar. biol. Ass. India, **42** (1&2) 2000 : 135 - 138

Effect of Thermal Power Plant effluents on the hydrological conditions in the Tuticorin Bay

D.C.V. Easterson, P.S. Asha, and M.Selvaraj

Tuticorin Research Centre of CMFRI, Tuticorin-628 001, India.

Abstract

The effluents discharged from the Thermal Power Station at Tuticorin, caused various physico-chemical and biological changes in the Bay waters. The preliminary survey indicated that the temperature of the water was high upto 2 km from the discharging point. Upto 1.5 km there were no vegetation and from 0.5 to 2.5 km distance, dead shells could only be collected. The scarcity of the biota revealed the ill effects of the fly ash deposits and turbidity coupled with enhanced temperature in the Bay waters of Tuticorin.

Thermal power station situated at the southern end of Tuticorin Bay (Fig.1) has five units. Each unit, capable of producing 210 MW of electricity, consumes 2800 tonnes of coal per day and produces huge quantity of ash at a rate of 10-25% of coal used (Easterson, 1998). Since the first dyke constructed to retain the ash has already been filled-up, subsequent dykes were constructed. In spite, through the numerous gaps between the boulders, which formed the dyke and also through separate outlets installed in isolated places (Fig. 2) ash is leaking into the bay. Each boiler utilizes about 750 cubic meter of seawater per hour for cooling and the effluent hot water is discharged into Tuticorin Bay. To study the extent of temperature increase due to hot water discharge, a survey was conducted in the Tuticorin Bay during September and October '99. In addition, the benthic conditions within this area were

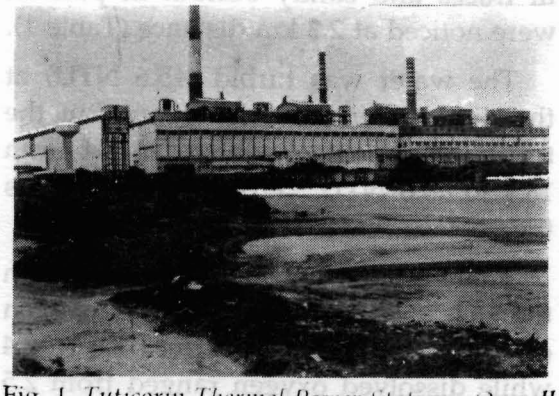

Fig. 1. *Tuticorin Thermal Power Station - Overall view showing hot water effluent discharge and ash deposition.*

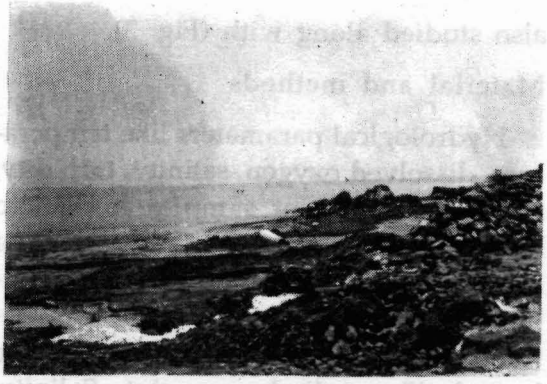

Fig. 2. *The ash laden water escaping through dyke into the sea.*

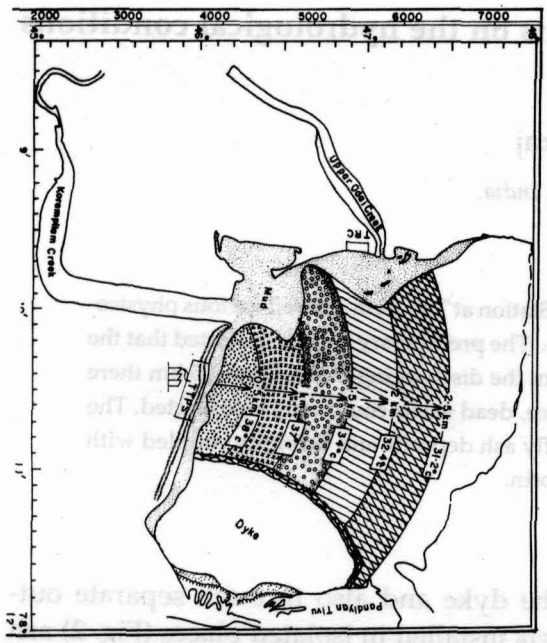

Fig. 3. *Area of survey and position of stations.*

also studied along with (Fig. 3).

Material and methods

Hydrological parameters like temperature, dissolved oxygen, salinity, turbidity, nutrients, sediment samples for macro biota, depth of water and the extent of ash deposition were collected from 24 stations, fixed at a distance of 100 m between each station starting from the heated effluent discharge point. Salinity, pH, dissolved oxygen and nutrients such as nitrite, phosphate and silicate in the samples were determined according to the standard methods (Strickland and Parsons, 1968). Zooplankton haul was made using a net, having a mouth of 50 cm diameter, for a horizontal distance of 700 m and also in the open sea to find out the influence on the secondary production. Sediment collection and observations on benthic macro biota were made by under water diving.

Results and discussions

At the nominal reference point, fixed opposite to fishing harbour considered to be away from heated water effluent, the surface water temperature was observed to be 31.5°C, and at the discharge point it showed a maximum of 38.9°C. Upto 1 m distance from discharge point the temperature varied from 37.5 to 38.9°C. Temperature neutralisation to 31.5°C was noted 2.5 km away from the discharge point where as bottom temperature was high up to 400 m beyond this point and thereafter it decreased (Table 1).

The depth at dischage point was 360 cm due to the force of discharged water, otherwise the area was shallow. The stations 3 & 4 were the shallowest. There after the depth of the bay ranged from 130 to 260 cm. Ash layer was noticed from a distance of 400 m onwards. The thickness of the layer varied from 6 cm to 70 cm (at 700 m distance). After a distance of 1.9 km the presence of ash was in traces and sandy bottom in patches were noticed at 2.3 km distance (Table 1).

The water was turbid (45.6 NTU) at the dischage point. Up to one km the turbidity of surface water ranged from 18.9 to 45.6 NTU. From 2 km onwards the surface water was clear (Table 1).

There was no considerable variation in the pH, salinity, and dissolved oxygen content. The pH varied from 7.6 to 8.4 while dissolved oxygen ranged from 2.5 to 3.1 ml/l. Fig. 4 indicates that the quantity of phosphate and silicates in the sur-

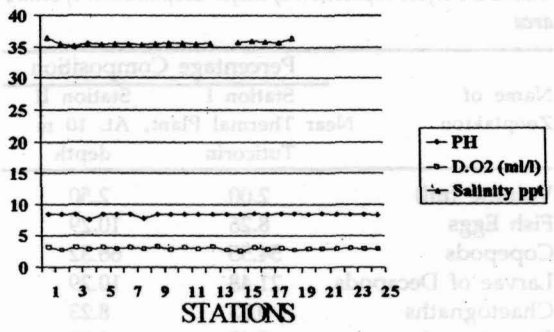

Fig. 4. *Graph showing hydrological parameters in the Bay*

face water do not vary much. The nitrite content was high nearer to the discharge point to a distance of 1 km (0.4 to 0.84 µgN/1). Near the discharge point and up to 300 m, the silicate content was high (17.6 to 19.8 µg si/1) (Fig. 5).

Presence of biota was scarce. In the isolated limited areas, which were free from pollution, like a site near the discharge point seaweads like *Chaetomorpha* sp. was present. Up to 1.5 km there were

Table 1: *Temperature and other parameters as observed from the effluent discharge point of Thermal Power Station and along its course in the sea.*

Station	Temperature(°C)		Depth	Ash Layer	Turbidity	Flora	Fauna
	Surface	Bottom	(cm)	Depth (cm)	(NTU)		
		31.5	30.7	-	-	26.1	
1	38.9	37.5	360	-	45.6	nil	nil
2	37.5	38.0	160	-	35.6	*Chaetomopha* spp	*Etroplus* sp.
3	38.0	37.0	42	nil	35.2	nil	Gastropod shells
4	38.0	37.0	69	6	24.4	*Chaetomorpha* spp	*Turretella* sp.
5	38.0	33.5	130	28	35.8	nil	*Turretella* sp.
6	38.5	33.5	140	45	38.3	nil	nil
7	38.0	34.3	165	70	36.2	nil	nil
8	38.5	31.6	180	30	23.6	nil	Bivalve shells
9	38.0	30.7	210	20	18.9	nil	nil
10	37.1	32.5	220	40	24.5	nil	Gastropod shells
11	36.3	32.2	218	50	34.7	nil	Bivalve shells
12	35.5	31.5	250	60	26.4	nil	Windowpane oysters & Gastropod shells
13	35.0	32.6	230	50	-	nil	Windowpane oyster shells -do-
14	34.9	32.5	260	55	21.8	nil	Bivalve & Gastropod shells
15	34.0	30.2	160	20	19.9	*Hypnea* sp.	Gastropod shells
16	33.5	32.0	150	trace	20.8	*Cymodocea* sp.	Gastropod shells
17	34.0	32.5	230	30	17.5	*Hypnea* sp.	nil
18	32.8	31.9	160	10	13.4	"	Bivalve shells
19	32.8	31.3	180	trace	"	"	"
20	32.4	32.0	160	trace	"	"	"
21	32.0	31.5	180	trace	"	*Cymodocea* sp.	Bivalve & Gastopod shells
22	32.0	31.0	195	trace	"	"	
23	31.8	30.5	220	nil	"	"	Bivalve shells
24	31.5	30.0	225	nil	"	"	Bivalve shells

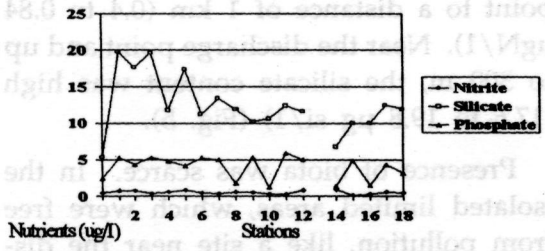

Fig. 5. *Graph showing the level of nutrients in the Bay.*

no vegetation. There after, only *Hypnea* sp. and *Cymodacea* (Seagrass) were noticed. *Turretella* sp., Cichilids and *Etroplus* sp. were the representatives of the live fauna recorded. From 0.5 to 2.5 km distance, dead gastropods and bivalve shells could only be collected. Among dead bivalves, majority of the shells were that of windowpane oysters (Table 1).

The zooplankters, though scarce were represented by copepods, decapods, fish eggs, appendicularia, stomatopods and bivalve larvae in the hauls made near the Thermal Plant (Station I) and in the station II at distance away from Thermal Power Plant. Near the thermal discharge point, in the order of abundance, the appendicularian fauna was 12.4%, whereas it was only 2.05% in station 11. The bivalve larvae constituted 2.05% of the zooplanton while it was only 0.83% in the sample collected near Thermal Plant (Table 2).

This preliminary survey indicated that the temperature of the surface water was high upto to 2 km from the discharge point. There was not much difference in the other hydrobiological parameters. As the ash slurry diffusing into the bay from the dyke was altering the depth of the

Table 2 *Perfect coposition of major zooplankton of study area*

Name of Zooplakton	Percentage Composition	
	Station I Near Thermal Plant, Tuticorin	Station II At. 10 m depth
Volume (ml)	2.00	2.50
Fish Eggs	8.26	10.29
Copepods	54.55	66.32
Larvae of Decapods	21.48	10.29
Chaetognaths	0.83	8.23
Stomatopods	1.65	8.23
Appendicularia	12.40	2.05
Bivalve Larvae	0.83	2.05
Ostracods	-	0.26

bay, ash layer deposition and turbidity were observed. Presence of *Chaetomorpha* sp. may be due to its thermophilic nature. Absence of live animals except *Turretella* and *Etroplus* sp. and the dead mollucan shells indicated the ill effects of the ash deposition coupled with enhanced temperature on the bottom of the bay. Absence of seaweeds in the Bay was mainly due to high turbid condition and ash depositing over the seaweed bed that once existed. Though the preliminary study showed the temperature and ash from Thermal Plant affect the Tuticorin Bay, detailed study has to be carried out on the physiological stress of the marine animals in high temperature and ash rich water.

References

Easterson, D.C.V. 1998. Impact of Marine Pollution on the ecological Resources of Gulf of Mannar. In Biodiversity of Gulf of Mannar Marine Biosphere Resource, M.S. Swaminathan Foundation of India, Chennai. pp.56-57.

Srinivasan, A.R. Santhanam and V. Ramdhas. 1995. *Shrimp feed* pp. 103-104.

Strckland J.D.H. and T.R. Parsons, 1968. A Practical Hand Book of sea water analysis. *Bull. Fish. Res. Bd. Canada*, No. 167.