

PCB and Hydrocarbon Contamination of Plankton by Nets

by GEORGE R. HARVEY and JOHN M. TEAL
Woods Hole Oceanographic Institution
Woods Hole, Mass. 02543

Our concern over extraneous contamination of biological samples collected at sea for pollution analysis (GRICE, et al., 1972) has caused us to examine plankton nets. Extraction of several nylon mesh nets, both new and used revealed measurable concentrations of petroleum hydrocarbons and polychlorinated biphenyls (PCB). We wished to determine if plankton are capable of adsorbing these hydrocarbons from the net while the net is adsorbing them from the water. Thus, three experiments were performed to determine the magnitude of cross contamination of plankton (Table 1). Another experiment was designed to determine the capacity of nylon mesh to extract hydrocarbons from the water (Figure 1).

Methods

The plankton tows were taken in Vineyard Sound, Massachusetts from the starboard boom of R/V ASTERIAS. In tow No. 1 (Table 1) a new nylon No. 6 mesh net was towed along with a well-used net of unknown history for 30 minutes. The plankton were allowed to drip dry before being extracted. The extract was cleaned up by standard procedures for hydrocarbons and PCB and gas chromatographed using both flame ionization and electron capture detectors.

In tow No. 2, two new No. 6 mesh nets were washed thoroughly with reagent grade ethanol and towed for 30 minutes from one bridle in which the ring was divided down the middle, with each net attached to one semicircle. A glass cup was used at each cod end. After the plankton were removed, the nets were towed open for six hours, after which one of the nets was washed thoroughly again with ethanol before making tow No. 3.

Finally, used nylon netting was cut into six 25 x 25 cm flags and washed well with alcohol. The flags were towed behind the ship on a horizontal bar attached to the net frame. At intervals individual flags were removed for analysis. The results are shown in Figure 1.

Results

It is obvious from Figure 1 that the nylon netting is in equilibrium with the water and will rapidly adsorb or desorb hydrocarbons and PCB as it moves through areas of high and low contamination. Individual hydrocarbons not present in the initial high total appeared and disappeared from the flags during the interval.

FIGURE 1
VARIATION OF CONTAMINANTS ON NYLON MESH

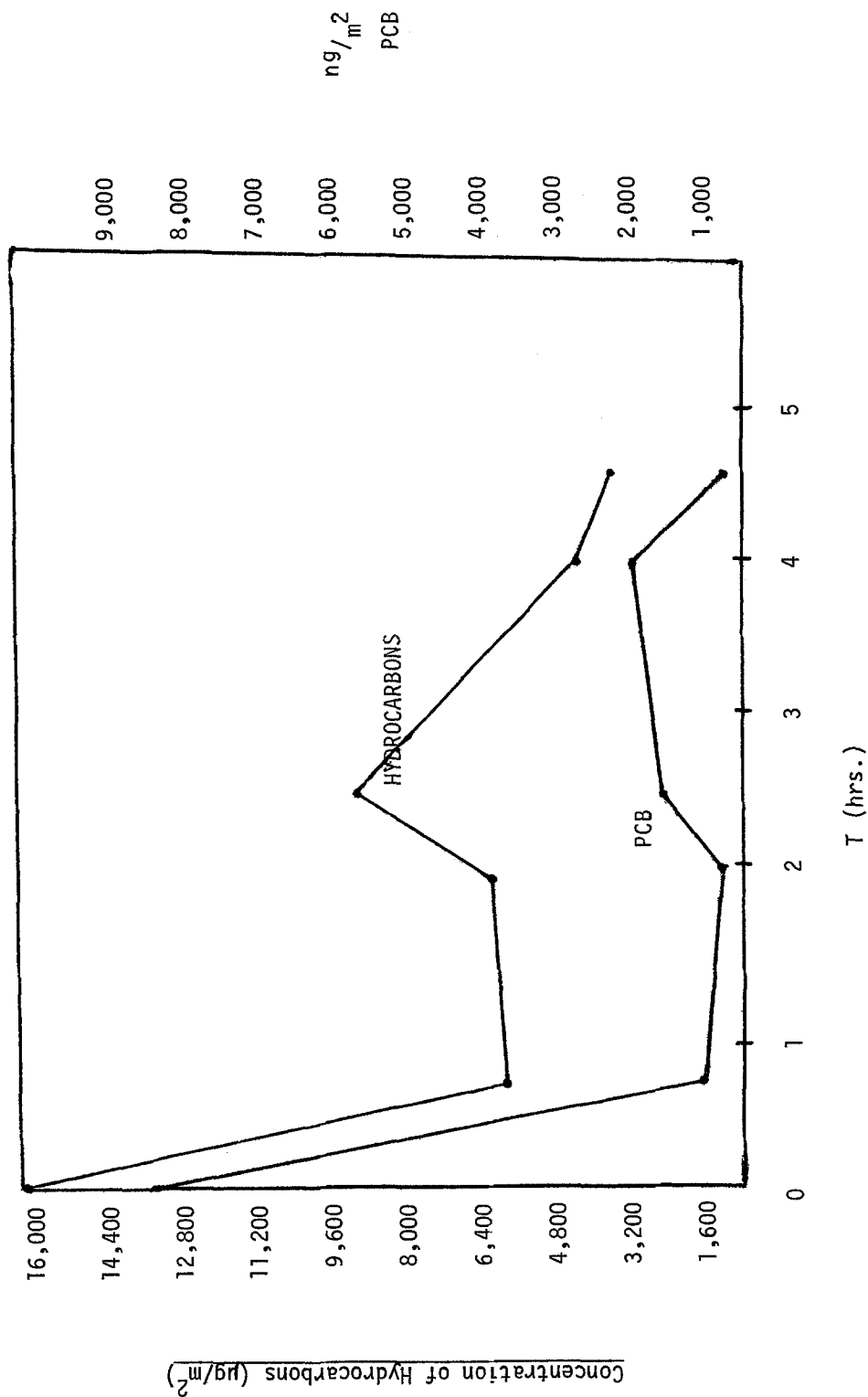


TABLE 1

DUPLICATE PLANKTON TOW RESULTS

#6 MESH

Tow	Net Status	Hydrocarbons (ppm)	PCB (ppm)
1	New Unwashed	2,020	.05
	Old Unwashed	12,200	.12
	Ratio	6	2.3
2	New Washed	355 (glc) 774 (weighed)	2.8
	New Washed	485 (glc) 1,700 (weighed)	2.1
	Ratio	1.4 (2.2)	1.5
3	Used Washed	1,326 (glc) 1,660 (weighed)	3.1
	Used Unwashed	1,585 (glc) 2,145 (weighed)	11.7
	Ratio	1.2 (1.3)	3.8

The plankton analyses are complicated by the known patchwork variation of plankton crops and the ubiquitous presence of small tar balls. The six-fold variation in hydrocarbons seen in tow No. 1 could be due to such an occurrence, though there was a correlation between compounds present on the net before the tow and those subsequently extracted from the plankton. Tow No. 2 results give some measure of the differences obtained by two nets, both sampling water with the same 1 meter diameter cylinder of water. The difference in total hydrocarbons was due to relatively heavy (C_{25} to C_{35}) compounds, indicating that one tow probably included a small tar ball. Tow No. 3 illustrates that there is cross contamination between the plankton and the nets, but considering the variability in the tow No. 2 analyses the magnitude is probably no more than twofold.

Conclusions

1. Nylon nets are in equilibrium with hydrocarbon materials in the water column.
2. Plankton can extract adsorbed hydrocarbons from the net.
3. In a plankton tow the entire water column (water, detritus, plankton, etc.) is really being sampled for hydrocarbons and PCB.
4. Care must be exercised in interpreting PCB or hydrocarbon analyses of plankton. Several short tows would be more valuable than one long tow, because the latter might partially equilibrate with an area of high contaminant level encountered near the end of the tow.
5. Washing the nets with a good clean solvent prior to towing appears to be beneficial in reducing contamination from nets.

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References

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