May 1986, November 1986, January 1987 and February 1987 females dominated over the males in percentage contribution.

Mature specimens whose total length ranged from 165-244 mm were examined to study the facundity. It was estimated that the mature ovary contained an average of 18,545 eggs.

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EYE OPACITY AND FIN EROSION AMONG FISHES FROM VISAKHAPATNAM HARBOUR WATERS

ABSTRACT

Opacity of eye was confined to *Mugil cephalus* only (23.2%) while fin erosion was observed in several species — *Liza macrolepis* (36.1%), *Rastrelliger kanagurta* (39.1%) and *Sardinella longiceps* (63.4%) including *M. cephalus* (20.3%) from harbour waters of Visakhapatnam. The presence of pollutants in form of heavy metals, and oil and grease at toxic concentrations might be the cause for these abnormalities.

POLLUTION arising from domestic and industrial wastes is known to impair and debilitate the biota in any water system. In fish populations not only debility but physical deformities of different kinds also seem to be manifested with species specific variations. In the case of other organisms which are lowly organised the physical deformities are not likely to be so manifest as in fishes. Thus, the physical deformities in fishes serve as biological indicators of the degree of pollution of a water system. Various substances enter the natural waters at seemingly sublethal levels and the usual *in vivo* toxicity tests may not reveal the harmful effects of pollution at these sublethal levles. Occasional fish kills and disease prevalence are found under conditions of extreme deterioration in addition to the presence of pollutants at sublethal levels. Such observations act as a late eye opener to the degree of deterioration of a water systems. The present report deals with the frequency patterns of deformities in the fishes from the harbour waters of Visakhapatnam.

Visakhapatnam harbour is a receptacle of city's sewage and effluents from several industries (Satyanarayana *et al.*, 1985). Since the growth of the industries has been on the increase for the past two decades, there is ever increasing accumulation of pollutants in Visakhapatnam harbour, which is more or less a closed system except for ineffective tidal flushings. Industrial effluents enter the harbour at station 2 (Satyanarayana *et al.*, 1985) (Northwestern arm of Visakhapatnam harbour), where fish were collected by doing experimental fishing with boat seine. Species specific deformities or abnormalities were often encountered in these fish collections.

Opacity of the iris and adipose covering of the eyes of grey mullet *Mugil cephalus* (Pl. I A) was observed in 13 out of 56 fish (23.2%). This was predominant in fishes of larger size group (>30 cm). This abnormality, which was reported earlier (Steucke *et al.*, 1968; Dukes *et al.*, 1975) in culture fish was attributed to nutritional deficiency. Since there is

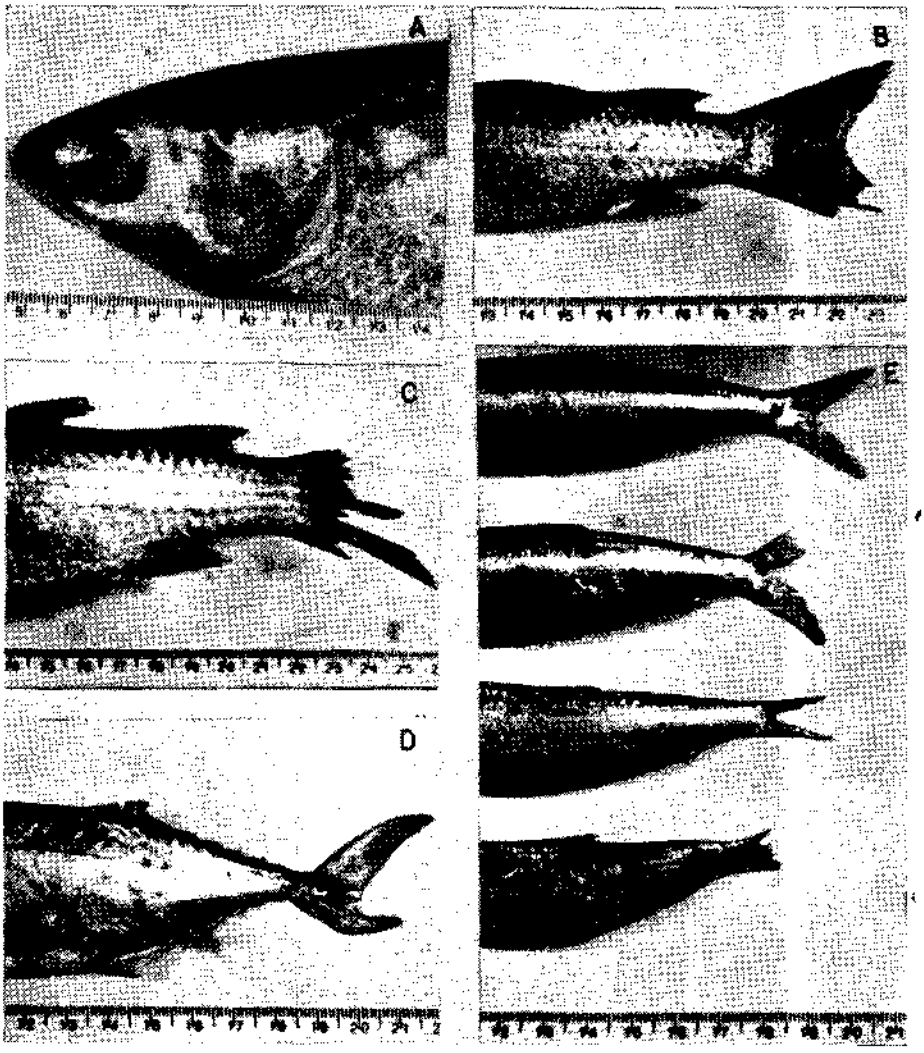

PLATE I A. Opacity of the iris and adipose covering of the left eye of *M. cephalus*. Tail fin erosion : in B. *M. cephalus*, C. *L. macrolepsis*, D. *R. kanagurta* and E. *S. longiceps*. N - Normal fish.

no dearth of food for *M. cephalus* (detritus feeder) in the harbour, the abnormality may be attributed to insidious biochemical changes due to pollution of the medium in which they live.

The abnormality that dominated among many species was tail fin erosion. This occurred in *M. cephalus* (Pl. I B) in 12 out of 56 fish (20.3%) and *Liza macrolepis* in 13 out of 36 fish (36.1%). In one *L. macrolepis* (Pl. I C) almost the whole of the tail fin was eroded. In 18 out of 46 (39.1%) mackeral *Rastrelliger kanagurta* caudal fin erosion was observed. Regeneration of the eroded tail fin was seen in one mackeral (Pl. I D). Maximum incidence (63.4%) of caudal fin erosion was recorded in oil sardine *Sardinella longiceps* (in 1,350 out of 2,130 fish), showing a size related degree of erosion (Pl. I E). In the small size group (9 cm) the erosion was at its maximum, with a gradual decrease of erosion in relation to increase in size, until in the largest size (13 cm) collected from harbour, the caudal fins of all fish were normal (Pl.I E). Nevertheless, schools of *S. longiceps* inhabit the polluted harbour waters of Visakhapatnam especially during the summer months (April to July).

A detailed study on fin erosion in different species was made by Cross (1985) near Southern California municipal waste-water outfalls. He observed fin erosion in about 24% of 122 species of fish and in 9% of more than 1,70,000 individuals collected over a period of 12 years. He states that the magnitude of contamination and incidence of fin erosion are directly related. In the present study, the contamination of the harbour waters of Visakhapatnam is found to be on the increase over the past two decades, but the fish abnormalities are found since 1986 only. The levels of concentration (ppb) of the toxic elements in the harbour surface waters at station 2 by 1986 are quite high (Cd : 20 ; Pb : 50 ; Cu : 20 ; Mn : 10 ; Ni : 20 ; Zn : 1,600 ; Fe : 11,000 ; Co : 10 ; Oil and grease : 43,000) according to Dr. N. Someswara Rao and T. N. V. Venkateswara Rao, Analytical Chemistry Section, School of Chemistry, Andhra University (Per. Comm.). As the concentrations of these elements in the harbour waters are likely to be on the increase, it is necessary to keep a watch not only on the harbour water fishes, but also on the coastal fishes in the vicinity of Visakhapatnam.

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