

HERBICIDES FROM THE CHARENTE RIVER AND THE ESTUARINE ZONE (MARENNES-OLÉRON) TO THE COASTAL SEAWATER



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Spatial distribution of herbicides was investigated in the fluvial section, the estuary of the Charente river and the coastal zone (Marennes-Oléron). The fluvio-estuarine zone is the site of agricultural activities on drained grounds (cereals, forage) and aquaculture-beds (oyster- and mussel-beds) on reclaimed marshes sensitive to continental contributions of the Charente river and the entire complex system of fresh-water canals pouring into the coastal waters.

Monthly samplings were performed on a fluvial section from Angoulême to Saintes, at Chalonne, Nersac, Sireuil, Bourq and Brives from 1993 onwards. Estuarine and coastal sea-waters were sampled during two cruises in May 1991 and February 1992.

Monitoring of trace levels of phenylurea and chlorotriazine was performed on river, estuarine and coastal seawater by off-line and on-line preconcentration techniques using reversed-phase chromatography and UV diode array detection and sometimes electrochemical detection (detection limit 10-50 ng/l).

Fluvial section (from Angoulême to Saintes). Atrazine, simazine, and DEA are continuously present all year round (≈ 200 ng/l). Higher concentrations were observed from April to July and can peak at up to 700 ng/l when stored herbicides are flushed out from agricultural soils by rainfall. Significant but erratic amounts of diuron, isoproturon and linuron are found, corresponding to local sources of contamination.

Fluxes of atrazine, simazine and DEA were evaluated from four years' worth of monthly samplings gathered upstream of Saintes. Large variations of the desethylatrazine/atrazine ratios (DAR) were observed since 1994, from <1 to 10, depending on the season and the climatic conditions

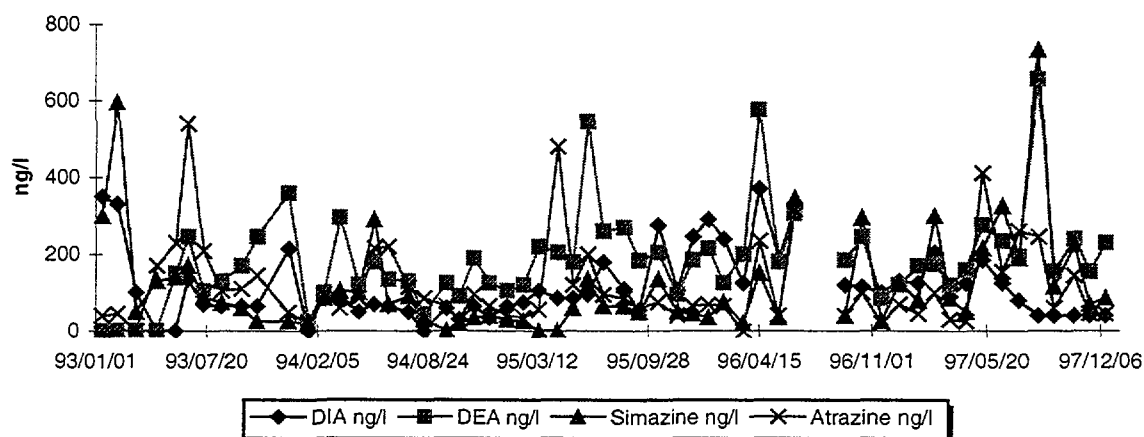


FIG. 1. Concentration of DEA, DIA, simazine and atrazine in runoff from the Charente river at Brives for 1993-1997

TABLE I. YEARLY FLUXES OF DIA, DEA, ATRAZINE AND SIMAZINE

	DIA (kg/y)	DEA (kg/y)	Atrazine (kg/y)	Simazine (kg/y)
1993	235	315	215	185
1994	160	330	220	195
1995	205	300	135	105

Yearly fluxes (kg/y) of atrazine, simazine and their metabolites (DEA and DIA) exported were estimated at Brives from monthly measurements and daily average flow rates (Table I). Exports of atrazine and simazine occur chiefly in the April - July period and can represent 50 to 70 % of the annual flow. 60 to 80 % of the metabolized form (DIA and DEA) are transported during autumn and winter. 1995 is distinguished from previous years by the fact that flow rates are weak from May to October. There is very little herbicide carried along (surface flow). During the late fall rains, replenishment of the Charente river occurs, generating a transfer of herbicides from soils to the river. From the inner and the outer estuary of the Charente river, atrazine, simazine, desethylatrazine and diuron concentrations were found, dependent on sampling location and water salinity at two key-periods of the hydrological cycle (spring and winter). Atrazine, simazine and DEA show conservative behaviour in contrast to diuron.

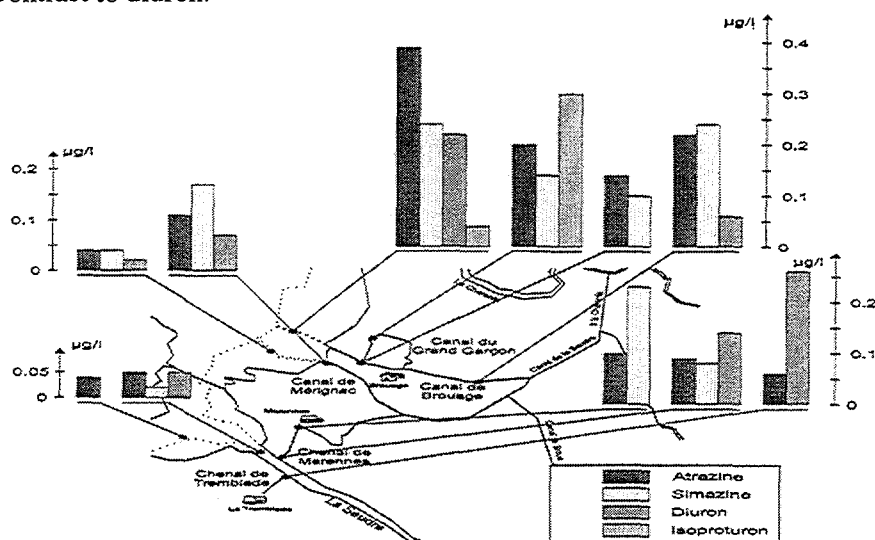


FIG 2. Concentration of triazines and phenylureas in sea-water and drainage canals (91/05/04)

In drainage canals (Brouage, Charras, Marennes), high concentrations of atrazine and simazine were observed in freshwater (atrazine: 7500ng/l, 93/06/21) during the sampling period (April-August 1991). This situation may lead locally to sharp increases in the concentrations of herbicides in coastal seawater (atrazine:400 ng/l; diuron:200 ng/l) when the fresh water is flushed out from the canals into the sea (Fig. 2). This three-year assessment, these investigations points out that the flux of metabolites (DEA and DIA) is clearly greater than their precursors (simazine and atrazine). The influence of the Charente Maritime (Marennes-Oléron) reclaimed marshes' canals and channels on coastal water contamination was observed from high concentrations of atrazine, simazine, diuron and isoproturon in the coastal waters, a phenomenon that cannot be explained by the contributions of the Charente river alone.

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