Determination of heavy metals and fluorinated organic compounds in Molise areas with different anthropogenic impacts using honey matrix
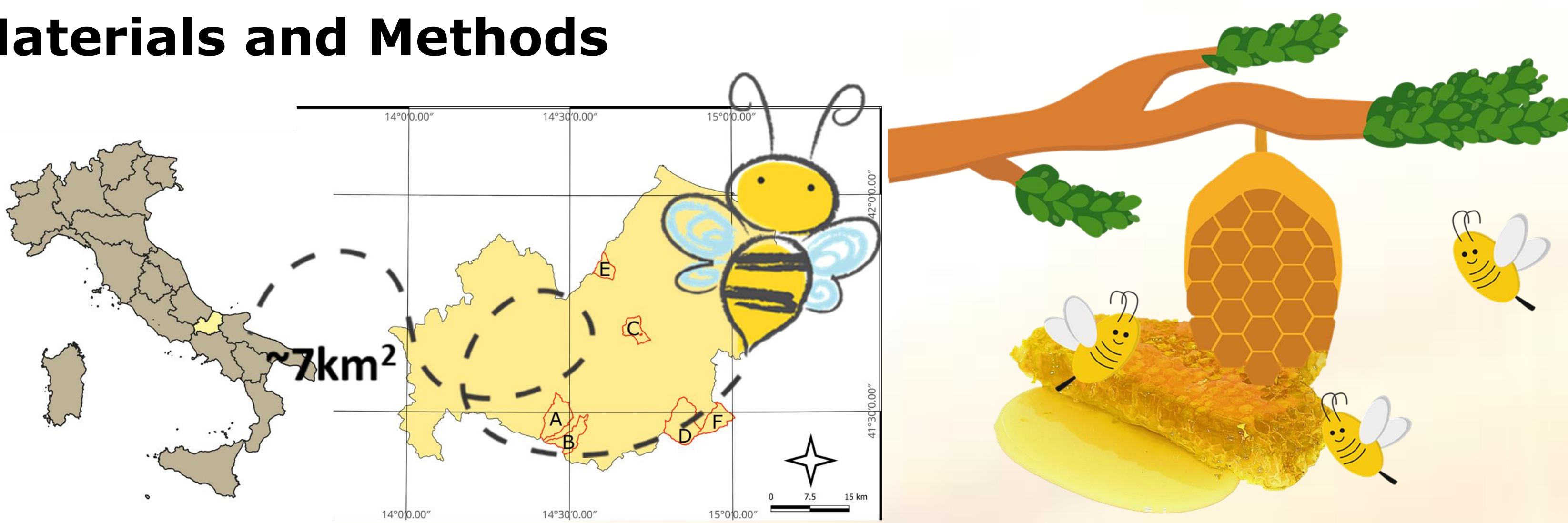
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Introduction

This poster presents the primary findings from the activities scheduled for the first two years of the PhD, in compliance with the PhD thesis proposal. Target molecules were chosen and analyzed using a methodology grounded in scientific understanding and cutting-edge analytical approaches (A1). After the sampling region was defined and the food matrix was chosen (A2), the analytical steps were carried out (A3), and the collected results were then examined (A4).

Materials and Methods

Bojano (A), Campochiaro (B), Petrella Tifernina (C), Riccia (D), Roccavivara (E), and Tufara (F).

→ Heavy metals analysis were performed with: Agilent Technologies 4210 MP-AES/ICP in accordance with the EPA method 6010C.

→ PFAS analysis were performed with: Thermo Ultimate 3000 HPLC system coupled with mass analyser Q-Orbitrap according to the Barola et al., 2020 method.
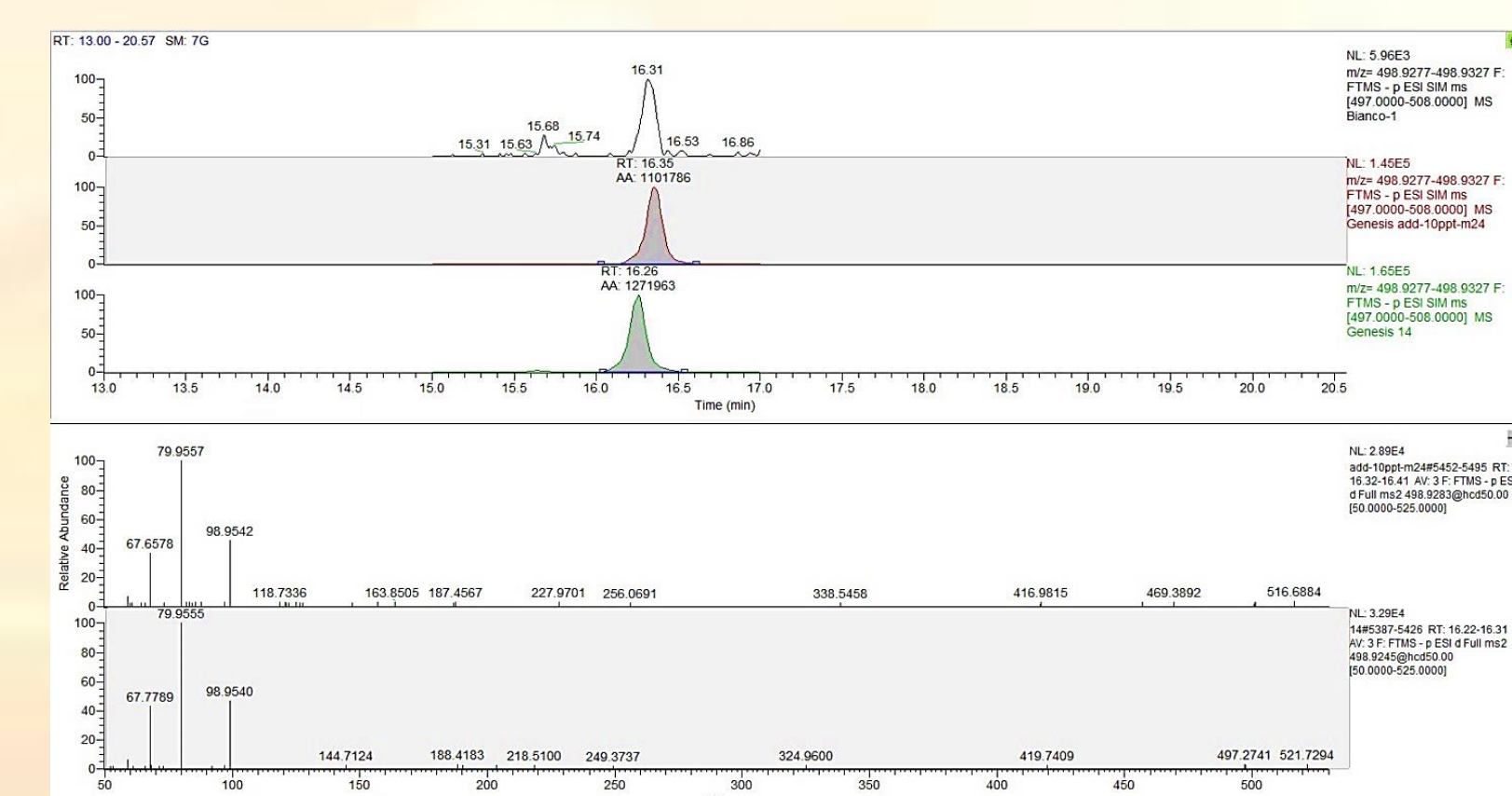
Results and Discussion

Fluorinated organic molecules were almost entirely absent from the 56 samples that were analyzed. Only three samples from area E and one from area F contained PFAS, while two of the four contaminated samples contained 6:2FTS. Specifically, 6:2FTS was detected in samples E4 at 0.005 ng g^{-1} and F2s at 0.007 ng g^{-1}, Bistriflimide was detected in sample E3s at 0.008 ng g^{-1}, and L-PFOS was detected in sample E6 at 0.010 ng g-1.

Figure 1 *Chromatogram concerning L-PFOS: blank sample; fortified blank, E6 sample; MS/MS spectrum fortified sample; MS/MS spectrum E6 sample.*
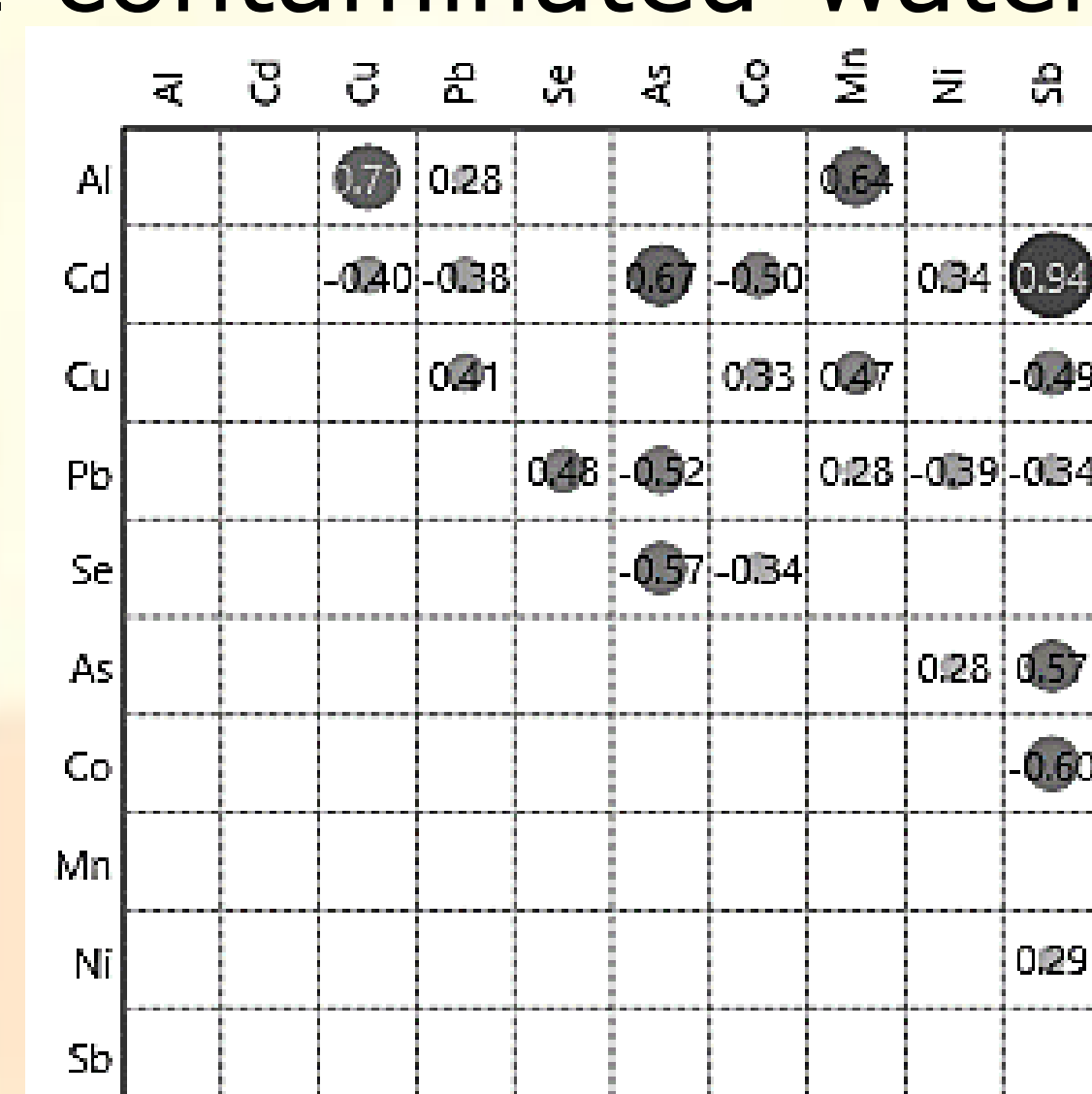
Based on the scientific literature, an estimation of the sources of PFAS contributions to the samples was made. Bistriflimide, an ionic fluid used in lithium battery production and lubrication, was found in Site E, possibly due to contamination from an ecological island. Fluorotelomers (6:2 FTS), a class of chemical compounds used in a range of products including paints, adhesives, printer inks, anti-fog products, surface coatings and adhesives, are capable of releasing leachate from landfills, which can subsequently enter nearby waterways and cause environmental damage. PFOS, a surfactant with several uses, may result even from POSF deterioration. Because of its low volatility in the air, it is a persistent, hazardous, and mobile pollution, especially in aquatic environments. Hence, it makes sense to draw the conclusion that contaminated water caused the contamination of the two remaining chemicals.

Table 1 *Descriptive statistics of metals present in all samples.*

Chemical	Min (ng g^{-1})	Max (ng g^{-1})	Average (ng g^{-1})	DS	RDS
Al	104	233	143.9	26.8	18.6
Cd	0	19.5	8.3	6.9	82.4
Cu	8	75	30.5	13.4	44.0
Pb	0	24	10.1	7.2	71.4
Se	85.8	194.6	137.5	26.5	19.2
As	0	128.6	77.5	49.0	63.2
Co	0	4.7	0.5	1.1	235.3
Mn	21	143	52.8	28.9	54.8
Ni	0	52.8	3.8	7.8	207.2
Sb	33.8	137.2	96.4	34.5	35.8

Cadmium values range from 0 to 19.5 ng g^{-1}, with an average of 8.3 ng g^{-1}; Lead from 0 to 24 ng g^{-1}, with an average of 10.1 ng g^{-1}; Arsenic 0 to 128.6 ng g^{-1}, with an average of 77.5 ng g^{-1}.

As illustrated in Fig. 2, there are notable positive correlations (p<0.05) greater than 0.7 between Cu and Al and between Sb and Cd.

Figure 2 *Pearson correlation between chemicals (p<0.05).*

References

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