

## Vessel-related contamination of southern California harbours by copper and other metals

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### ABSTRACT

A number of trace contaminants appear to be introduced to nearshore marine waters as a result of vessel-related activities. Such inputs are clearly reflected by elevated concentrations of these constituents in several tissues of the bay mussel *Mytilus edulis*. Comparative studies using this bioindicator suggest that harbour-related activities can be as important a source as coastal wastewater discharges in the contamination of nearshore marine ecosystems. Vessels constitute a potentially significant source of certain trace contaminants to coastal marine waters. For example, mercury and tin have been used extensively as toxicants in antifouling paints, while chromium, lead, and zinc are important constituents of bottom primers (SCCWRP, 1973). Cadmium also occurs in certain paint pigments (Page & Bingham, 1973), and zinc is utilized in sacrificial anodes attached to vessel bottoms to prevent corrosion of metal parts (SCCWRP, 1973). In addition, prior to 1972 polychlorinated biphenyls (PCB) were used in paints and hydraulic fluids (Jensen, 1970; Nisbet & Sarofim, 1972). Because of the large number of recreational, commercial, and naval vessels in southern California, we conducted a study of the application of antifouling paints to boats in marinas and harbours along this coast. Samples of the principal brands of paints used were obtained and the copper concentrations determined. The results of this survey have been incorporated into estimates of annual mass emission rates to the coastal marine ecosystem for this pollutant, and the values compared to estimated inputs via three other routes. To determine the degree to which the biota can be contaminated due to vessel-related activities in nearshore waters, we also measured the concentrations of trace metals in tissues of the bay mussel *Mytilus edulis* from three major southern California harbours. The resultant distributions for this intertidal mollusc, which is now widely used as a pollutant indicator (Koeman *et al.*, 1968; Young & Folsom, 1973; DiSalvo *et al.*, 1975; Alexander & Young, 1976; Risebrough *et al.*, 1976; Eganhouse & Young, 1978), are presented and compared to corresponding bottom sediment values.

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