

AMBIENT LEVELS AND OCCURRENCE OF PERSISTENT ORGANIC POLLUTANTS (POPs) IN THE AIRSHED OF A MEDITERRANEAN COASTAL LAGOON

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INTRODUCTION and OBJECTIVES

Persistent organic pollutants (POPs) present in the airshed of a given environment may participate in exchange / deposition processes that will determine their inputs to the terrestrial or aquatic ecosystems. In addition, physico-chemical properties of POPs may favour long range atmospheric transport to other areas, even reaching remote zones. It is therefore important to determine the airshed POPs concentration in order to evaluate the potential amounts that may participate in the mentioned processes. Thau lagoon (France) (Fig.1A) is one of the largest Mediterranean lagoons where an intensive shell farming activity (oysters and mussels), that covers about 20% of the whole lagoon, produces about 15000 tons of oysters yearly. This ecosystem seems to be under intense anthropogenic pressure (urban, industrial, agricultural and shell farming activities). Moreover, indications of an important role of the atmosphere in the accumulation of some POPs families in the lagoon were found in a previous study based on results from a short sampling campaign (see reference below). The **overall objective** of this work was to gather in-depth knowledge on the ambient levels and occurrence of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs), polychlorinated biphenyls (PCBs), and polybrominated diphenylethers (PBDE) in this lagoon. PCDD/Fs occur as unintentional byproducts of chemical manufacturing and incineration processes, whereas PCBs were mainly used by the power industry in electrical transformers, capacitors, hydraulic equipment, and as lubricants. PBDEs constitute an important group of brominated flame retardants and, unlike PCBs, are still being used as additives in commercial products (especially in electrical equipment and textiles) to meet fire safety regulations. These chemicals are highly toxic and able of producing a wide spectrum of adverse health effects in biota and humans.

EXPERIMENTAL

Integrated air samples were collected during the period February 2007-2008 by using a high volume air sampler. The sampler was set up at Ifremer Institute, located on the South shore of the Lagoon (43°23 51 N, 3°39 34 E) (Fig.1B,C). The sampling head module integrated a quartz fibre filter (QFF) of 102 mm diameter for the air particulate phase collection and a polyurethane foam (PUF) plug of 65 mm diameter, 75 mm length and 0.22 g cm⁻³ of density for the gas phase trapping (Fig.1D,E). The sampler was operated once a month for a period of 7 days. A total of 13 samples were collected the average volume being ~ 1400 m³. QFFs and PUFs were Soxhlet extracted independently. Extract purification was executed with an automated clean-up system (Power-Prep P6). Two fractions were collected; one containing indicator PCBs and PBDEs and one for PCDD/Fs and DL-PCBs. Analysis was performed by isotopic dilution high resolution gas chromatography – high resolution mass spectrometry (HRGC-HRMS).

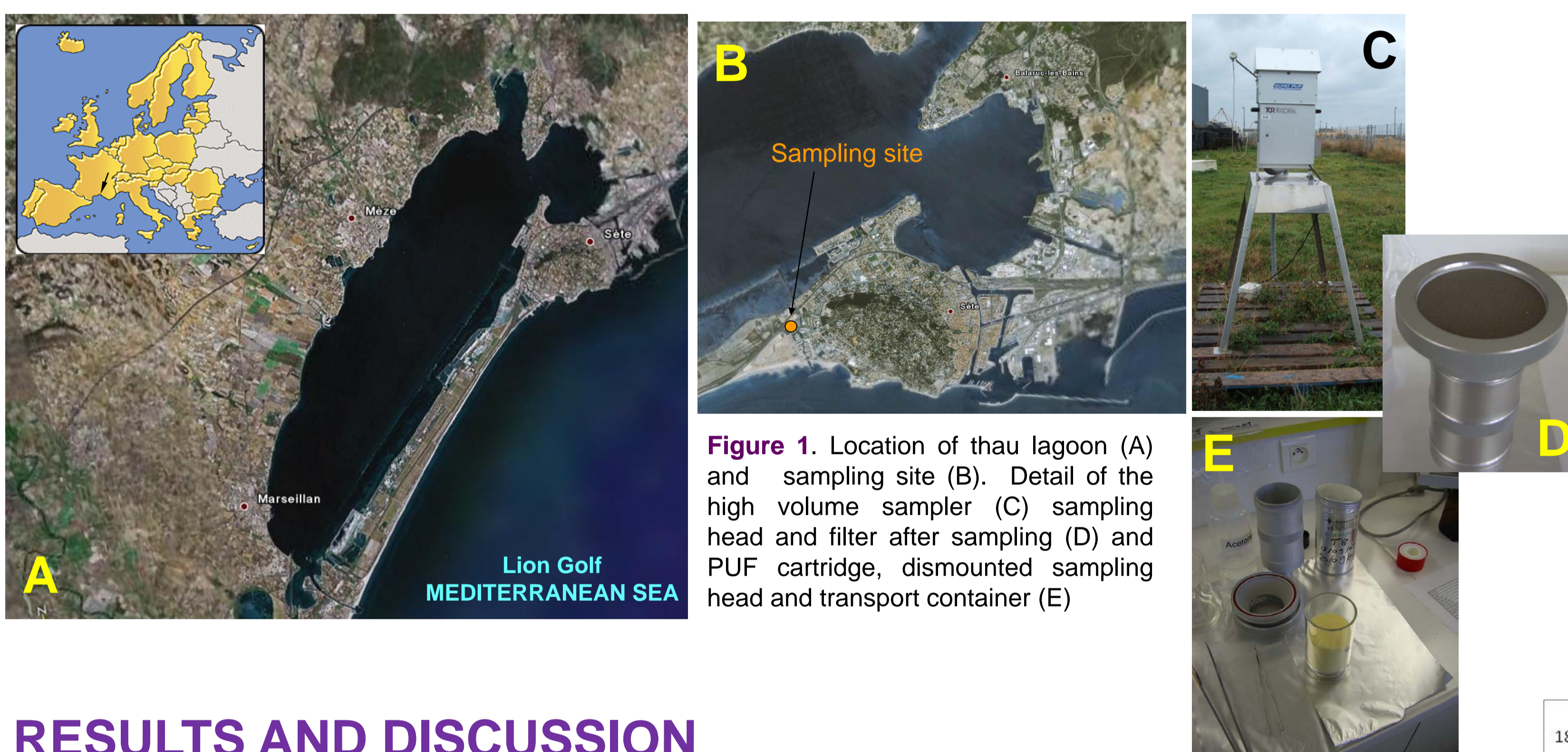
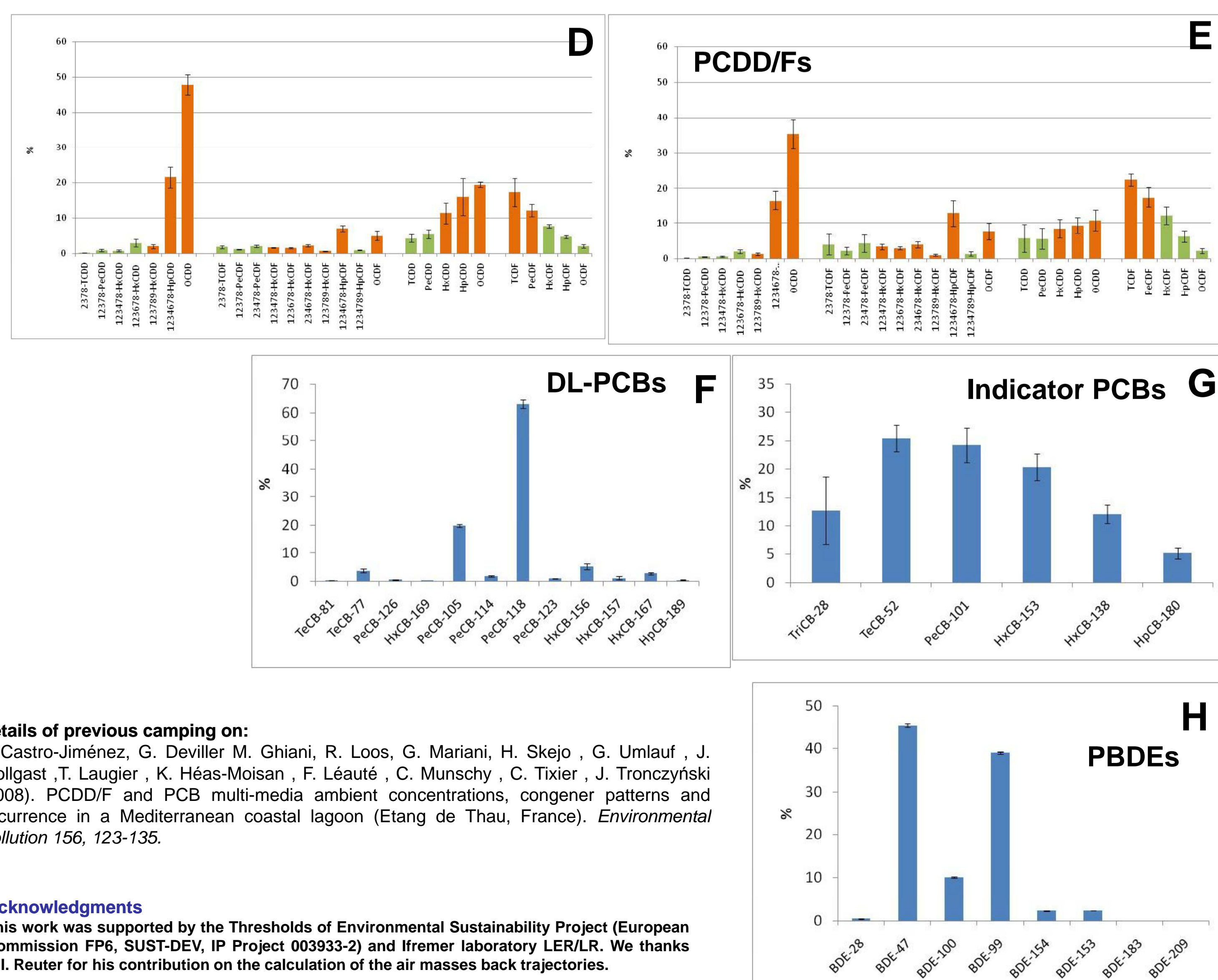


Figure 1. Location of Thau lagoon (A) and sampling site (B). Detail of the high volume sampler (C) sampling head and filter after sampling (D) and PUF cartridge, dismounted sampling head and transport container (E)

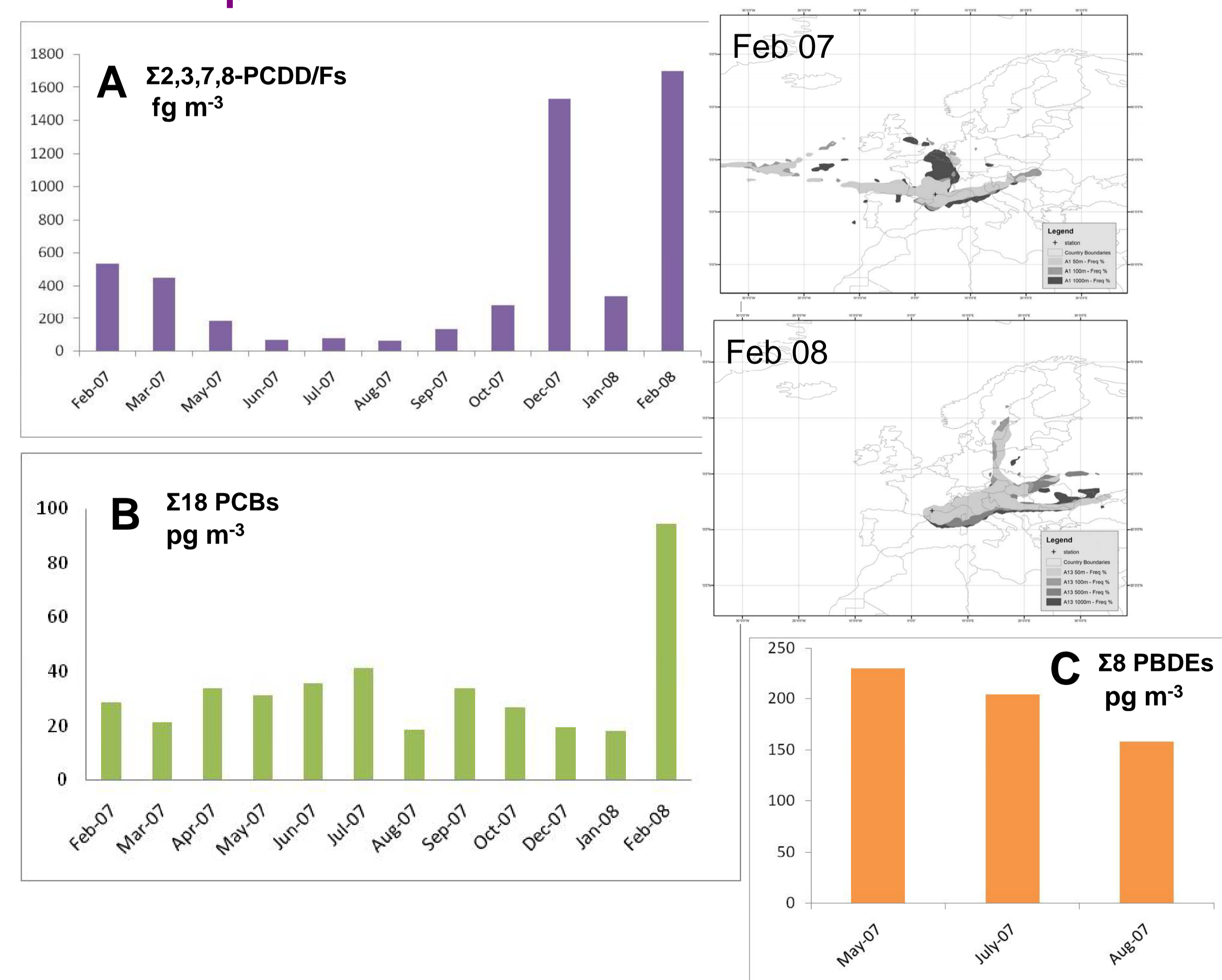
RESULTS AND DISCUSSION

$\Sigma 2,3,7,8$ -PCDD/Fs and Σ C14-8DD/Fs (gas+particulate) air concentrations ranged from 67 to 1700 and 175 to 4455 fg m⁻³, respectively. Higher levels were observed during the winter months, in particular in December 07 and February 08 (A). $\Sigma 12$ DL-PCB ambient concentration (gas+particulate) varied from 1 to 8 pg m⁻³, whereas $\Sigma 6$ indicator PCB levels ranged from 11 to 87 pg m⁻³ (B). Ambient air concentrations over Thau lagoon are dominated by the PCB concentrations in the gas phase, contrary to PCDD/Fs. $\Sigma 8$ PBDE air concentrations (gas+particulate) varied from 158 to 230 pg m⁻³, however these values correspond only to the period May-August 08 (C). Atmospheric levels were driven by PBDE gas phase concentrations as for PCBs. Interestingly, PCDD/Fs and PCB concentrations measured in Feb 08 are much higher than for Feb 07. This fact may be explained by different air mass trajectories for both months (see back trajectories plots). Two different PCDD/Fs congener patterns were found. A first group of samples (Feb, Mar, Aug, Dec 07 and Jan 08) presented a pattern characterized by a predominance of OCDD and 1,2,3,4,6,7,8-HpCDD and higher chlorinated dioxins and lower chlorinated furans in the homologue series (D). The other group of samples (May, Jun, Jul, Sep, Oct 07 and Feb 08) exhibited a pattern characterized by a lower predominance of OCDD and 1,2,3,4,6,7,8-HpCDD and by the lower chlorinated furans respect to higher chlorinated dioxins in the homologue series (E). PCB-118, 105 and 156 dominated the DL-PCB pattern (F) whereas PCBs 52, 101 and 153 dominated the indicator PCB pattern (G). PBDE pattern was dominated by BDE-47 and 99 and 100 (H).

Congener patterns



Atmospheric concentrations



FINAL REMARKS

- A one year data set on PCDD/Fs and PCBs atmospheric concentration and indicative PBDE summer concentrations in Thau lagoon has been generated. These data are now available for modeling development and validation and risk assessment in Mediterranean coastal lagoons
- PCDD/Fs and PCBs ambient levels are in agreement with previous measurements in Thau lagoon airshed (see reference below)
- Air masses origin and composition play a role in pollutants loading in the Thau lagoon airshed. However, local sources and re-volatilization have to be further investigated for PCB and PBDEs since atmospheric levels are driven by gas phase concentrations.
- Atmospheric deposition fluxes are under calculation and will help to provide an estimation of pollutant loads to the aquatic ecosystem.
- Back trajectories of air masses together with congener pattern composition is under evaluation in order to understand possible sources, in particular of PCDD/Fs, in the area.

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Details of previous camping on:

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Acknowledgments

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