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Herbicides and Submerged Plants in Chesapeake Bay

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ABSTRACT

An on-going study in the upper Chesapeake Bay, Maryland has been examining, for 1.5 years, movement of 6 herbicides, applied to cultivated fields to control unwanted plants; sediments; and nutrients into estuarine waters and the limited effects of these variables on rooted aquatic plants. During the 1976 growing season atrazine was commonly detected at higher levels than the other herbicides in all aquatic environments. Alachlor, which is applied at higher rates, was also commonly detected, but at lower concentrations. Mean concentrations discharged into the estuary were 3.6 $\mu\text{g}/\text{l}$ atrazine and 0.34 $\mu\text{g}/\text{l}$ alachlor. Total herbicide discharge into the Rhode River estuary sediment trap zone during a 24 week period from a 2400 ha watershed was estimated to be 7.1 Kg atrazine and 0.59 Kg alachlor. Concentrations discharged in one week periods ranged from below 0.8 to 58 $\mu\text{g}/\text{l}$ for atrazine and from below 0.08 to 4.9 $\mu\text{g}/\text{l}$ for alachlor. For the total period 54% of the atrazine and 57% of the alachlor was discharged in solution. The largest single discharge occurred in October, four and a half months after herbicides were applied to the fields. Concentrations of these two herbicides were also measured at a series of estuarine stations during the growing season and ranged from below 0.008 to 13.6 $\mu\text{g}/\text{l}$ for atrazine and from below 0.002 to 0.68 $\mu\text{g}/\text{l}$ for alachlor in whole surface waters. The range for bottom sediments was from less than 0.008 to 0.80 $\mu\text{g}/\text{g}$ for atrazine and from less than 0.002 to 0.010 $\mu\text{g}/\text{g}$ for alachlor. Peak concentrations were observed at Rhode River stations on June 22 and at an open bay station on Aug. 26. An average of 88% of the atrazine and 46% of the alachlor in the surface waters of the sediment trap was bound to suspended particulates and the concentration of atrazine on these particulates was observed to reach 560 $\mu\text{g}/\text{g}$.

The spring of 1976 was drier than normal and submerged vascular plants grew more abundantly than in several prior years. Most stations studied had significant plant populations, until in early August when a widespread plant die off occurred for all species.

Dose response bioassays of atrazine toxicity to Horned Pond Weed (*Zanichellia palustris*) were carried out in laboratory microcosms under brackish estuarine conditions. Concentrations of atrazine of from 0.5 to 2 ppm in bottom sediments and 0.1 to 1.4 ppm in the water column were found to drastically inhibit net oxygen production per day and

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