

Stéphane Bruzaud¹, Yves Grohens¹, Bruno Dumontet², Pierre Voisin², Amanda Elineau^{3,4}, Gabriel Gorsky^{3,4}

¹ Laboratoire d'Ingénierie des Matériaux de Bretagne, Université de Bretagne-Sud, Rue de Saint Maudé, 56321 Lorient Cedex, France.

² Expédition MED, 29 rue de Lattre de Tassigny, 56230 Molac, France.

³ Sorbonne Universités, UPMC Université Paris 06, UMR 7093, LOV, Villefranche sur Mer, France.

⁴ CNRS, UMR 7093, LOV, Villefranche sur Mer, France.

INTRODUCTION: Surface floating microplastic material was collected in the Ligurian Sea during specific campaigns of the citizen science association Expedition MED. 52 samples were collected between Toulon, Calvi and Genova at an average speed of 2.5 knots during 60 min each with a Manta trawl net lined with 0.333 mm mesh. Samples were transferred to the collaborating scientific institutes. Microplastic was enumerated and measured by imaging techniques and sorted out. It was further characterized using spectroscopy or thermal analysis in order to classify it into different families of plastics as polyolefins, polystyrenics, polyesters, polyamides and others. Volunteers were involved in assisting sampling operations and were supervised closely. This interactive science program allows comforting the study on the long term. A more collaborative governance of the marine environment by citizens is another benefit of this approach.

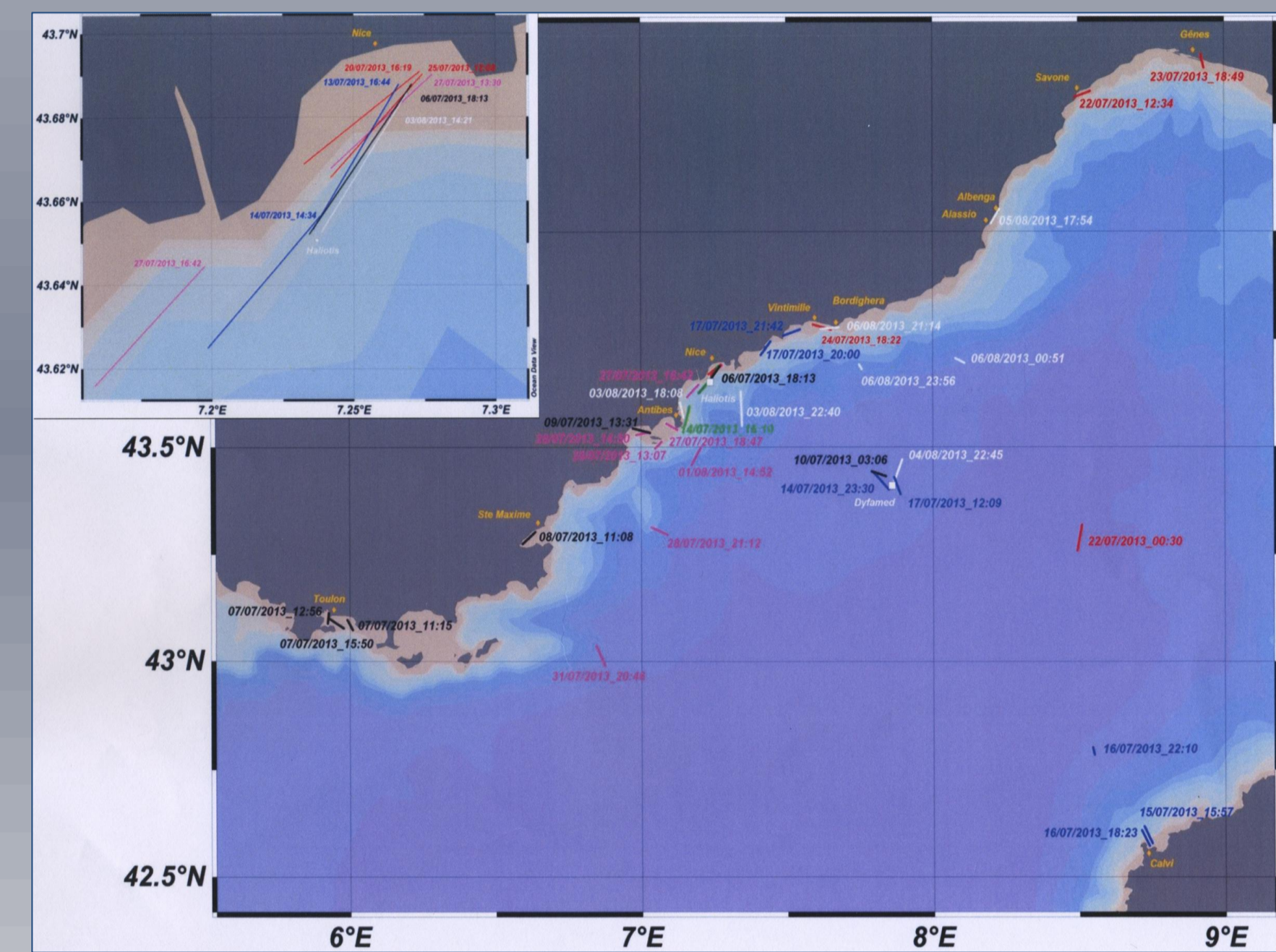


Fig. 1. Location, date and hours of Manta tows. The various colors refer to the different legs. Several tows were performed in coastal environment, see insert.

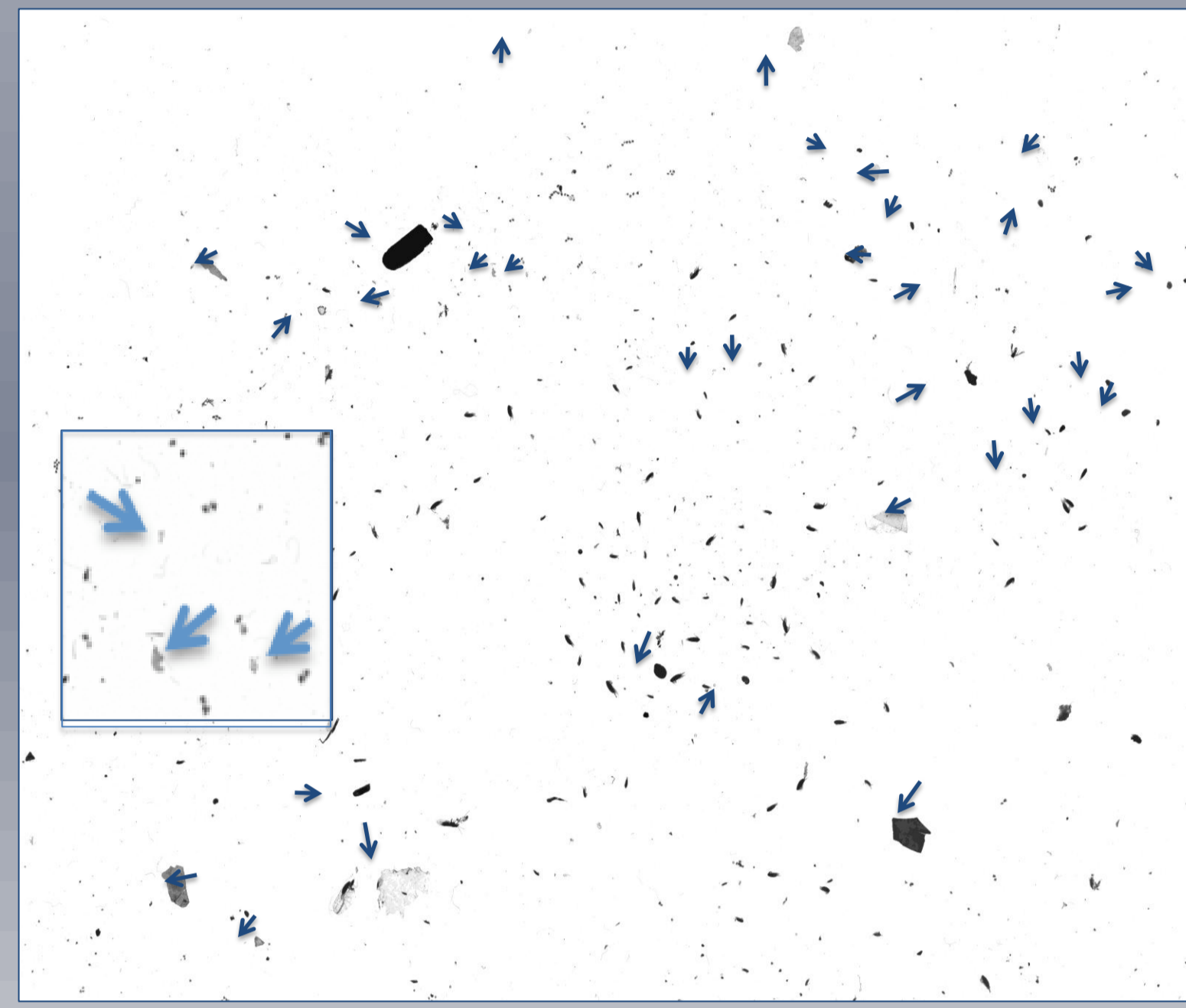


Fig. 2. A ZooScan image of a Manta tow sample fraction. Most of the black particles are polystyrene particles. Insert: zoom on small plastic fragments.



Collecting with Manta trawl

Sampling operations with volunteers

SPATIAL DISTRIBUTION OF MICROPLASTIC

Comparison between the ZooScan and stereomicroscopy shows an underestimation of microplastic by the former method. Modification of the settings should improve the precision of the instrument. The spatial distribution of microplastic is contrasted. High in the harbors and near-shore, lower in the bays with open sea connection. Offshore, microplastic concentration and surface area are increasing.

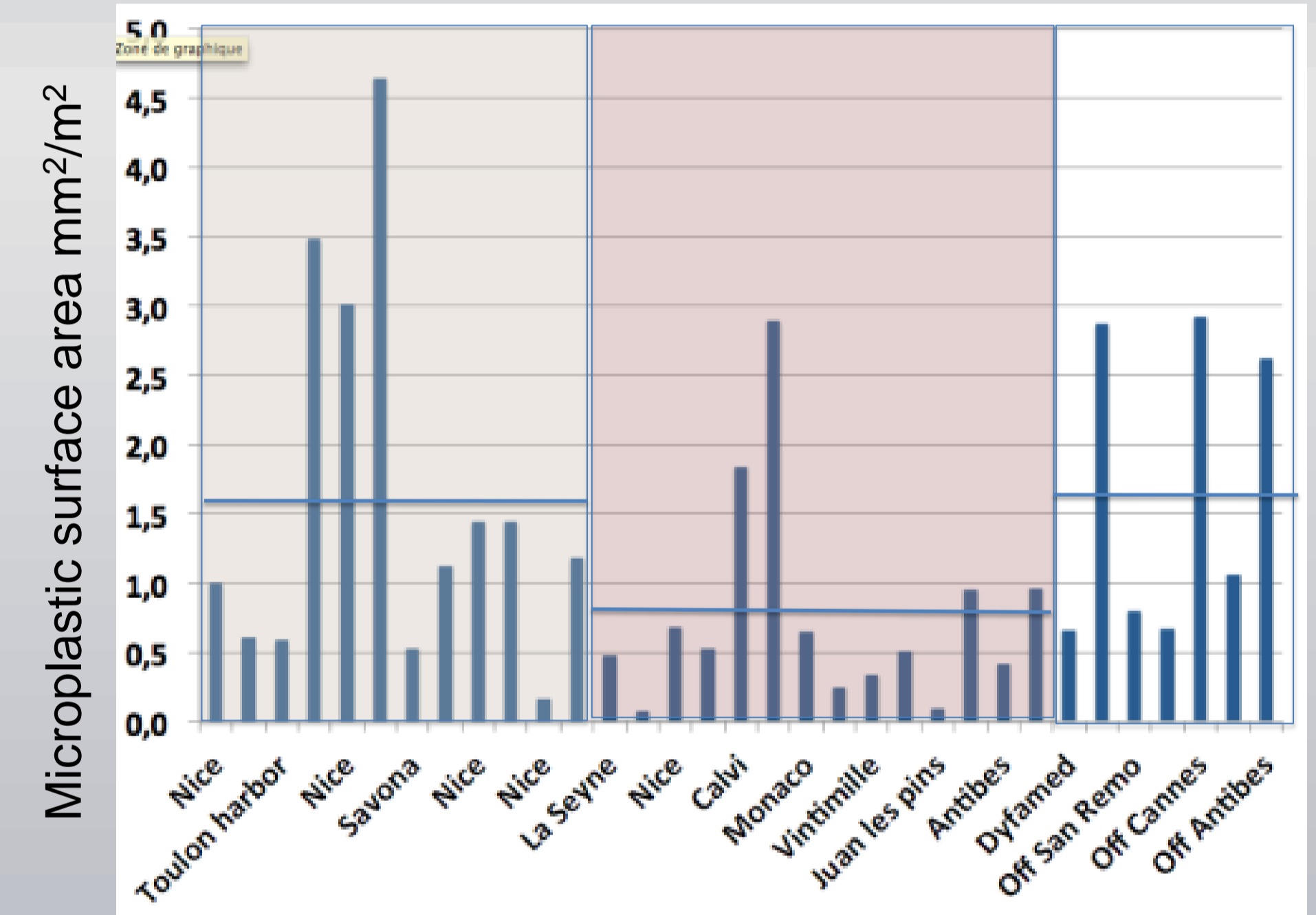
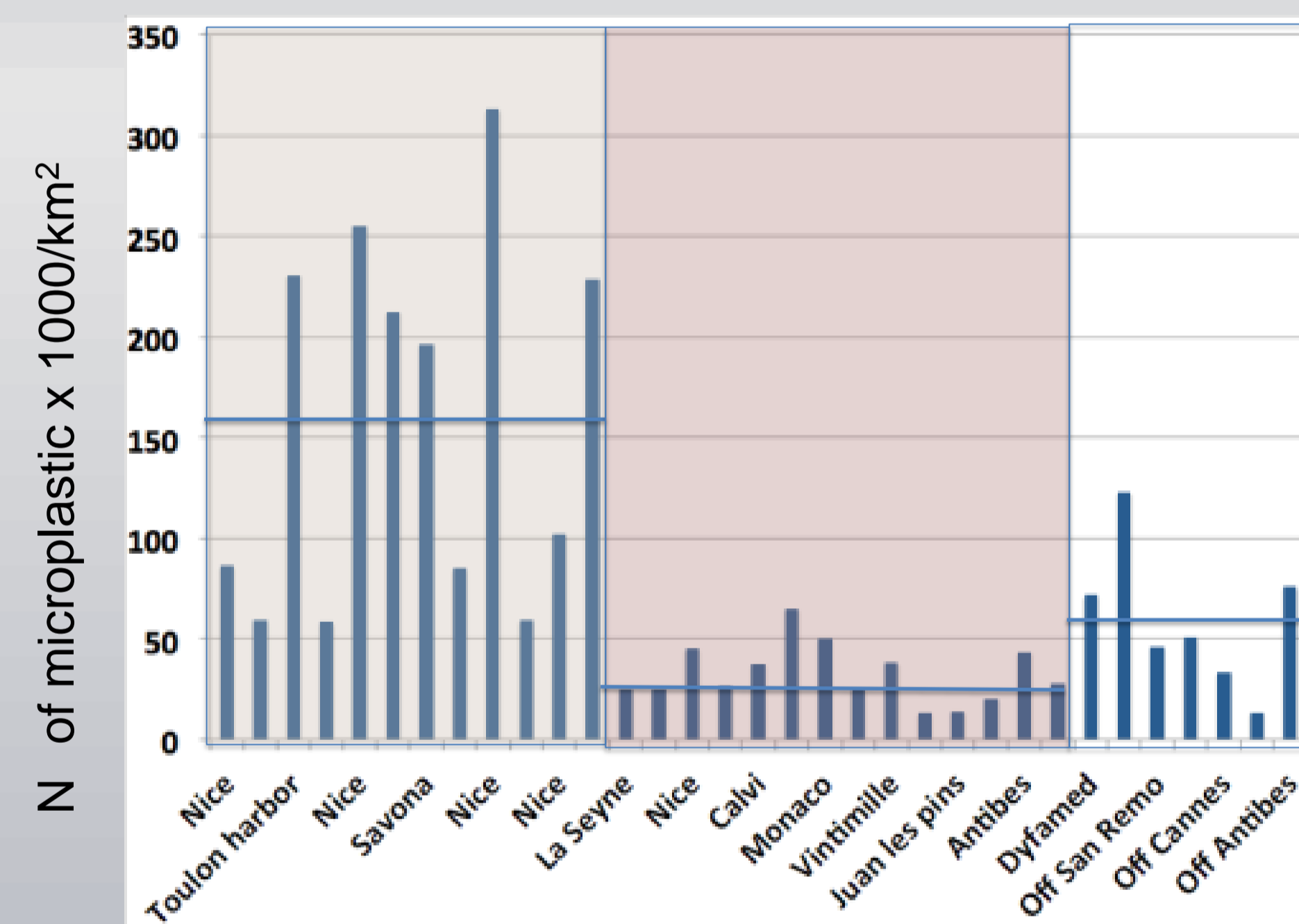


Fig. 3a & 3b. Microplastic numerical concentration from ZooScan imaging (a) and their surface area (b) in harbors and near coast (yellow), in bays (pink) and offshore (white). Horizontal lines = mean values.

REFERENCES

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CHARACTERIZATION

Non-destructive Fourier transform infrared spectroscopy (FTIR) was used to specify absorption bands for each microplastic and to compare them with spectra found in literature. On the base of these results, a data bank containing the spectra of main marine microplastic has been established. Thermogravimetric analysis (TGA) was carried out on each microplastic sample. Finally, the thermal characteristics of microplastics, i.e. glass transition temperatures (T_g), crystallinity and melting temperatures (T_m), were collected using differential scanning calorimetry (DSC). The results obtained using the combination of the different characterization techniques allowed us to initiate and to develop a methodology for classifying microplastic samples into the main families of plastics previously mentioned.

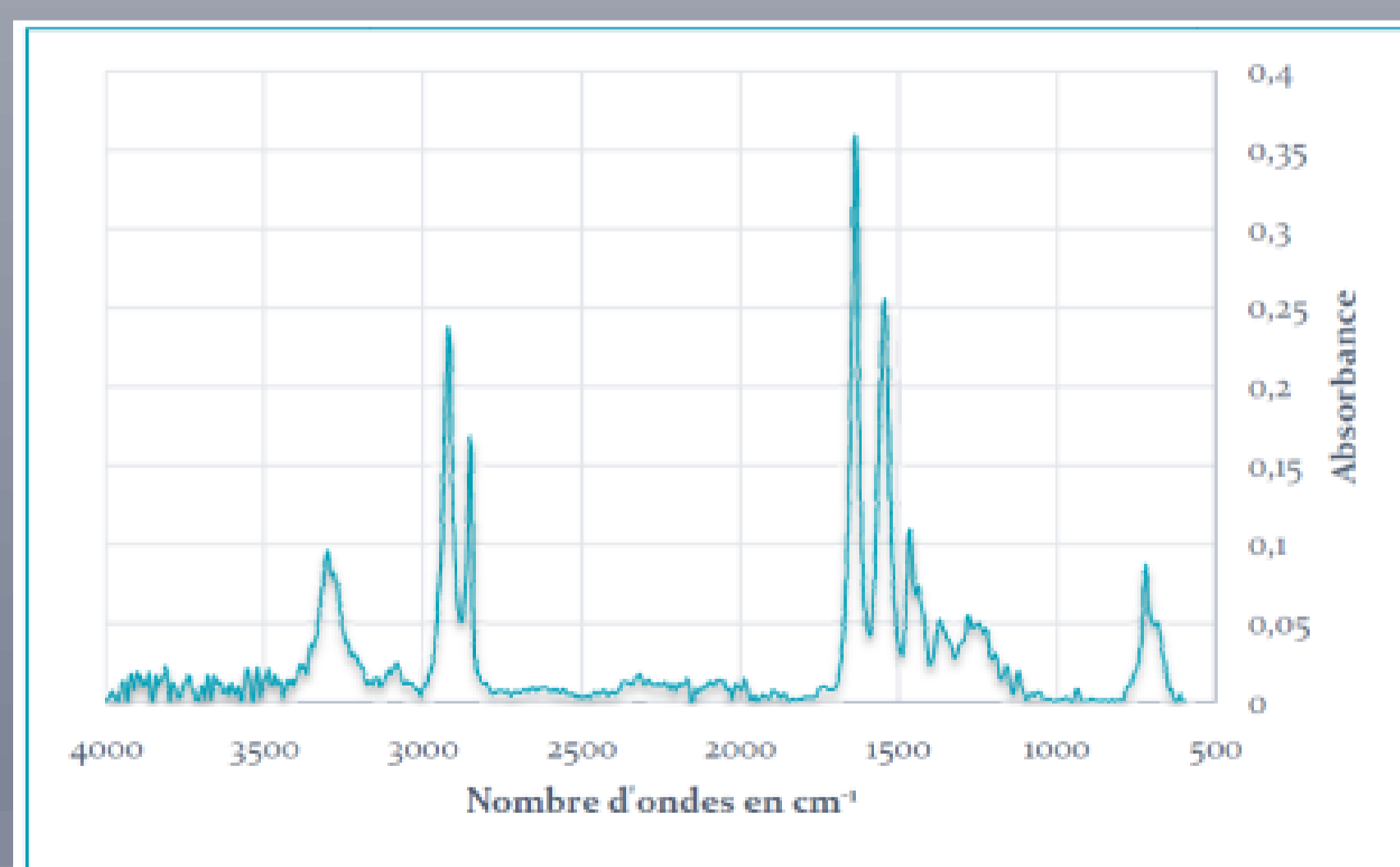


Fig. 4. IR spectrum of polyamide 6,6 (NYLON®).

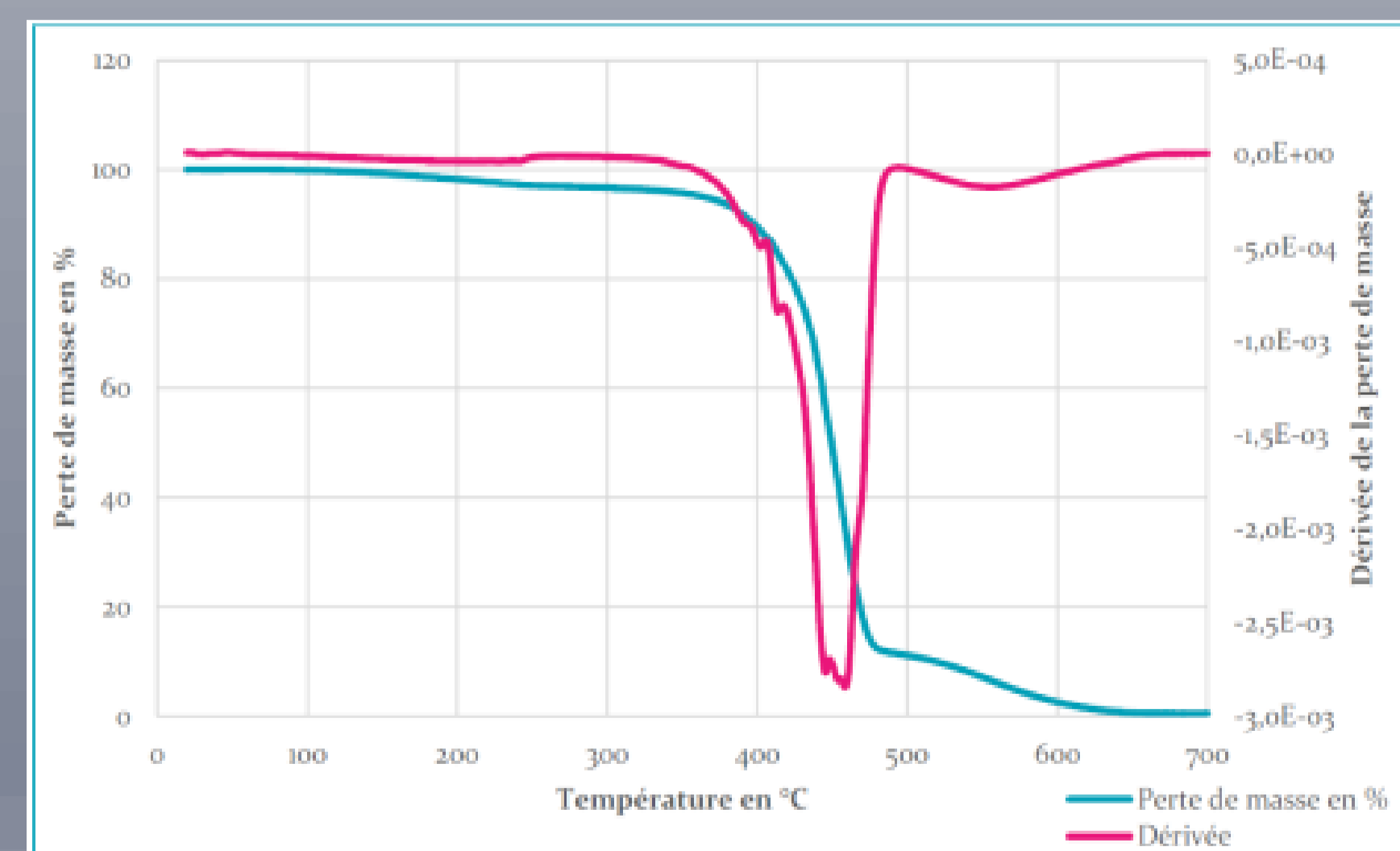
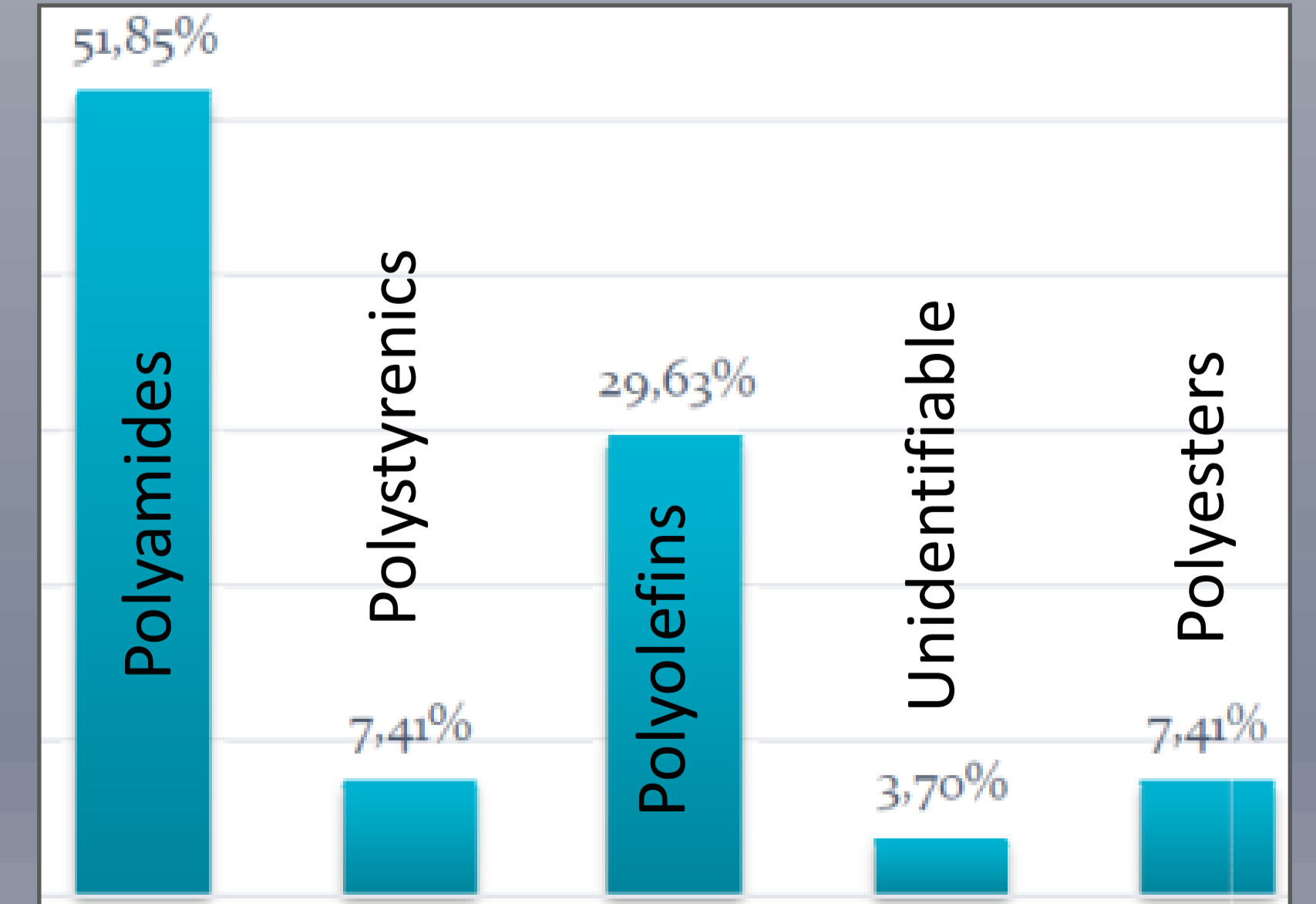


Fig. 5. TG analysis of polyamide 6,6 (NYLON®).

DSC results for polyamide 6,6 (NYLON®) : $T_g = 57^\circ\text{C}$; crystallinity $\approx 50\%$; $T_m = 260^\circ\text{C}$

Fig. 6. Distribution of main plastic families in collected samples.



KEYWORDS: Microplastics, Ligurian sea, imaging, infrared spectroscopy, thermal analysis.

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