

Methane Emission from Mangrove Wetland Soils Is Marginal but Can Be Stimulated Significantly by Anthropogenic Activities

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Table S1. CH₄ and CO₂ effluxes from ZJ and QL mangrove wetlands.

Mangrove Wetlands	Tidal Position	Species	Wet Season		Dry Season	
			CH ₄ ($\mu\text{mol m}^{-2} \text{h}^{-1}$)	CO ₂ ($\text{mmol m}^{-2} \text{h}^{-1}$)	CH ₄ ($\mu\text{mol m}^{-2} \text{h}^{-1}$)	CO ₂ ($\text{mmol m}^{-2} \text{h}^{-1}$)
ZJ	LW	KO	123.59±41.79b	2.42±0.19a	1.87±1.29A	1.80±0.13A
	MZ	KO	8.80±8.80a	3.67±1.16a	0.73±0.73A	1.52±0.29A
	SW	KO	3.57±13.76a	4.91±0.98a		
QL	LW	BS,HL	1.13±1.70a	9.50±2.70a	0.65±0.91A	3.52±1.17A
	MZ	BS,RA	14.18±6.35a	9.14±2.69a	7.88±4.29A	3.80±0.93A
	SW	Mixed	2.57±3.43a	0.94±0.41a	1.68±7.96A	0.98±0.13A

ZJ: Zhangjiang Estuary Mangrove National Natural Reserve; QL: Qinglan Harbour Mangrove Provincial Natural Reserve; LW: Landward zone; MZ: Middle zone; SW: Seaward zone; KO: *Kandelia obovata* (red mangrove) community; BS: *Bruguiera sexangula* (upriver orange mangrove) community; HL: *Heritiera littoralis* (looking-glass mangrove) community; RA: *Rhizophora apiculata* (red mangrove) community; Mixed: Mixed species community. Error bars represent the standard error (SE) of the means (n = 4). Different letters indicate significant difference among tidal positions for each period (wet and dry seasons) according to ANOVA test ($p < 0.05$).

Table S2. Summary of CH₄ efflux data as reported by authors or calculated from literature in other mangrove wetlands.

Region	Name	Location	Country	Year	Eutrophic Status	Mangrove Area (ha)	CH ₄ Efflux (μmol m ⁻² h ⁻¹)	References
Tropical	North Sulawesi	1°23'02"N, 125°05'46" E	Indonesia	2013	Undisturbed		-6.05-13.14	[1]
	Mtoni creek	6°05'00"S, 39°41'00" E	Tazania		Undisturbed	400	1.3-79	[2]
	Ranong Biosphere Reserve	9°30'48"N, 98°21'00" E	Southern Thailand	2002	Undisturbed	10927	0.49-1.35	[3]
	Pichavaram	11°27'00"N, 79°47'00" E	India	2001	Undisturbed	1400	19.22	[4]
	Wright Myo	11°47'28"N, 92°42'24" E	Eastern India	2004	Undisturbed		17.8-28.8	[5]
	Puerto Rico	18°00'00"N, 67°00'00" W	USA	1994	Undisturbed		0.78-8.85	[6]
	Qinglan Harbour	19°37'48"N, 110°46'12" E	China	2016	Undisturbed	1223.3	0.65-14.18	this study
	Dongzai Harbor	19°51'00"N, 110°24'00" E	China	1996-1997	Undisturbed	1578.2	0.86-2.78	[7]
Subtropical	Bhitarkanika	20°40'00"N, 86°45'00" E	East India	2008	Undisturbed	67200	53.75	[8]
	Zhangjiang Estuary	23°55'49"N, 117°24'54" E	China	2014	Undisturbed	2360	0.73-8.80	this study
	Balandra Lagoon	24°20'00"N, 110°20'00" W	Mexico	1995	Undisturbed		not detectable	[9]
Subtropical	Jiulong River Estuary	24°23'00"N, 117°54'00" E	China	2002-2003	Undisturbed	10	0.21-2.75	[10]
	Jiulong River Estuary	24°23'00"N, 117°54'00" E	China	2013	Undisturbed		2.34-17.28	[11]
	Kang-nan wetland	24°45'00"N, 120°53'00" E	Taiwan, China	1995-1999	Undisturbed		2.50-5.63	[12]
Tropical	Everglades National Park	25°08'54"N, 80°55'00" W	South Florida	1980-1985	Undisturbed	244.4	4.95-20.05	[13]
	Muthupet	10°20'00"N, 79°32'00" E	South India	2002-2003	Anthropogenic	6803	49.45-97.73	[14]
	Pichavaram	11°27'00"N, 79°47'00" E	India	2001	Anthropogenic	1400	56.15	[4]
	Pichavaram	11°27'00"N, 79°47'00" E	India	1998-1999	Anthropogenic	241	19.27-165.89	[15]
	Puerto Rico	18°00'00"N, 67°00'00" W	USA	1994	Anthropogenic	32	9.64-47.92	[6]
	Bhitarkanika	20°40'00"N, 86°45'00" E	East India	2008	Anthropogenic	67200	72.24	[8]
	Shenzhen and Hongkong	22°30'20"N, 114°00'05" E	China	2008	Anthropogenic		10.10-5168.62	[16]
Subtropical	Zhangjiang Estuary	23°55'49"N, 117°24'54" E	China	2014	Anthropogenic	2360	14.18	this study
	Jiulong River Estuary	24°23'41"N, 117°54'43" E	China		Anthropogenic		0.64-133.81	[17]
	Queensland	27°30'00"S, 153°30'00" E	Australia	1998-1999	Anthropogenic		1.25-21.88	[18]
	Queensland	27°33'00"S, 152°59'00" E	Australia	2004-2005	Anthropogenic	14386	0.19-1087.50	[19,20]

Table S3. Nutrient concentrations and assignment of eutrophic status.

Name	TP ($\mu\text{g g}^{-1}$)	TN ($\mu\text{g g}^{-1}$)	NO ₃ ⁻ ($\mu\text{g g}^{-1}$)	NH ₄ ⁺ ($\mu\text{g g}^{-1}$)	Agricultural Sewage	Domestic Sewage	Aquaculture Sewage	Others	Eutrophic Status	References
North Sulawesi		1.62-4.56	1.53-13.67	4.99-12.19	N	N	N		Undisturbed	[1]
Mtoni creek	6.19				N	N	N	High sulfide smell	Undisturbed	[2]
Ranong Biosphere Reserve		2.3-3.2			N	N	N		Undisturbed	[3]
Pichavaram					Y	N	N		Undisturbed	[4]
Wright Myo, Andaman Island			0.03-0.23*	0.07-0.43*	N	N	N		Undisturbed	[5]
Puerto Rico					N	N	N		Undisturbed	[6]
Qinglan Harbour		0.7-7.3	1.28-4.31	2.26-8.02	N	N	N		Undisturbed	this study
Dongzai Harbor					N	N	N		Undisturbed	[7]
Bhitarkanika					N	N	N		Undisturbed	[8]
Zhangjiang Estuary		1.4-1.7	0.15	9.09	N	N	N		Undisturbed	this study
Balandra Lagoon	0.8-16	0.3-5.7			N	N	N		Undisturbed	[9]
Jiulong River Estuary		0.77-1.20			N	N	N		Undisturbed	[10]
Jiulong River Estuary	0.35-0.88	1.13-1.99	0.46-1.08	0.67-11.14	N	N	N		Undisturbed	[11]
Kang-nan wetland		1.50	3.00	20.00	N	N	N		Undisturbed	[12]
Everglades National Park					N	N	N		Undisturbed	[13]
Muthupet			0.21-0.45 *	0.58-1.41 *	Y	N	Y		Anthropogenic	[14]
Pichavaram					Y	Y	N		Anthropogenic	[4]
Pichavaram	0.07-0.08 *				Y	Y	N		Anthropogenic	[15]
Puerto Rico			24.8*		N	N	N	Discharge from a sewage treatment plant	Anthropogenic	[6]
Bhitarkanika					Y	N	Y	Deforestation	Anthropogenic	[8]
Shenzhen and Hongkong	0.10-1.62	0.3-1.9	0.65-1.64	5.46-50.05	N	N	N	Discharge from polluted rivers	Anthropogenic	[16]

Name	TP ($\mu\text{g g}^{-1}$)	TN ($\mu\text{g g}^{-1}$)	NO ₃ ⁻ ($\mu\text{g g}^{-1}$)	NH ₄ ⁺ ($\mu\text{g g}^{-1}$)	Agricultural Sewage	Domestic Sewage	Aquaculture Sewage	Others	Eutrophic Status	References
Zhangjiang Estuary		1.5	0.14	9.50	N	Y	Y		Anthropogenic	this study
Jiulong River Estuary		1.5-1.9	0.51-0.96	4.12-14.31	N	N	Y	Deforestation	Anthropogenic	[17]
Queensland					N	Y	N	Discharge from a sewage treatment plant	Anthropogenic	[18]
Queensland		1.44-1.87	1.00-25.00	50-580	N	Y	N	Discharge from a sewage treatment plant	Anthropogenic	[19,20]

TP: Total phosphorus concentration from soils; TN: Total nitrogen concentration from soils; NO₃⁻: Nitrate concentration from soils; NH₄⁺: Ammonium concentration from soils; * represents the nutrient concentration from water.

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