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Text S1 IBR analysis

Individual biomarker data (X_i) are compared to a mean reference value (X_0) and a log transformation is applied to reduce variance.

$$Y_i = \log\left(\frac{X_i}{X_0}\right) \quad (1)$$

In a next step, the general mean (μ) and standard deviation (σ) of Y_i were computed as previously described by Beliaeff and Burgeot [1], and Y_i is standardized:

$$Z^i = \frac{Y_i - \mu}{\sigma} \quad (2)$$

To create a basal line centered on 0 and to represent biomarker variation according to this basal line, the mean of standardized biomarker response (Z_i) and mean of reference biomarker data (Z_0) are used to define a biomarker deviation index (A):

$$A = Z_i - Z_0 \quad (3)$$

To obtain an integrated multi-biomarker response named IBRv2, the absolute value of A parameters calculated for each biomarker in each investigated site are summed:

$$IBRv2 = \sum |A| \quad (4)$$

Table S1. Particle size characteristics of pristine and mechanically weathered PS microplastics determined from SEM images.

Group	n	Mean $\pm$ SD (μm)	Median(μm)	Range(μm)
Pristine PS microplastics	107	6.32 $\pm$ 2.05	6.34	2.58–12.16
Mechanically weathered PS microplastics	111	6.14 $\pm$ 2.26	5.68	2.58–13.61

Statistical comparison: Welch's t-test, P = 0.534; Mann–Whitney U test, P = 0.344.

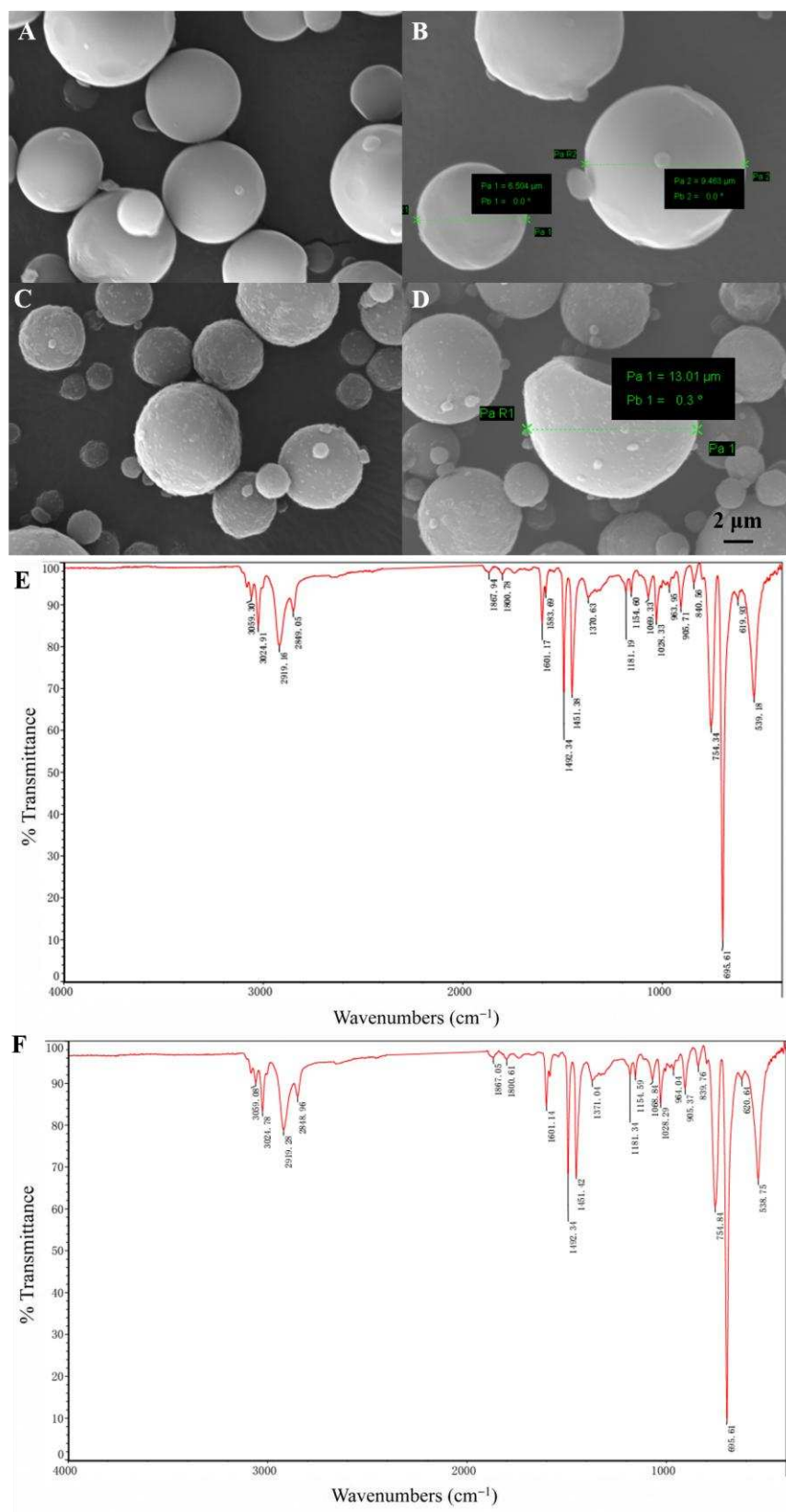


Fig. S1. SEM images of pristine (A and B) and weathered (C and D) PS microplastics.

FTIR spectra of pristine (E) and weathered (F) PS microplastics.

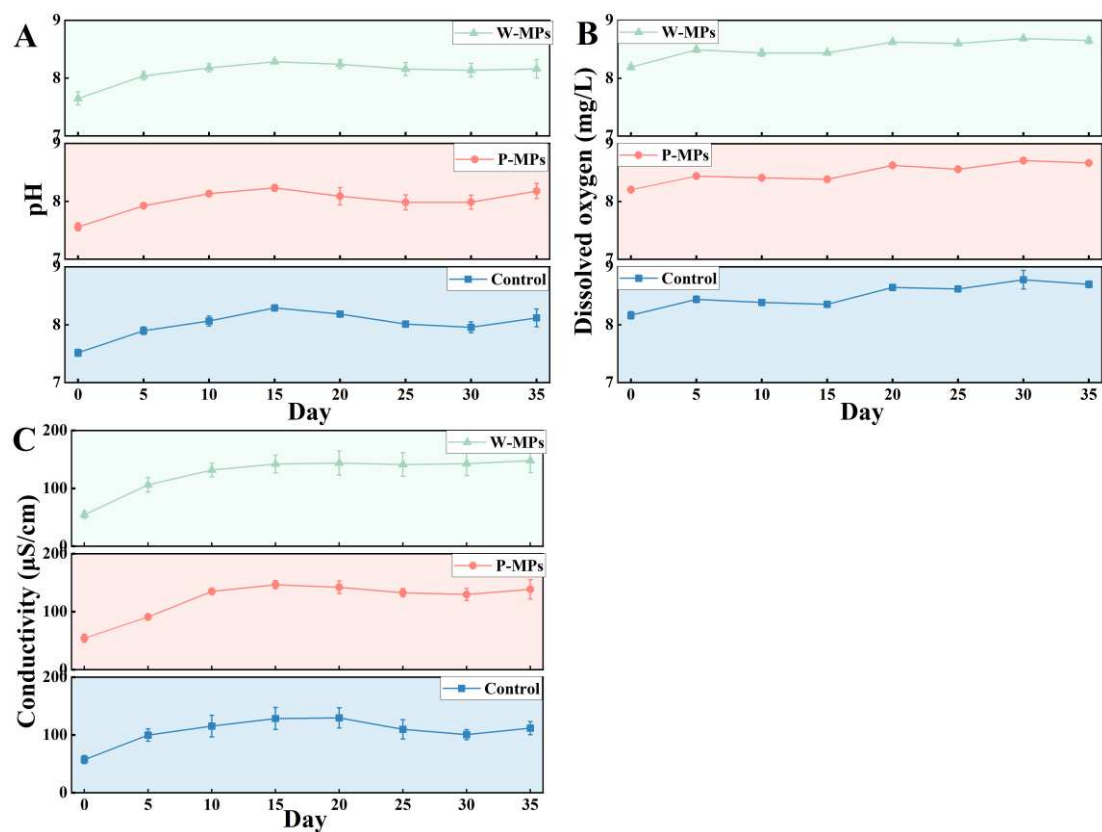


Fig. S2. Alteration of pH (A), dissolved oxygen (B) and conductivity (C) of overlying water during 5-week exposure.

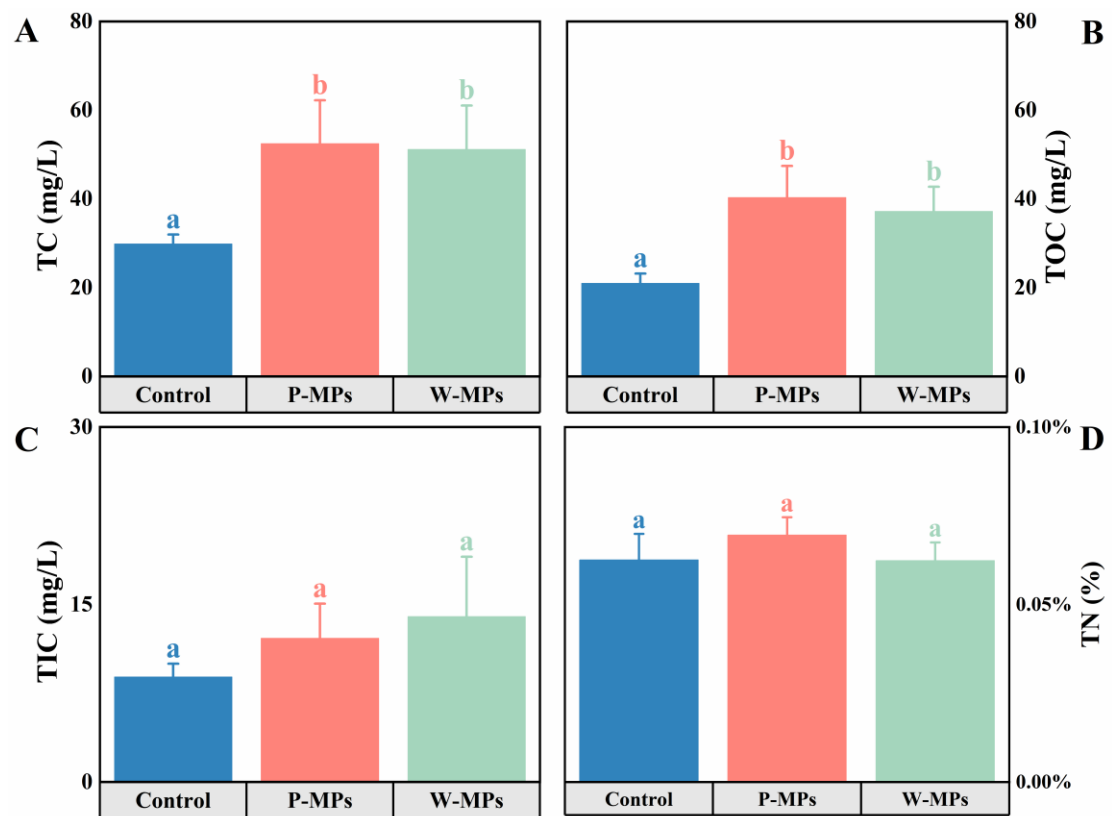


Fig. S3. Carbon content in water and nitrogen content in sediment. A: total carbon in water; B: total organic carbon in water; C: total inorganic carbon in water; D: total nitrogen in sediment. Data represent mean $\pm$ SD. Different letters indicate significant differences between treatments ($p < 0.05$).

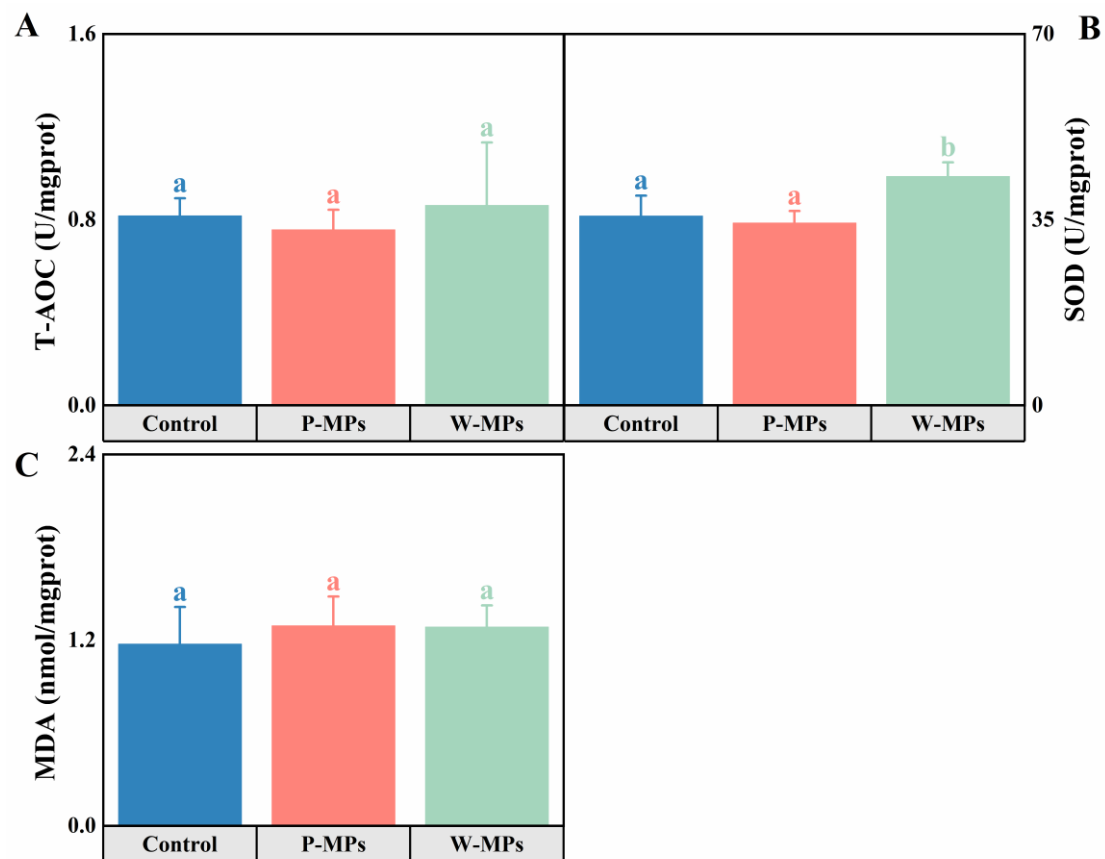


Fig. S4. Oxidative stress in snail after exposure to pristine and weathered PS microplastics. A: T-AOC level; B: SOD activity; C: MDA content. Data represent mean $\pm$ SD. Different letters indicate significant differences between treatments ($p < 0.05$).

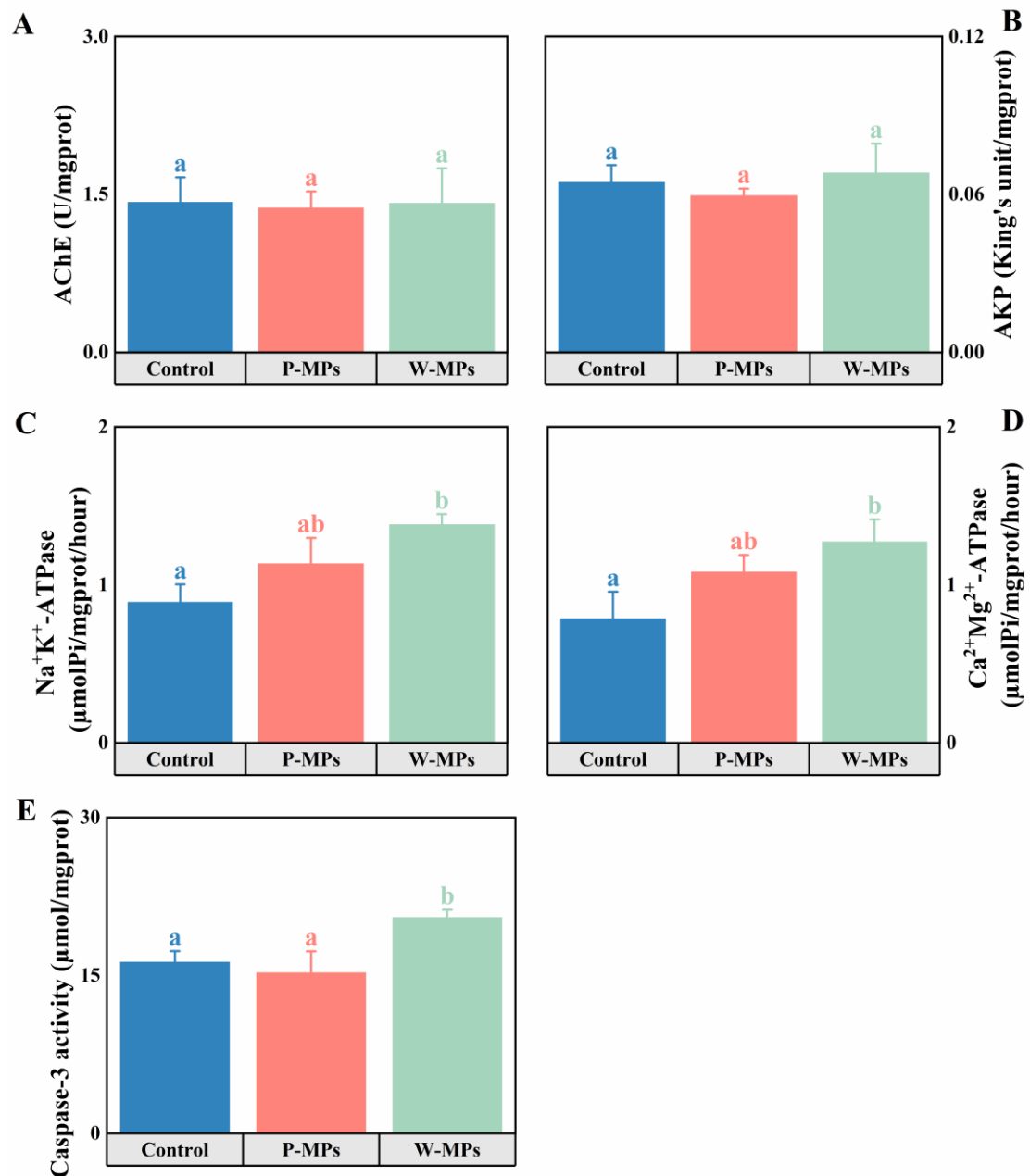


Fig. S5 Enzyme activities of snail after exposure to pristine and weathered PS microplastics. A: AChE; B: AKP; C: Na⁺K⁺ATPase; D: Ca²⁺Mg²⁺ATPase; E: caspase-3. Data represent mean $\pm$ SD. Different letters indicate significant differences between treatments ($p < 0.05$).

Reference

- [1] B. Beliaeff, T. Burgeot, Integrated biomarker response: a useful tool for ecological risk assessment, *Environ Toxicol Chem*, 21 (2002) 1316-1322.