DDT Concentration in Zooplankton from the Arabian Sea

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A few zooplankton samples from Arabian Sea, between Goa and Bombay, were analysed for total DDT content by GLC. Concentrations found, vary from 0·05 to 3·21 ppm (wet wt), depending on the extractable lipid content. Since the method, used, does not provide separation of polychlorinated biphenyls from DDT and its metabolites, it is suggested that the values may be accepted with some caution.

INSECTICIDES and pesticides have been in use in abundance in agriculture and pest-control since many years. It has been suggested that about 25% of all these chemicals, used on land, ultimately may find their sink in the sea. The cumulative effect of their addition to our coastal waters can be expected to be considerable. An effort has, therefore, been made during the 16th cruise of *RV Gaveshani*, to analyse the DDT [DDT + metabolites (*t*-DDT)] content in mixed plankton samples collected at a few stations on 2 transects along the west coast of India, from Bombay to Trivandrum (Fig. 1). This study can be treated as a beginning to determine their levels in the various regions of the west coast and this information may serve only as a baseline. It was originally planned to have 12 plankton samples from the west coast. However, only 5 samples could be analysed as the rest were found to be contaminated with floating tar particles and paint chips from the ships, which give unwanted peaks in the chromatogram[1].

Zooplankton samples were collected by IOSN (Indian Ocean standard net) having a mesh size of 500 μ. The samples largely consisted of copepods, chaetognaths, decapods and ostracods. The method of collection and preservation were that of Grice *et al.*[2]. On reaching the shore laboratory, the samples were thawed and checked for the presence of any tar particles and paint chips. Those which showed positive contamination were discarded. Plankton, fresh weight 4-5 g, were macerated in a pestle and mortar (Agate) adding sufficient quantity of anhydrous sodium sulphate until a free flowing powder was obtained. Fat plus DDT were extracted by the cold extraction method[3], using redistilled hexane previously checked for contamination by concentrating the maximum volume used (150 ml) to 1 ml, which gave no peaks. For each samples, the extraction was done several times using 25 ml of hexane in each extraction. The various extracts were mixed, dried over anhydrous sodium sulphate, evaporated and the fat content was determined[4]. The fat was dissolved in 2 ml hexane and the cleaning up was done using H_2SO_4. (ref. 5) 10 μl of this extract was injected into a Toshniwal gas chromatograph Type RLO4 equipped with 6 ft × 6 mm glass column having 3% DCQF-1 chromosorb W (HP) 80/100, and electron capture detector having a tritium source. The chromatograms were assessed by injecting standards (obtained from EPA, USA) of DDT and the metabolites, and were identified by comparing the retention times of the sample peaks with that of the standard and the concentration was calculated by reading the peak area (Fig. 2).

Estimation of DDT in sea water by relay-extraction of 5 l samples with distilled hexane was also tried. As no peak was obtained in the chromatograms, after treating the samples as noted above, it was presumed that the concentrations were below the detection limit of the instrument employed. With the instruments and reagents available a recovery of over 80% which is the normally accepted standard in residue analyses[6] was obtained.

The results obtained from the analysis are given in Table 1. High concentration of *t*-DDT depending on the fat content was recorded. Although our interest was only on DDT, the presence of BHC (benzene hexachloride) and PCB (polychlorinated biphenyls, used extensively in several types of industries, e.g. plastic, marine paint, etc.) was also noticed. No attempt was, however, made to quantify these peaks as the components were not separated from one another. Although the chro-

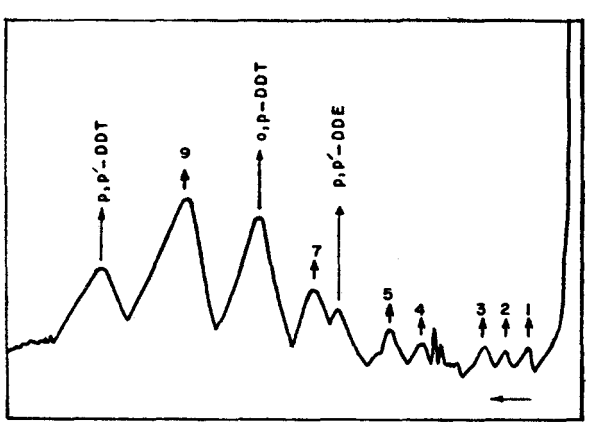

Fig. 1 — Station positions

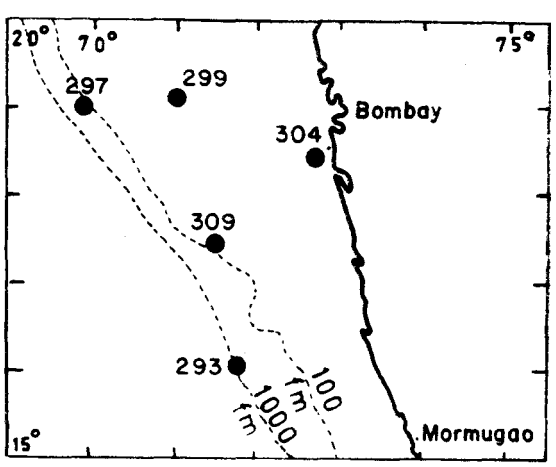

Fig. 2 — Chromatogram of a sample [Numbers indicate unidentified peaks — 1, 2 and 3, may be BHC; and peaks 4, 5, 7 and 9, may be PCB]

TABLE 1 — DDT AND METABOLITES IN ppm FRESH WEIGHT

Stn No.	*o-p*-DDT (a)	*p-p'*-DDT (b)	*o-p* -DDE (c)	*p-p'*-DDE (d)	Others (PCB and BHC)	Extractable lipid (%)	Total DDT (a+b+c+d)
293	2	0·9	—	0·31	P	6	3·21
297	1·28	—	0·15	—	P	3·7	1·43
299	0·94	—	Trace	0·33	P	2·3	1·27
304	—	—	—	0·05	—	1·6	0·05
309	—	—	—	—	—	2	—

P = presence indicated; — = not detectable.

matograms obtained were not complex, the interference from certain other chlorinated hydrocarbon specially PCB cannot be ruled out and more so because the PCB peaks are found to interfere with that of DDT. Hence these high values may be accepted with some caution.

Since the chlorinated hydrocarbons are lipophilic compounds it becomes rather difficult to interpret the data because of the varying lipid contents of the organisms themselves under study. This is even more difficult in plankton which have a variation in their lipid content with seasons, together with a seasonal change in the quantity of inert materials related to species composition[7]. However, from the present study, it becomes evident that the plankton, between Bombay and Goa, contain high levels of total-DDT. This should be a cause of concern as they constitute the major source of food for animals higher in the food chain. Marine food webs are, however, very complicated and there is much disagreement among marine biologists on prey-predator relationship as marine organisms have much flexibility in their food preference[8]. It is, therefore, difficult to generalize the accumulation in the organisms of the west coast due to insufficient data, but the concentrations found could, probably, give adverse effects. We have a detailed programme for monitoring DDT and other chlorinated hydrocarbons and phosphorus pesticides in various areas along the Indian coastline because in India DDT and other chlorinated hydrocarbons are still in use for agriculture and eradication of pests.

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Occurrence of a Bank with Living Corals Off the South-West Coast of India

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A bank with living corals has been discovered during the 18th cruise of *RV Gaveshani* and named as Gaveshani Bank. The bank is located about 100 km off Malpe along lat. 13°24'N and long. 73°45'E. The depth over the bank ranges from 38 to 60 m and the sediment around the bank is largely composed of calcareous sand. Living corals are profusely dredged from the bank and 5 species have been identified so far. Probably coral growth in this area started during the Pleistocene period when the sea level was low, and during the Holocene, when the sea level began to rise, coral growth continued resulting into a bank.

DURING the 18th cruise of *RV Gaveshani* in April 1977, which was largely devoted to geological work, a submerged bank with living corals was discovered off Malpe (north of Mangalore). The bank is located about 100 km from the coast (Fig. 1) at a depth of about 80 m. A part of the echogram showing the main topographic features of the bank is given as Fig. 2. The bank is about 300 m wide and occurs at a depth of about 38 m. It has a pinnacle whose tip is at a depth of about 32 m. The Indian Naval Hydrographic Office Chart 22 gives a shallow depth of 37 m in the area. Almost adjoining the base of the bank, there is a valley-like depression which could possibly be a moat or a scour channel surrounding the bank (Fig. 2). A satellite fix obtained over the bank gave its position as lat. 13°24'N and long. 73°45'E.

The sea floor surrounding the bank appears to be flat with a low gradient and apparently the main topographic feature of the bank is an abruptly rising periphery (Fig. 2). Sediments collected by grabs from the sea floor around the bank were silty sand, predominantly carbonate, consisting of shells of foraminifera, fragments of molluscs and corals. Non-carbonate components of the sediments were quartz and other minerals. The radiocarbon age of