Supplementary data

Assessment of Microplastic Pollution Load and Ecological Risk Index in Surface Water and Sediment Matrices in the Mangrove Ecosystem along Butuan Bay, Southern Philippines

Table S1. Basic information on selected mangroves along Butuan Bay, Philippines

Mangrove area	Transect	Point	Coordinates	Description of the mangrove area	Pollution contributors
Butuan City (BCMS)	1	1	8° 59’ 45.40” N, 125° 28’ 41.0” E	The Butuan City mangrove is located in a tourist area. The waters of this mangrove is connected to a nearby commercial milkfish breeding ground. Business establishments like beach resorts, food kiosks and hotels are near this mangrove. The locals use this mangrove as food source for mangrove crabs, snails and fish.	Discharge from marine fishing, aquaculture, and tourism activities.
		2	8° 59’ 43.73” N, 125° 28’ 39.58” E		
		3	8° 59’ 42.90” N, 125° 28’ 39.00” E		
	2	1	8° 59’ 44.26” N, 125° 28’ 41.20” E		
		2	8° 59’ 43.24” N, 125° 28’ 40.42” E		
		3	8° 59’ 42.28” N, 125° 28’ 39.53” E		
	3	1	8° 59’ 41.70” N, 125° 28’ 48.45” E		
		2	8° 59’ 41.32” N, 125° 28’ 46.92” E		
		3	8° 59’ 40.93” N, 125° 28’ 45.84” E		
Buenavista (BMS)	1	1	8° 58’ 31.0” N, 125° 25’ 40.6” E	The Buenavista mangrove area is an urban mangrove site with residential and industrial zones located near the vicinity. Numerous beach resorts and fishing grounds are also in close proximity to this mangrove.	Discharge from domestic sewage, marine fishing and tourism activities.
		2	8° 58’ 30.0” N, 125° 25’ 40.1” E		
		3	8° 58’ 29.4” N, 125° 25’ 39.8” E		
	2	1	8° 58’ 37.3” N, 125° 26’ 03.1” E		
		2	8° 58’ 36.5” N, 125° 26’ 02.78” E		
		3	8° 58’ 35.3 N, 125° 26’ 02.4” E		
	3	1	8° 58’ 43.5” N, 125° 26’ 13.0” E		
		2	8° 58’ 42.8” N, 125° 26’ 12.5” E		
		3	8° 58’ 42.3” N, 125° 26’ 12.1” E		
Nasipit (NMS)	1	1	8° 59’ 25.26” N, 125° 21’ 47.31” E	The Nasipit mangrove area is located near beach resorts and residential homes are found at the banks of this mangrove. Locals also use this mangrove site as food source for endemic crabs, snails and fish.	Discharge from domestic sewage, tourism activities, and marine fishing.
		2	8° 59’ 25.64” N, 125° 21’ 45.64” E		
		3	8° 59’ 26.31” N, 125° 21’ 44.80” E		
	2	1	8° 59’ 23.48” N, 125° 21’ 46.03” E		
		2	8° 59’ 24.16” N, 125° 21’ 45.24” E		
		3	8° 59’ 25.39” N, 125° 21’ 44.47” E		
	3	1	8° 59’ 22.39” N, 125° 21’ 45.23” E		
		2	8° 59’ 23.13” N, 125° 21’ 43.99” E		
		3	8° 59’ 23.98” N, 125° 21’ 42.77” E		

Table S2. Ecological risk and pollution loading indices categories for risk assessment of MPs pollution

Potential ecological risk assessment					
Eri	<40	40-80	80-160	160-320	>320
RI	<150	150-300	300-600	600-1200	>1200
Risk Category	Minor (I)	Medium (II)	High (III)	Danger (IV)	Extreme danger (V)
Pollution loading index					
PLI	<10	10-100	20-30	>30	
Hazard Level	I	II	III	IV	

Source: (Li et al., 2020; Pan et al., 2021)

Table S3. Confirmed number of microplastics per polymer type in the surface water samples of each mangrove site

Polymer type	Sampling sites								
	BCMS			BMS			NMS		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
EVA	0	2	0	1	0	0	0	0	1
GPPS	0	0	0	0	0	1	0	0	0
HDPE	1	0	1	1	1	0	2	2	3
LDPE	4	2	0	9	3	6	4	4	4
NY6	0	0	0	0	0	0	0	0	0
NY66	0	0	0	1	0	0	0	0	0
PET	3	1	1	2	7	6	2	6	0
PMMA	0	0	0	0	0	0	0	0	0
PP	4	1	0	8	4	6	2	2	12
PVC	0	0	1	1	0	1	0	0	1
Total	**12**	**6**	**3**	**23**	**15**	**20**	**10**	**14**	**21**

Table S4. Confirmed number of microplastics per polymer type in the surface water samples of each mangrove site

Polymer type	Sampling sites								
	BCMS			BMS			NMS		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
EVA	3	0	0	1	0	0	0	0	0
GPPS	0	0	0	0	0	0	0	0	0
HDPE	0	1	1	5	4	2	1	2	6
LDPE	0	1	4	12	6	7	0	10	16

Table S4. Confirmed number of microplastics per polymer type in the surface water samples of each mangrove site (cont.)

Polymer type	Sampling sites								
	BCMS			BMS			NMS		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
NY6	1	0	0	1	0	0	0	0	0
NY66	0	0	0	0	0	0	0	0	0
PET	5	4	3	4	3	0	5	0	2
PMMA	1	0	0	0	0	0	0	0	0
PP	2	3	6	22	20	33	18	9	6
PVC	0	0	0	0	0	0	0	0	0
Total	**12**	**9**	**14**	**45**	**33**	**42**	**24**	**21**	**30**

Table S5. Ecological risk evaluation of MPs pollution in the selected mangrove sites

Sampling sites						
Surface water				Sediments		
Eri	BCMS	BMS	NMS	BCMS	BMS	NMS
EVA	6.00	0.60	0.60	4.50	0.50	0.00
GPPS	N/A	N/A	N/A	N/A	N/A	N/A
HDPE	5.50	1.88	9.54	6.20	8.19	8.07
LDPE	14.67	15.20	17.60	10.14	17.97	23.83
NY6	0.00	0.00	0.00	8.33	2.78	0.00
NY66	0.00	4.19	0.00	0.00	0.00	0.00
PET	4.67	5.33	5.33	11.88	1.89	2.00
PMMA	0.00	0.00	0.00	170.17	0.00	0.00
PP	1.00	1.42	1.47	2.38	5.09	2.45
PVC	3333.67	1450.36	666.73	0.00	0.00	0.00
RI	3365.50 (V)	1478.97 (V)	701.27 (IV)	213.60 (II)	36.41 (I)	36.35 (I)
PLI	1.26 (I)	1.19 (I)	1.33 (I)	1.54 (I)	1.64 (I)	1.38 (I)

Note: GPPS do not have assigned hazard score. Roman numerals (I, II, III, IV, and V) correspond to the risk and hazard level categories as outlined in Table S2.

REFERENCES

Li R, Yu L, Chai M, Wu H, Zhu X. The distribution, characteristics and ecological risks of microplastics in the mangroves of Southern China. Science of the Total Environment 2020:708;Article No. 135025.

Pan Z, Liu Q, Jiang R, Li W, Sun X, Lin H, et al. (2021). Microplastic pollution and ecological risk assessment in an estuarine environment: The Dongshan Bay of China. Chemosphere 2021:262;Article No. 127876.