Microplastic levels on sandy beaches: Are tourism and coastal recreational activities effects really important?

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Introduction:

This study assessed the effect of tourism and other recreational activities on microplastics (MPs) levels and their characteristics in the sand and the surf zone of the seawater.

Metodology:

Six sites belonging to 3 sandy beaches with similar geomorphologic and morphodynamic characteristics but with different tourism activities were chosen. MPs in seawater were collected using a manta net (pore size 300 µm) and then digested using H202 30%. MPs in sand samples were separated by decantation using a saturated NaCl solution. Finally, samples were filtered using glass filter (0.45 µm) and MPs were analyzed by Raman spectra.

Results:

In the Coastal Marine MPA Pehuén Co – Monte Hermoso where the flow of tourists is low, MPs levels were the lowest and particles were the largest being mainly blue or black fibers, and with less polymer diversity; cotton and PET were the most prevalent polymers suggesting a recent input of textile fibers to this site.

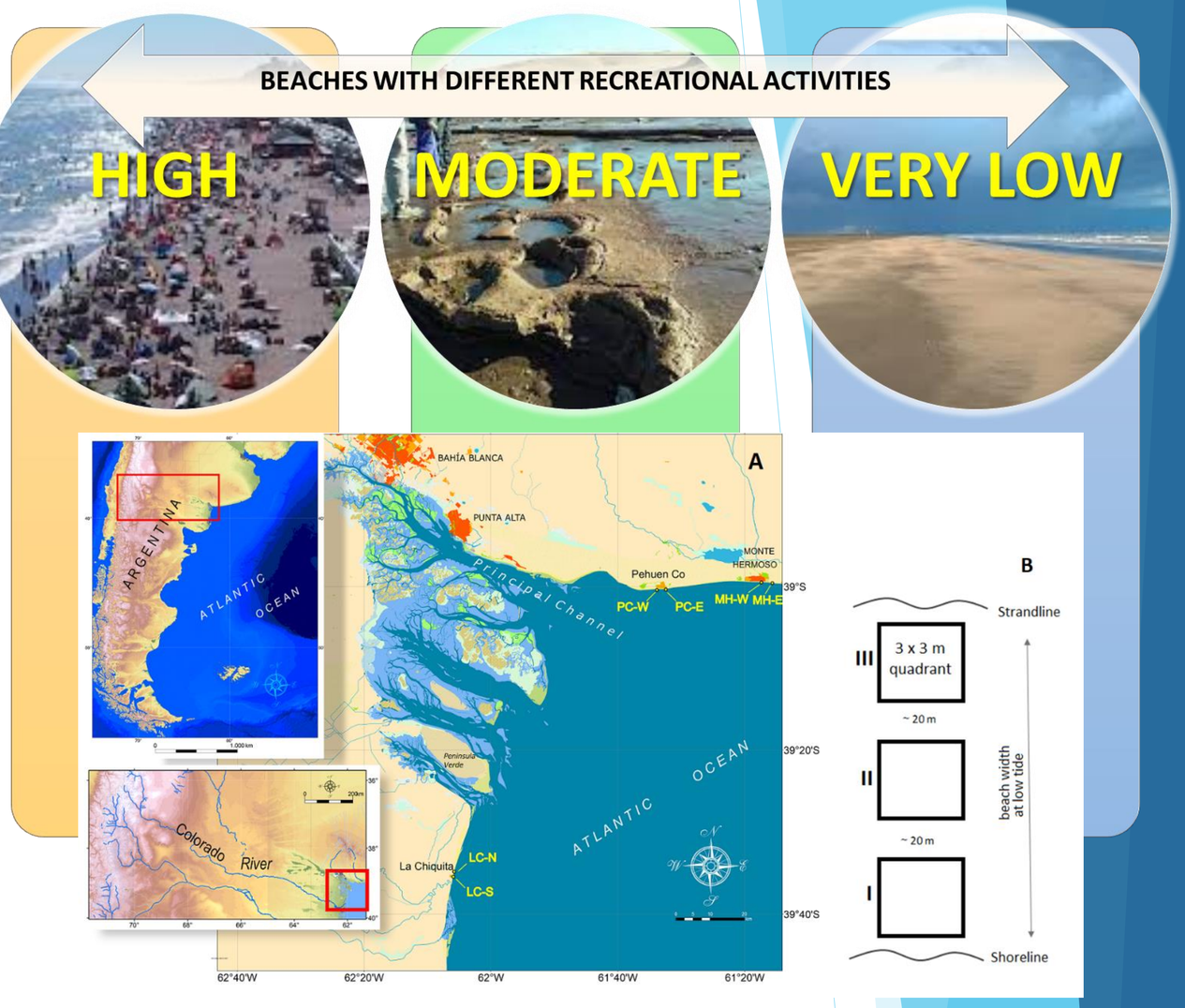

Figure 1: A: Study area on the coast of the Southwestern Atlantic Ocean. MH-W and MH-E are sampling sites from Monte Hermoso West and East, respectively. PC-W and PC-E are sampling sites from Pehuen Co West and East, respectively. LC-N and LC-S are sampling sites from La Chiquita North and South, respectively. **B:** Sampling design of superficial sand. Five centimeters surface sub-samples at the vertices and in the center of the delimited quadrant were obtained for each quadrant.

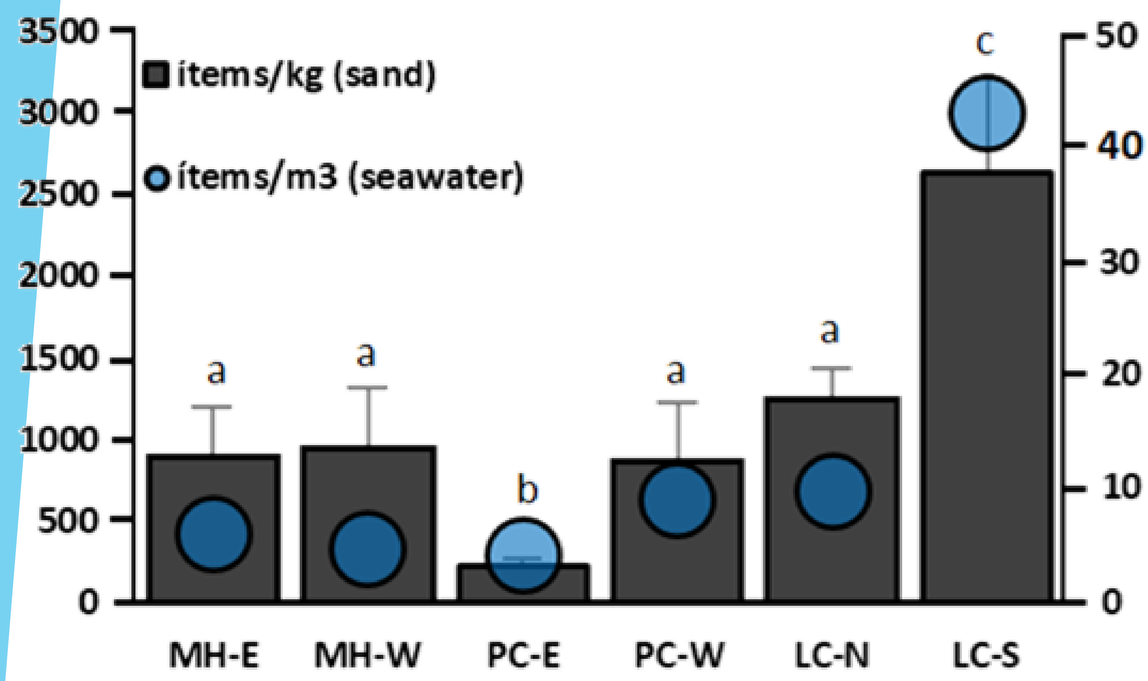

Figure 2: MPs concentration in the sand (items/kg dry wet - bars) and seawater (items/m3 - bullets) at different sampling sites. MH-E: Monte Hermoso East, MH-W: Monte Hermoso West, PC-E: Pehuen Co East, PC-W: Pehuen Co West, LC-N: La Chiquita North, LC-S: La Chiquita South. For sand, values are mean ± SD; different letters indicate significant differences between means (One-way ANOVA, $p < 0.05$).

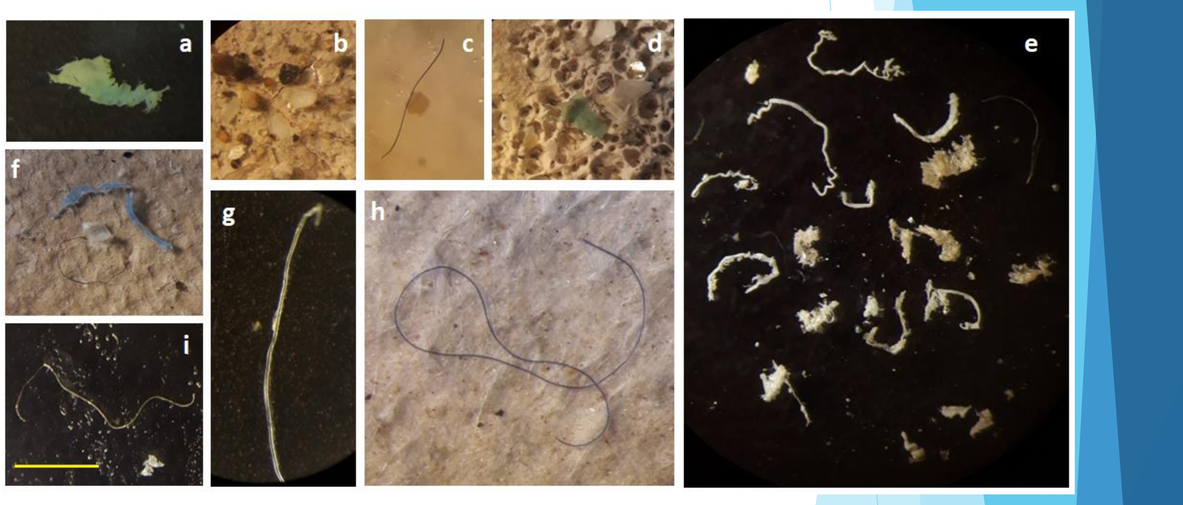

Figure 3: Examples of MPs found: a) white-sky blue fragment, b) red and black fibers, c) green film, d) green fragment, e) typical white filaments and films found mainly in LC-S, f) blue fragment, white film, and black fiber, g) transparent fiber, h) blue fiber, and i) yellow fiber. The yellow bar at the bottom left corresponds to a size of 500 µm.

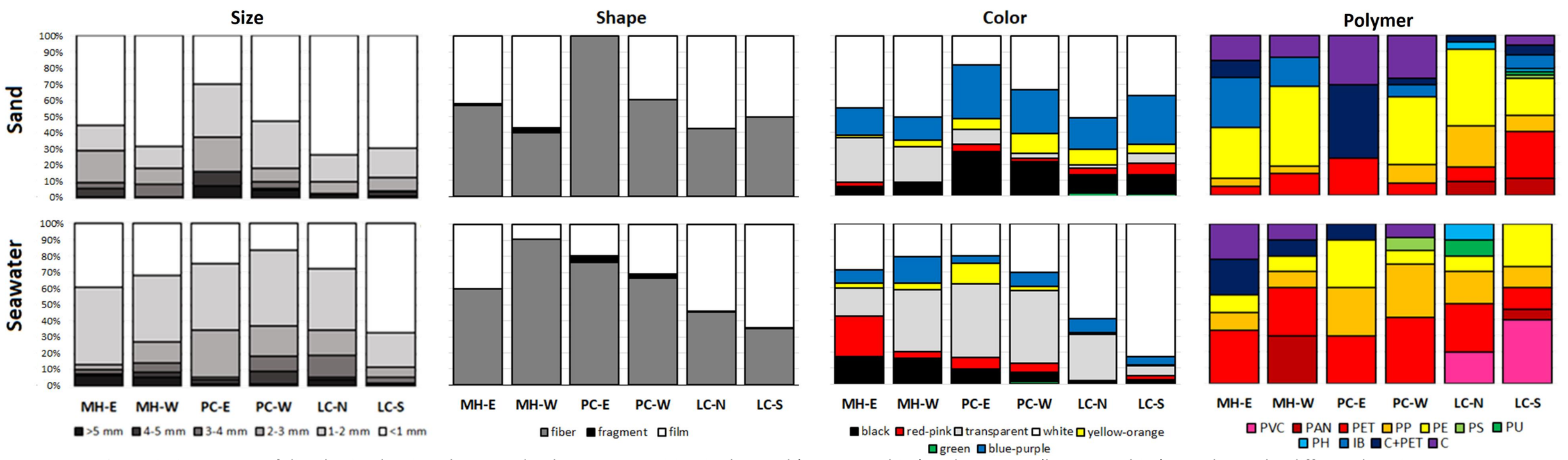

Figure 4: Percentage of distribution by size, shape, and polymer composition in the sand (upper graphics) and seawater (lower graphics) samples at the different locations.

In the southern site of a beach considered more pristine due to the negligible human activity (LC-S), the highest concentration of MPs was found, including the smallest size pattern, mostly composed of white films or fibers, with a greater diversity of polymers, prevailing PE > PET > PP. A great occurrence of PVC white films was also found in the surf zone of this site.

Conclusions: Apart from tourism and recreational activities, other sources might play a major role in the input of MPs to sandy beaches, such as proximity to the mouth of a river and coastal drift.