

Supplementary Materials: Occurrence, bioaccumulation, metabolism and ecotoxicity of fluoroquinolones in the aquatic environment: A review

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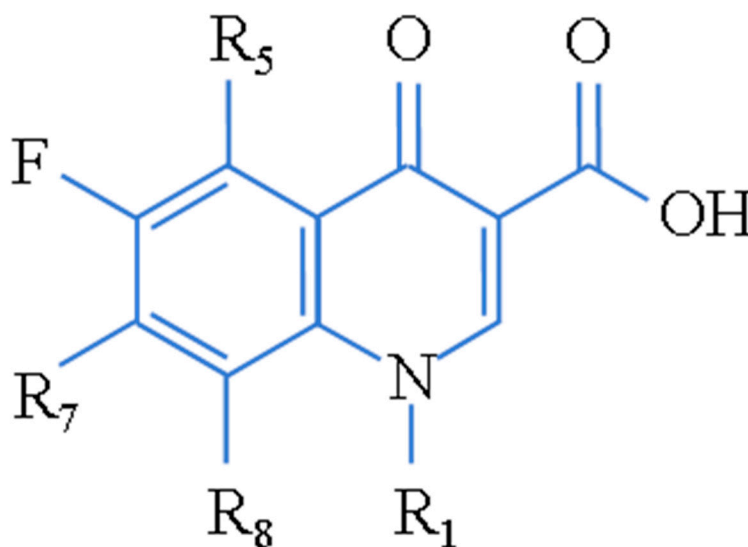
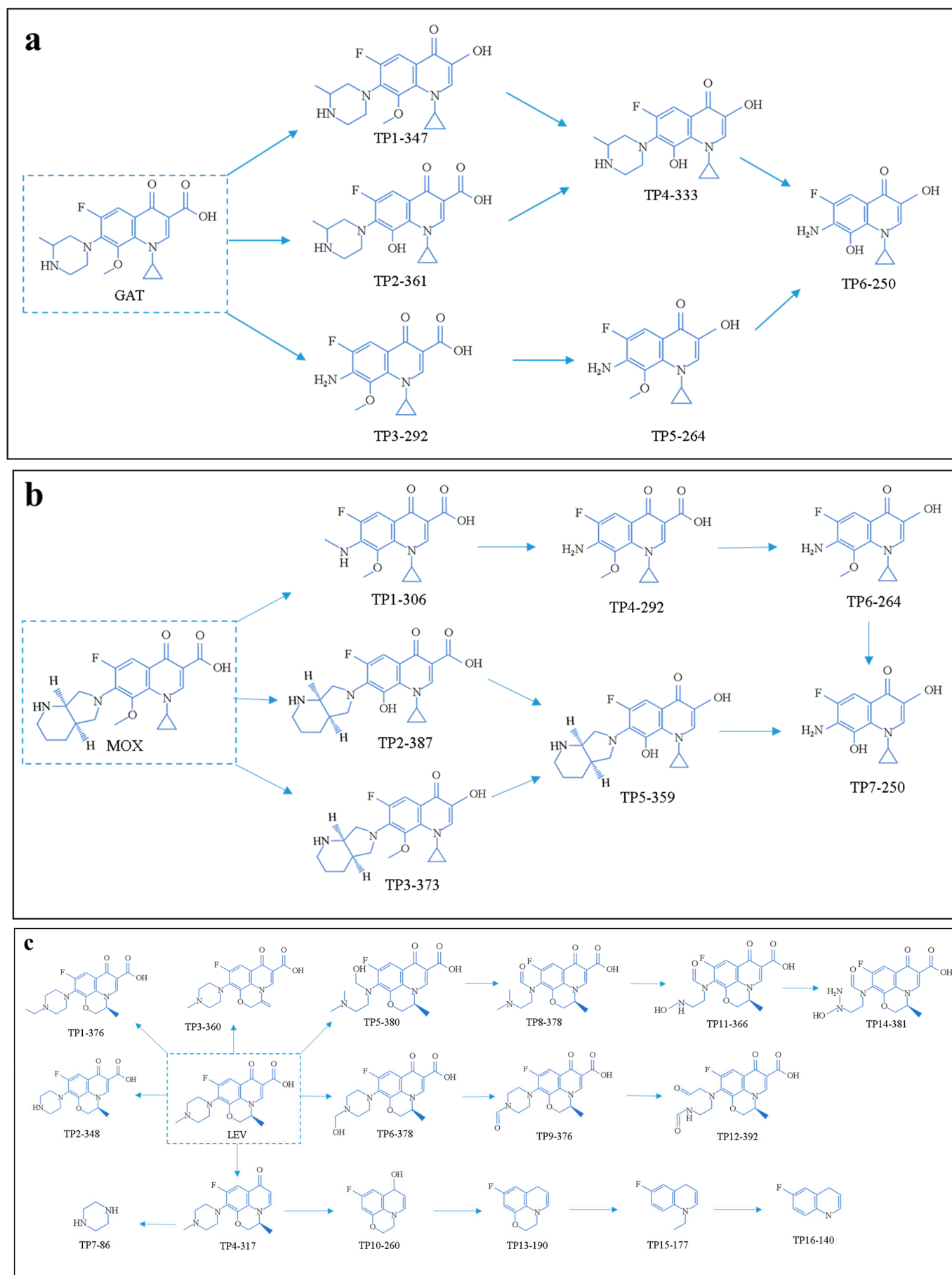


Figure S1. The structural formula of FQ.



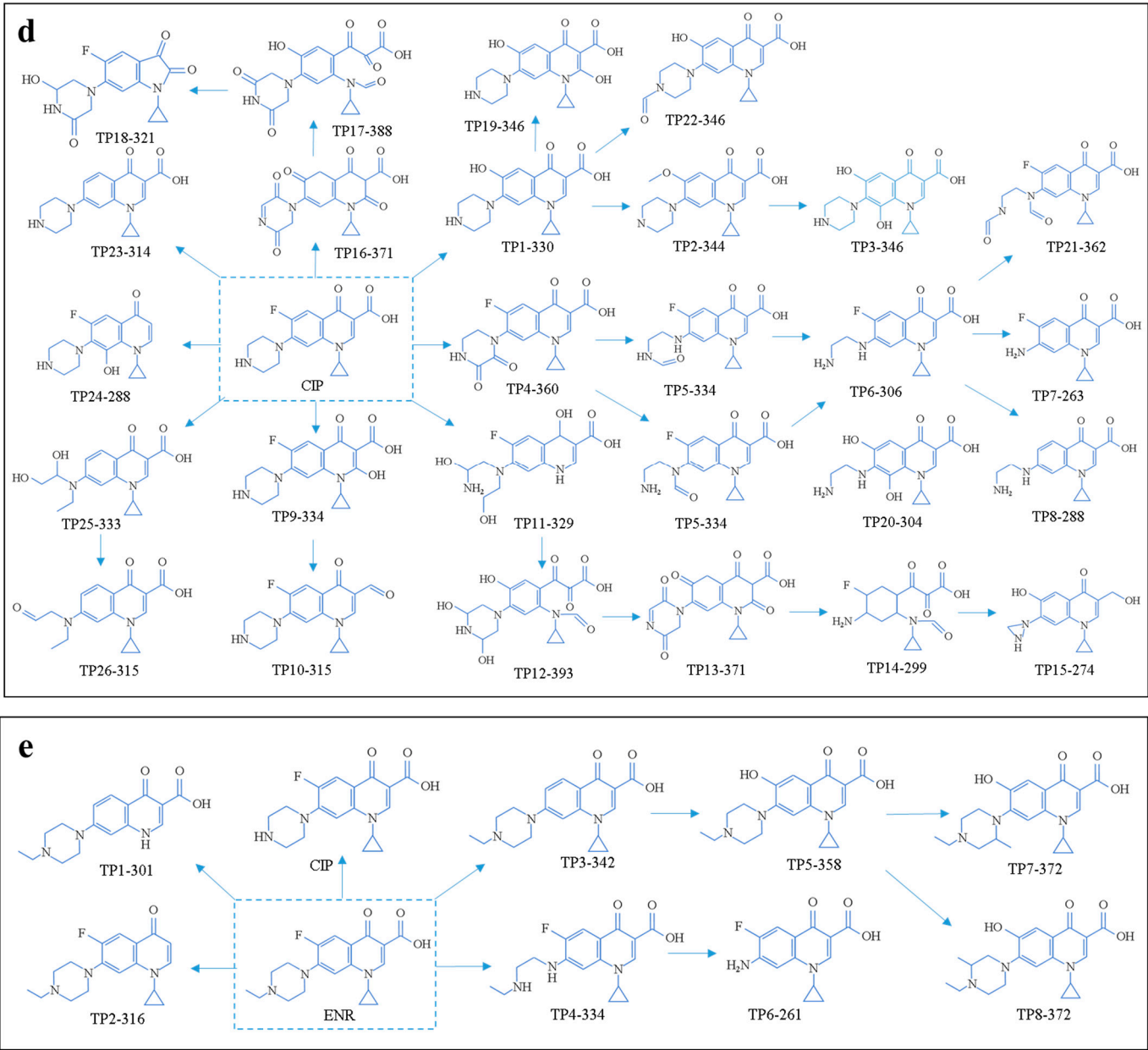
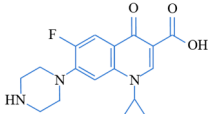
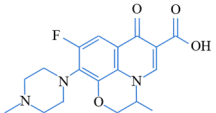
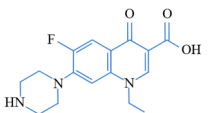
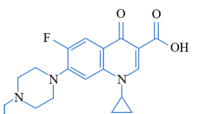
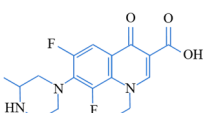
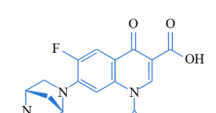
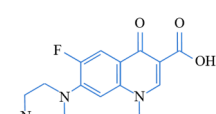
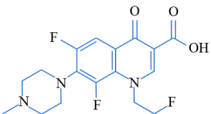
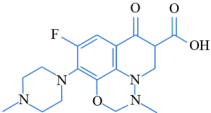
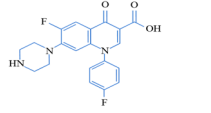
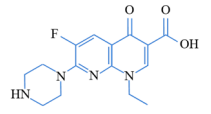
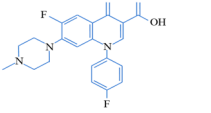
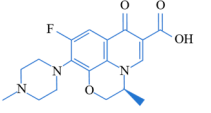


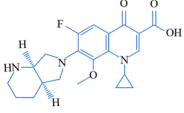
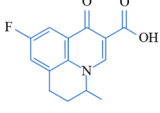
Figure S2. The metabolites and possible pathways of GAT (a), MOX (b), LEV (c), CIP (d), and ENR (e) biodegradation in aquatic organisms. Table S1. Physicochemical properties of selected FQs.

Table S2. Minimum, maximum, mean, and median concentrations of representative FQs detected in different surface water.

Compound	Molecular	Chemical Structure	CAS	Molecular	Log	pKa	References
	Formula		number	Mass	Kow		

Ciprofloxacin	C ₁₇ H ₁₈ FN ₃ O ₃		85721-33-	331.34	0.28	5.56/8.77	[1]
			1				
Ofloxacin	C ₁₈ H ₂₀ FN ₃ O ₄		82419-36-	361.38	-0.39	5.35/6.72	[1]
			1-0				
Norfloxacin	C ₁₆ H ₁₈ FN ₃ O ₃		70458-96-	319.33	-1.03	5.58/8.77	[1]
			7				
Enrofloxacin	C ₁₉ H ₂₂ FN ₃ O ₃		93106-60-	359.39	1.1	6.19/7.59	[2]
			6				
Lomefloxacin	C ₁₇ H ₁₉ F ₂ N ₃ O ₃		98079-51-	351.35	-0.3	-	[2]
			7				
Danofloxacin	C ₁₇ H ₂₀ FN ₃ O ₃		112398-	357.38	0.44	5.65/6.73	[1]
			08-0				
Pefloxacin	C ₁₇ H ₂₀ FN ₃ O ₃		70458-92-	333.36	0.27	5.55/7.01	[1]
			3				

Compound	Molecular Formula	Chemical Structure	CAS number	Molecular Mass	Log Kow	pKa	References
Fleroxacin	C ₁₇ H ₁₈ F ₃ N ₃ O ₃		79660-72-3	369.34	0.24	5.44/6.06	[1]
Marbofloxacin	C ₁₇ H ₁₉ FN ₄ O ₄		115550-35-1	362.35	-2.92	5.38/6.16	[1]
Sarafloxacin	C ₂₀ H ₁₇ F ₂ N ₃ O ₃		98105-99-8	385.36	1.07	5.55/8.76	[1]
Enoxacin	C ₁₅ H ₁₇ FN ₄ O ₃		74011-58-8	320.32	-0.20	5.50/8.59	[3]
Difloxacin	C ₂₁ H ₁₉ F ₂ N ₃ O ₃		98106-17-3	399.39	0.89	-	[4]
Levofloxacin	C ₁₈ H ₂₀ FN ₃ O ₄		100986-85-4	361.37	0.51	5.7	[5]

Moxifloxacin	C ₂₁ H ₂₄ FN ₃ O ₄		151096-	401.43	0.95	-	[4]
			09-2				
Flumequine	C ₁₄ H ₁₂ FN ₃ O ₃		42835-25-	261.25	1.60	6.50	[3]

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Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
Ciprofloxacin	USA	Columbia River			0.021			[5]
		Sacramento River			0.14			[5]
		Surface water			116			[6]
	Australia			1300		70	30	[6]
	Argentina				102.04			[7]
	Bangladesh	Aftabnagar Lake	ND	88	30		67	[8]
		Rampura Canal	455	1407	766		100	[8]
		Trimohoni pump	ND	16	0		67	[8]
		Trimohoni River	466	754	624		100	[8]
	Brazil	Doce river watershed	171.93	3993.61	2277.61			[9]
	China	Beibu Gulf	ND	2.76	0.57	0.46	71	[10]
		Beijing		30.7	<10			[11]
		Beijing	ND	12.8		3.5	63	[12]
		Beiyangdian Lake	19.02	32.03	27.75	29.77	100	[13]
		Bohai Estuarine water	17	200	75	48		[14]
		Bohai region	0.42	21.56	2.27	1.48	54.29	[15]
		Bohai Sea	ND	346	101			[16]
		Bohai Seawater	5.2	85	38	42		[14]
		Chaohu Lake		23.15	<2.5			[17]
		Chaohu Lake	ND	21.35	3.47	ND	16	[18]
		Chaohu Lake			23.2			[19]
		Changzhou	1.5	4.7		4		[12]
		Dongting Lake	ND	27.02	0.64		2.37	[20]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Dongting Lake	ND	134	29.9		70%	[21]
		Eastern China	0.019	30	5.56	1.2	100%	[22]
		Estuary		2.28				[23]
		Guangdong	ND	43.76		1.1	77.8%	[24]
		Guangxi	3	<7	<4			[25]
		Guilin	142.59	244.63	177.21	171.15	100%	[26]
		Haikou	0.12	0.63				[27]
		Hanjiang River	ND	4.4				[19]
		Hetao Irrigation District	0.83	161.47	14.42		100%	[28]
		Hong Kong River		16.74	1.55	1.2	100%	[29]
		Houguanxia Lake			6.3			[30]
		Huangpu River	ND	34.2				[19]
		Jiangnan Plain	4.46	96	25.14			[16]
		Laizhou Bay			66			[31]
		Liaohe River Basin	ND	5.02	0.17		3.45%	[4]
		Mediterranean River	21.3	59.16				[19]
		Nansi Lake	ND	0.85	0.1			[32]
		North China Plain	ND	10.71	0.19		2.47%	[33]
		Peal River		365				[34]
		Peal River	4.24	49.9	9.94		100%	[35]
		Shatian Lake	1.2	7.6	2.72	2.4	100%	[36]
		Songhua River		80.54				[34]
		Surface water	0.1	2850	153.5	26.7		[37]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Surface Water		1729		11.44		[38]
		Surface Water		551.4	68.99			[6]
		Surface Water	ND	450.2	145.13	134.2	83.33%	[39]
		Surface water in basins	0.1	230	57.96	15.3		[37]
		Suzhou	ND	90.5	10.02	4.73	96.09%	[40]
		Tianjin	0.35	14.4	1.97	1.29	100%	[41]
		Wangyang River	238.3	551.4				[42]
		WWPTs		<100				[43]
		Xiaoqing River	ND	552.38	18.16			[44]
		Xiaoqing River	ND	877	125		82.1%	[45]
		Xiaoqing River (Mainstream)	LOQ	2715	95.7		59.7%	[46]
		Xiaoqing River (Tributaries)	LOQ	1857	83.7		56.9%	[46]
		Xinjiang Uygur Autonomous	2.1	3.35	2.72		100%	[1]
		Xiong'an New Area	ND	15.77			85%	[3]
		Yang River		1.20				[23]
		Yangjie River	0.77	4.32				[19]
		Yangtze River	ND	0.94	0.34			[16]
		Yangtze River		283.5				[34]
		Yangtze River	ND	46.68	8.1			[47]
		Yangtze River	ND	0.94	0.34		67%	[48]
		Yellow River			37.73			[34]
		Yellow River (Mainstream)	LOQ	1476	406		36.4%	[46]
		Yellow River (Tributaries)	LOQ	4467	633		46%	[46]
		Yellow River (Henan)	ND	10.1	3.03		66.67%	[49]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Zhejiang	0.1	<20	<10			[50]
	Costa Rica	Surface Water	160	1330	160		18%	[42]
	Croatia	Sava	0.39	5.38	2.04	1.24	100%	[51]
	Cyprus	Surface Water	252.3	316.8	284.55			[52]
	Finland	Surface Water	38.4	43.2	40.8			[52]
		Surface Water			20			[31]
	France	Charmoise River	5	1523	288			[16]
		Surface Water		1523	90.42			[6]
		Surface Water		25				[53]
	Germany	Surface Water	43.8	230.6	137.2			[52]
	Global	Surface Water	ND	542452				[54]
	India	Chennai city	10.5	186.1	31.95		100%	[55]
		Ganges	LOQ	26.8	7.7	5	63.3%	[56]
	Iran	Ekbatan	127	248				[31]
		Firozaba River			656.8			[19]
		Kan River			22.7			[19, 31]
		Kan River	552.6	796.2				[31]
	Ireland	Surface Water	234	259.8	246.9			[52]
	Italy	Surface Water			7.7			[57]
		Surface Water		16	8.8			[6]
	Kenya	Jujia drain	20300	75700	48700	52300	100%	[58]
		Nzoia River Basin		8.6	0.9		23.81%	[59]
		Surface Water	12	510				[19]
		Surface Water	500	2800	1775		100%	[60]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Surface Water	ND	1300				[16]
	Korea	Chungcheong Province		0.52				[53]
	Malaysia	Gombak River	225.18	299.88	267.2			[61]
		Larut River	LOQ	577.97	56.41		55.56%	[62]
		Lui River	52.5	138.7				[63]
	Norway	Surface Water	159.2	159.2	159.2			[52]
	Pakistan	Lahore		0.07				[53]
	Peru	Titicaca Lake	85.5	408.2	201		100%	[64]
	Poland	Surface Water	12	182	99.25		100%	[65]
		Surface Water		277	24.83			[6]
	Portugal	Leca River	ND	339				[16]
		Surface Water		88.7		88.7	1.82%	[6]
		Tejo Estuary	1.56	7.14				[19]
		Surface Water			88.7			[57]
		Surface Water	231.4	584.9	424.53			[52]
	Romania	Cluj Napoca		77.53				[53]
		Surface Water			15			[57]
	Spain	Baix Fluvià			211.8			[31]
		Barcelona		443				[53]
		Ebro delta	80	5875	2027.5			[66]
		Mijares River	ND	1105				[67]
		NE Catalonia		77.2				[53]
		Surface Water		740	30.99			[6]
		Ter River	48.2	72.4				[19]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
	Sweden	Surface Water	1	93.9				[57]
		Surface Water	200.3	200.3				[52]
		Surface Water	LOQ	33.66			29%	[68]
		Surface Water			17.78			[57]
		Surface Water	LOQ	560	48.64	5.05		[69]
	Turkey	Surface Water		13567	50.55			[6]
	Uganda	Victoria Lake	2	41		15	91%	[70]
		Surface Water	29	88				[71]
	Vietnam	Hanoi	ND	990		ND	13%	[72]
Ofloxacin	USA	Surface Water		182				[6]
	Argentina	Surface Water			34.14			[7]
	China	Beibu Gulf	ND	0.46	0.07	0.02	58%	[10]
		Beijing		717.3		60.9		[11]
		Beijing	2	200.6		4.2	100%	[12]
		Beiyangdian Lake	11	11.45	11.27	11.28	100%	[13]
		Bohai Estuarine	3.2	30	9.3	9.2		[14]
		Bohai region	0.21	43.63	1.36	0.38	3.97%	[15]
		Bohai Sea (North China)	ND	45.4	9.9			[16]
		Bohai Seawater	3	11	6.6	6.4		[14]
		Changzhou	3.6	8.2		3.1	100%	[12]
		Chaohu Lake			383.4			[31]
		Chaohu Lake	ND	50.6				[19]
		Dianchi Lake	ND	713.6				[31]
		Dongting Lake	6.77	943.49	87.15		100%	[20]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Dongting Lake	ND	LOQ	LOQ		20%	[21]
		Estuary		2.63				[23]
		Fenhe River	18.21	283.34	<106.74			[73]
		Fuxian Lake	0.77	7.3	3.4		100%	[74]
		Guangdong	0.57	17.31		2.58	100%	[24]
		Guangxi	50	<650	<150			[25]
		Guilin	ND	290.78	96.07	ND	40%	[26]
		Hanjiang River	ND	9.5				[19]
		Hetao Irrigation District	0.82	253.51	12.92		100%	[28]
		Hong Kong River		12.98	1.49	1.14	100%	[29]
		Huangpu River	ND	28.5	6.5			[16]
		Huangpu River	ND	28.5				[19]
		Hubei Province	2.21	127.4				[31]
		Jiangnan Plain	ND	45.3	9.03			[16]
		Jiaozhou Bay			16.7			[75]
		Kaidu River and Boaten	ND	<5			80%	[76]
		Laizhou Bay	ND	6.2				[19]
		Liaohe River Basin	ND	27.21	3.68		27.59%	[4]
		Liaohe River (Jilin)			67.1			[31]
		Main River	ND	4.3				[19]
		Nansi Lake	ND	50	3.13		85.33%	[32]
		Pearl River	0.6	60.3	8.52		100%	[35]
		Pearl River			6.93			[31]
		Pearl River	53	108				[19]

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Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Shatian Lake	0.1	0.6	0.25	0.2	100%	[36]
		Songhua River		14.1				[34]
		Surface Water	0.1	5100	134.8	15.2		[37]
		Surface Water		127400		11.02		[38]
		Surface Water		11734.6				[6]
		Surface Water	ND	5.98	3.18	2.62	71.4%	[77]
		Surface Water in Basins	ND	118.1	22.67	6.4		[37]
		Suzhou	ND	195	10.18	3.47	99.22%	[40]
		Taihu Lake	<1	<1	<1			[78]
		Taihu Lake	7.45	17.01				[31]
		Tianjin	LOQ	44.4	3.3	1.44	100%	[41]
		Wanfeng Lake		246.96	169.48	149.58	100%	[79]
		Wangyang River	668.3	11734.6				[80]
		Wuhan City WWTPs	LOQ	4.4	1.45		66.67%	[30]
		Xiaoqing River	ND	<7500				[43]
		Xiaoqing River	ND	6374.45	241.39			[44]
		Xiaoqing River	0.5	240	38.2		100%	[45]
		Xiaoqing River (Mainstream)	4.48	368	64.9		67.7%	[46]
		Xiaoqing River (Tributaries)	3.6	1371	54.1		60%	[46]
		Xinjiang Uygur Autonomous	0.75	3.55	1.39	1.17	100%	[1]
		Xiong'an New Area	ND	76.25			69%	[3]
		Yang River		12.95				[23]
		Yangtze River	ND	0.82	0.32		75%	[48]
		Yangtze River	ND	48.92	7.89			[47]

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Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Yangtze River		30.6				[34]
		Yangtze River	ND	0.82	0.32			[16]
		Yangtze River (Nanjing)	ND	34.66	3.27			[81]
		Yanjie River	0.14	4.49				[80]
		Yellow River			119			[31]
		Yellow River (Mainstream)	3.2	329	10.9		54.5%	[46]
		Yellow River (Tributaries)	LOQ	491	11.4		57.1%	[46]
		Yellow River (Henan)	ND	511	11.65		72%	[49]
		Zhejiang	0.1	97.5	<3			[50]
		Zhuhai			114.9			[82]
	Costa Rica	Surface Water	90	1250	670		7%	[42]
	Cyprus	Surface Water	196.7	305.1	250.9			[52]
	Finland	Surface Water	20	22.8	21.4			[52]
	France	Charmoise River	100	2888	1209			[16]
		Surface Water		19.7				[53]
		Surface Water		2888	113.52			[6]
	Germany	Surface Water	ND	66.5	33.25			[52]
	Global	Surface Water	ND	6840				[54]
	India	Chennai City	0.8	222.8	80.38		100%	[55]
		Ganges	LOQ	1.4	1	1.1	11.1%	[56]
		Kshipra River	640	1460	985.71			[83]
		Surface Water		11000	4284.55			[6]
	Ireland	Surface Water	39.9	65.4	52.65			[52]

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Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
	Italy	Surface Water		18.06	10.09			[6]
	Korea	Chungcheong Province		0.70				[53]
	Malaysia	Larut River	LOQ	253.09	21.47		33.33%	[62]
	Norway	Surface Water	27.1	27.1	27.1			[52]
	Poland	Bialka River	0.73	13.71	3.47	2.16		[84]
		Surface Water		89	8.83			[6]
		River	4	32	18.85		100%	[65]
	Portugal	Leca River	ND	120				[16]
		Surface Water	89.7	184.9	135.8			[52]
	Spain	Barcelona		79.5				[53]
		Ebro Delta	137	1161	535			[66]
		Ebro River	ND	78.6				[80]
		NE Catalonia		18.2				[53]
		Surface Water		8770	210.74			[6]
		Surface Water	142.3	142.3	142.3			[52]
		Ter River	100.7	137.6				[80]
		Tributaries	ND	79.9				[80]
		Valencia Region	1547	4778				[80]
	Sweden	Surface Water	LOQ	37.5	2.75			[69]
	United States	Surface Water		13.53				[53]
	Vietnam	Hanoi	ND	630		ND	38%	[72]
Norfloxacin	USA	Chesapeake Bay	59.2	94.1				[80]
	Brazil	Surface Water		285			42%	[85]
	China	Beibu Gulf	0.43	6.17	2.1	1.83	100%	[10]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Beijing		290.2	<50			[11]
		Beijing	ND	47		28.5	88%	[12]
		Beiyangdian Lake	16.9	22.95	19.14	18.4	100%	[13]
		Bohai Estuarine	40	230	146	137		[14]
		Bohai Region	0.33	25.52	1.65	0.92	68.57%	[15]
		Bohai (North China)	ND	572	118			[16]
		Bohai Seawater	8.4	134	57	59		[14]
		Chaohu Lake		24.18	<5			[17]
		Changzhou	63.8	70.9		69.3	100%	[12]
		Chaohu Lake	ND	19.11	1.59	ND	8%	[18]
		Chaohu Lake	ND	70.2				[80]
		Dongting Lake	ND	6.22	4.52		40%	[21]
		Dongting Lake	ND	12.17	0.29		2.37%	[20]
		Eastern China	0.07	53	8.93	0.75	100%	[22]
		Guangdong	1.77	53.81		4.65	88.9%	[24]
		Guangxi	3	<7	<4			[25]
		Guilin	ND	187.56	110.17	177.61	60%	[26]
		Hangzhou	7	12.9				[27]
		Hanjiang River	ND	6.4				[80]
		Hetao Irrigation District	6.51	220.91	43.71		100%	[28]
		Hong Kong River		7.38	1.13	0.97	100%	[29]
		Huangpu River	ND	0.2				[80]
		Jiangnan Plain	9.57	277	65.87			[16]
		Laizhou Bay	7.5	103				[80]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Liaohe River	ND	13.65	0.65		6.9%	[4]
		Nanjing	146.72	290.2				[31]
		Nansi Lake	ND	1	0.24		52.33%	[32]
		North China	ND	7.92	1.96		51.85%	[33]
		Pearl River			68.06			[31]
		Pearl River	5.49	27.2	10.33		100%	[35]
		Shatian Lake	1.2	7.4	2.71	2.2	100%	[36]
		Songhua River		268.86				[34]
		Surface Water		6800		10.36		[38]
		Surface Water	0.1	6800	192.8	37.1		[37]
		Surface Water in Basins	1.8	64.4	29.64	22.9		[37]
		Suzhou	1.17	556	100.5	57.59	100%	[40]
		Taihu Lake	15.83	56.22				[31]
		Taihu Lake	<1	<1	<1			[78]
		Tianjin	1.42	16.6	5.76	5.1	100%	[41]
		Wangyang River	199.4	617.1				[80]
		WWTPs		<2500				[43]
		Xiaoqing River	ND	888.07	31			[44]
		Xiaoqing River (Mainstream)	LOQ	2477	13.9		35.5%	[46]
		Xiaoqing River (Tributaries)	LOQ	9173	11.1		33.8%	[46]
		Xinjiang Uygur Autonomous	2.91	9.85	4.81	4.33	100%	[1]
		Xiong'an New Area	ND	30.66			67%	[3]
		Yangtze River	0.11	2.37				[80]
		Yangtze River	ND	0.83	0.32		67%	[48]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Yangtze River		278.2				[34]
		Yangtze River (Nanjing)	146.72	290.2	180.93		100%	[81]
		Yellow River			26.03			[34]
		Yellow River	6.14	382.3	43.47	23.84	100%	[2]
		Yellow River			327			[31]
		Yellow River (Tributaries)	LOQ	10088	524		33.3%	[46]
		Yellow River (Henan)	ND	3450	86.13		96%	[49]
		Zhejiang	0.1	<10	<2			[50]
France		Charmoise River	14	1261	289			[16]
		Seine River			163			[31]
Global		Surface Water	ND	251137				[54]
India		Chennai City	0.5	20.9	4.33		88%	[55]
		Kshipra River	640	980	752.86			[83]
Kenya		Juja Drain	10500	52600	37500	41400	93%	[58]
		Surface Water	600	4900	2325		100%	[60]
		Surface Water	ND	2200				[16]
Korea		Chungcheong Province		1.27				[53]
Malaysia		Larut River	LOQ	2.55	0.37		33.33%	[62]
Poland		River	LOQ	95	23.75		25%	[65]
Romania		Cluj Napoca		8.15				[53]
Spain		Barcelona		123				[53]
		Ebro Delta	25	497	236			[66]
		Mijares River	ND	940				[67]
		NE Catalonia		30.3				[53]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
	Switzerland	Surface Water	LOQ	3.2			4%	[68]
		Karst System		2				[53]
	Tunisia	Mediterranean Sea	ND	20700				[80]
	Uganda	Victoria Lake	1.9	26		14	99%	[70]
Enrofloxacin	USA	Chesapeake Bay	8	17				[80]
	Asia		ND	30000	14.6			[86]
	Brazil	Doce River	73.2	566	351.27			[9]
		Watershed						
	China	Surface Water		71			50%	[85]
		Beibu Gulf	ND	1.1	0.25	0.19	87%	[10]
		Beijing	4.8	29.9		18.3	100%	[12]
		Bohai Estuarine	3.9	27	11	9		[14]
		Bohai Region	0.21	16.79	1	0.61	69.29%	[15]
		Bohai Sea (North China)	ND	24.6	10.6			[16]
		Bohai Seawater	3	11	6.2	6.1		[14]
		Chaohu Lake		25.16	<6			[17]
		Chaohu Lake	ND	4.7				[80]
		Changzhou	20.2	26.8		22.8	100%	[12]
		Dongting Lake	ND	4.82	3.61		23.5%	[21]
		Dongting Lake	ND	63.75	2.7		16.67%	[20]
		Eastern China	0.02	24.1	3.59	0.65	100%	[22]
		Estuary		0.14				[23]
		Guangdong	0.93	9.1		1.25	100%	[24]
		Guangxi	3	<7	<4			[25]
		Guilin	184.71	673.13	342.66	248.27	100%	[26]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Hangzhou	10.5	18.7				[27]
		Hanjiang River	ND	3.6				[80]
		Hetao Irrigation District	0.81	14.24	4.64		100%	[28]
		Hong Kong River		3.85	0.54	0.49	1005	[29]
		Honghu Lake		<5				[87]
		Huangpu River	ND	14.6	2.8			[16]
		Jiangnan Plain	ND	136	35.56			[16]
		Laizhou Bay	ND	7.6				[80]
		Laizhou Bay			209			[31]
		Liaohe River Basin	ND	5.47	0.35		13.79%	[4]
		Mediterranean River	2.87	154.34				[80]
		Nansi Lake	ND	0.94	0.21		53.33%	[32]
		North China	ND	33.29	1.43		45.68%	[33]
		Shatian Lake	1.1	15	6.05	4.9	100%	[36]
		Songhua River		16.4				[34]
		Surface Water		5681.9		9.18		[38]
		Surface Water	ND	900	36.8	6.6		[37]
		Surface Water in Basins	1.4	59.7	16.63	8.2		[37]
		Suzhou	0.68	67.3	14.76	11.19	100%	[40]
		Taihu Lake	<1	<1	<1			[78]
		Wangyang River	242.6	978.8				[80]
		Xiaoqing River	ND	146.51	3.63			[44]
		Xiaoqing River (Mainstream)	LOQ	11890	72.1		72.1%	[46]
		Xiaoqing River (Tributaries)	LOQ	15375	75.4		60%	[46]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Xiong'an New Area	ND	2.82			51%	[3]
		Yang River		0.61				[23]
		Yangjie River	0.53	5.56				[80]
		Yangtze River	ND	0.89	0.4		83%	[48]
		Yangtze River (Nanjing)	3	26.24	11.92		100%	[81]
		Yellow River	8.83	206.7	27.35	18.63	100%	[2]
		Yellow River (Mainstream)	LOQ	13462	74.7		63.6%	[46]
		Yellow River (Tributaries)	LOQ	11900	297		63.5%	[46]
	Croatia	Sava	4.64	80.14	21.04	6.50	100%	[51]
	France	Surface Water		9				[53]
	Global	Surface Water	ND	181609				[54]
	India	Chennai City	0.5	4.9	1.53		96%	[55]
	Korea	Chungcheong Province		0.19				[53]
	Malaysia	Larut River	LOQ	34.3	3.63		44.44%	[62]
	Peru	Titicaca Lake	56.2	63	60.7		100%	[64]
	South Africa	Apies River			3.12			[88]
	Spain	Barcelona		264				[53]
		NE Catalonia		60.1				[53]
		Surface Water	69.4	69.4	69.4			[52]
		Surface Water	11.8	970			89%	[68]
	Tunisia	Mediterranean Sea	4800	40200				[80]
Lomefloxacin	China	Beijing	1.1	10.9		5.2	100%	[12]
		Bohai Region	0.21	0.44	0.26	0.25	14.29%	[15]
		Dongting Lake	ND	3075	388		26.5%	[21]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Estuary		1				[23]
		Guangdong	0.85	2.61		0.89	100%	[24]
		Hetao Irrigation District	LOQ	1.37	0.18		56.5%	[28]
		Hong Kong River		1.77	0.62	0.43	100%	[29]
		Jiangnan Plain	ND	36.4	9.98			[16]
		Liaohe River Basin	ND	14.61	1.15		20.69%	[4]
		Surface Water		1170.4		5.63		[38]
		Surface Water	ND	1735.4	37.3	3.8		[37]
		Surface Water in Basins	ND	5.8	1.29	ND		[37]
		Xiaoqing River (Mainstream)	LOQ	214	89.1		41.9%	[46]
		Xiaoqing River (Tributaries)	LOQ	233	76.3		43.1%	[46]
		Yang River		2.37				[23]
		Yellow River	ND	1.94	0.29	0.2	88%	[2]
		Yellow River (Mainstream)	LOQ	181	91.4		51.5%	[46]
		Yellow River (Tributaries)	LOQ	212	71.8		47.6%	[46]
	France	Charmoise River	3.6	6.7	5.5			[16]
Danofloxacin	USA	Alamance County	8.31	299.62	122.83			[89]
		North Carolina	ND	1227		5.1	67%	[90]
	Brazilian	Surface Water		272			33%	[85]
	China	Guangdong	1.6	189.53		1.97	100%	[24]
		Liaohe River Basins	ND	32.38	2.36		27.59%	[4]
		Surface Water		603.29		62.83		[38]
		Xiaoqing River (Mainstream)	LOQ	4111	50.6		48.4%	[46]
		Xiaoqing River (Tributaries)	LOQ	231	61.5		46.2%	[46]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References	
		Xinjinag Autonomous	Uygur	0.92	4.82	2.39	2	100%	[1]
		Xiong'an New Area		ND	2.91			41%	[3]
		Yellow (Tributaries)	River	LOQ	496	61.3		41.3%	[46]
Pefloxacin	China	Guangdong		2.04	3.53		2.66	88.9%	[24]
		Hong Kong River			1.51	0.56	0.52	100%	[29]
		Surface Water			323		22.56		[38]
		Xiaoqing (Mainstream)	River	7.6	4154	903		72.6%	[46]
		Xiaoqing (Tributaries)	River	5.3	4870	886		69.2%	[46]
		Xinjiang Autonomous	Uygur	2.34	17.6	8.97	6.3	100%	[1]
		Yangtze (Nanjing)	River	ND	5.42	0.27			[81]
		Yellow (Mainstream)	River	171	3144	563		63.6%	[46]
		Yellow (Tributaries)	River	5.8	4467	633		66.7%	[46]
Fleroxacin	China	Dongting Lake		ND	8.88	4.79		46.5%	[21]
		Guangdong		0.89	1.43		0.94	100%	[24]
		Hong Kong River			1.07	0.51	0.52	100%	[29]
		Liaohe River Basins		ND	3.51	0.64		20.69%	[4]
		Shatian Lake		0.4	0.6	0.45	0.4	100%	[36]
		Surface Water			252		3.3		[38]
		Surface Water		ND	309.4	32.2	7.3		[37]
		Surface Water in Basins		ND	16.7	3.5	ND		[37]
		Xinjiang Autonomous	Uygur	1.1	17.15	3.77	2.2	100%	[1]
		Xiong'an New Area		ND	1.55			36%	[3]
Marbofloxacin	China	Dongting Lake		ND	1.01	0.91		30%	[21]
		Guangdong		0.18	5.31		0.25	100%	[24]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Hong Kong River		0.59	0.24	0.25	92.31%	[29]
		Liaohe River Basins	ND	40.49	5.07		24.14%	[4]
		Surface Water		16.7		0.9		[38]
		Xinjiang Uygur Autonomous	0.85	14.85	2.92	1.53	100%	[1]
	Croatia	Sava	0.54	24.53	5.75	1.16	100%	[51]
Sarafloxacin	China	Dongting Lake	ND	7.94	5.51		23.5%	[21]
		Estuary		0.11				[23]
		Guangdong	ND	18.2		2.7	33.3%	[24]
		Hong Kong River		1.56	0.85	0.81	100%	[29]
		Liaohe River Basins	ND	6.02	0.36		6.9%	[4]
		Shatian Lake	ND	32	12.85	9	94.12%	[36]
		Surface Water		80.04		1.3		[38]
		Xiaoqing River (Mainstream)	LOQ	1892	16.5		71%	[46]
		Xiaoqing River (Tributaries)	LOQ	2290	17.8		60%	[46]
		Xinjiang Uygur Autonomous	0.36	2.35	0.98	0.78	100%	[1]
		Xiong'an New Area	ND	7.05			41%	[3]
		Yang River		0.67				[23]
		Yellow River (Mainstream)	LOQ	1899	17.7		72.7%	[46]
		Yellow River (Tributaries)	LOQ	1528	20.3		73%	[46]
	Croatia	Sava	0.49	2.79	1.05	0.70	100%	[51]
	Peru	Titicaca Lake	72.7	76.5	74.2		100%	[64]
Enoxacin	Brazilian	Surface Water	ND	386			5%	[85]
	China	Beibu Gulf	ND	2.95	1.24	0.85	94%	[10]
		Bohai Sea	ND	508	116			[16]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
		Dongting Lake	ND	13.7	10.96		36.5%	[21]
		Surface Water		208	2.26			[38]
		Surface Water	0.2	508	71.7	48.6		[37]
		Surface Water in Basins	ND	92.8	21.5	1.6		[37]
		Xiaoqing River	ND	22.07	1.5			[44]
		Xiaoqing River (Mainstream)	LOQ	13428	448		82.3%	[46]
		Xiaoqing River (Tributaries)	13.9	18076	392		80%	[46]
		Xiong'an New Area	ND	2.5			77%	[3]
		Yangtze River (Nanjing)	ND	12.57	2			[81]
		Yellow River (Mainstream)	18.6	9185	323		78.8%	[46]
		Yellow River (Tributaries)	20.6	8070	319		71.4%	[46]
	France	Charmoise River	ND	1310	134			[16]
	Malaysia	Larut River	LOQ	2.55	0.14		11.11%	[62]
	Uganda	Victoria Lake	2.9	51		25	88%	[81]
Difloxacin	China	Beijing	ND	6.3		1.6	50%	[12]
		Changzhou	5.9	7.9		7.7	100%	[12]
		Dongting Lake	ND	4.75	2.38		45%	[21]
		Guangdong	0.84	1.24		0.85	100%	[24]
		Liaohe River Basins	ND	4.54	0.2		6.9%	[4]
		Surface Water		218.4		0.74		[38]
Levofloxacin	USA	Columbia River			1			[5]
		Sacramento River			2			[5]
	China	Chaohu Lake		89.86	<25			[17]
		Surface Water		23.4		6		[38]

Continuation S2

Antibiotics	Country	Place	Min (ng/L)	Max (ng/L)	Mean (ng/L)	Med (ng/L)	Frequency	References
	South Africa	Apies River			2.4			[88]
	Uganda	Victoria Lake	1.8	29		12	96%	[81]
Moxifloxacin	USA	Sacramento River			0.012			[5]
	China	Liaohe River Basins	ND	41.1			13.79%	[4]
	China			300				[38]
	Spain		1.4	9.8			7%	[68]
Flumequine	China	Estuary		0.43				[23]
		Liaohe River Basins	ND	3.82	0.17		6.9%	[4]
		North South China		22.6				[53]
		Surface Water		137		0.83		[38]
		Xiaoqing River (Tributaries)	LOQ	20.8	LOQ (1.2)		43.1%	[46]
		Xiong'an New Area	ND	1.02			49%	[3]
		Yang River		0.39				[23]
		Yellow River (Tributaries)	LOQ	8.6	LOQ (1.2)		47.6%	[46]
	France	Surface Water		16				[25]
	Korea	Chungcheong Province		1.58				[53]
	Spain	NE Catalonia		8.9				[53]

Table S3. Toxicity of selected fluoroquinolone towards various trophic groups of organisms.

fluoroquinolone	group	organism	duration	EC50 (mg/L)	references
Ciprofloxacin	algae	<i>Anabaena flosaquae</i>	72h	0.01	[91]
		<i>Chlorella sp.</i>	72h	23	[92]
		<i>Chlorella vulgaris</i>	96h	31.07	[93]
		<i>Chlorella vulgaris</i>	96h	20.6	[94, 95]
		<i>Desmodesmus subspicatus</i>	72h	>8.04	[95]
		<i>Desmodesmus subspicatus</i>	72h	8.8	[95]
		<i>Desmodesmus subspicatus</i>	72h	8.04	[91]
		<i>Microcystis panniformis</i>	96h	0.01	[96]
		<i>Microcystis aeruginosa</i>	24h	0.017	[96, 97]
		<i>Pseudokirchneriella subcapitata</i>	72h	5.57	[95]
		<i>Pseudokirchneriella subcapitata</i>	72h	11.3	[95, 98]
		<i>Pseudokirchneriella subcapitata</i>	24h	18.7	[97]
		<i>Pseudokirchneriella subcapitata</i>	96h	4.83	[95]
		<i>Pseudokirchneriella subcapitata</i>	72h	6.7	[95]
		<i>Pseudokirchneriella subcapitata</i>	72h	2.97	[95]
		<i>Raphidocelis subcapitata</i>	72h	1.25	[99]
		<i>Raphidocelis subcapitata</i>	96h	4.61	[100]

		<i>Raphidocelis subcapitata</i>	72h	4.4	[100]
				3.1	[92]
	bacteria	<i>Cyanobacteria</i>		0.05	[92]
		<i>Escherichia coli</i>	24h	0.014	[101]
		<i>Pseudomonas fluorescens</i>	24h	0.12-0.49	[102]
		<i>Pseudomonas putida</i>	11d	0.08	[103]

Continuation S3

fluoroquinolone	group	organism	duration	EC50 (mg/L)	references
		<i>Synechococcus elongatus</i>	96h	0.06	[100]
		<i>Synechococcus elongatus</i>	72h	0.07	[100]
	crustacean	<i>Ceriodaphnia dubia</i>	21d	4	[104]
		<i>Daphnia magna</i>	48h	>100	[6]
		<i>Daphnia magna</i>	21d	1.3-6.5(2.17)	[105]
		<i>Daphnia magna</i>	48h	28.59	[106]
		<i>Daphnia magna</i>	24h	>192	[107]
		<i>Daphnia magna</i>	48h	60	[6]
		<i>Daphnia magna</i>		87.14	[6]
		<i>Gammarus fossarum</i>	7d	13.6	[108]
		<i>Moina macrocopa</i>	48h	71	[92]
	fish	<i>Danio rerio</i>		100	[6]
		<i>Pimephales promelas</i>	7d	>10	[6]
				>60	[92]
	plant	<i>Lemna minor</i>	24h	0.2	[97]
		<i>Lemna minor</i>	7d	0.63	[91]
Ofloxacin	algae	<i>Microcystis aeruginosa</i>	24h	0.02	[97]
		<i>Pseudokirchneriella subcapitata</i>	72h	1.44	[95]
		<i>Pseudokirchneriella subcapitata</i>	96h	4.74	[95]
		<i>Pseudokirchneriella subcapitata</i>	72h	12.1	[95, 97]
		<i>Raphidocelis subcapitata</i>	72h	4.18	[100]
		<i>Raphidocelis subcapitata</i>	96h	4.26	[100]
	bacteria	<i>Pseudomonas putida</i>	11d	0.01	[103]

Continuation S3

fluoroquinolone	group	organism	duration	EC50 (mg/L)	references
		<i>Synechococcus elongatus</i>	72h	0.14	[100]
		<i>Synechococcus elongatus</i>	96h	0.1	[107]
		<i>Vibrio fischeri</i>	24h	0.014	[109]
	crustacean	<i>Ceriodaphnia dubia</i>	7d	10	[6]
		<i>Ceriodaphnia dubia</i>	24h	17.41	[6]
		<i>Ceriodaphnia dubia</i>	48h	26.7	[6]
		<i>Ceriodaphnia dubia</i>	7d	3.13	[6]
		<i>Daphnia magna</i>	48h	76.58	[6]

		<i>Daphnia magna</i>	48h	31.75	[6]
		<i>Daphnia magna</i>	48h	17.41	[6]
	fish	<i>Danio rerio</i>	10d	>16	[6]
		<i>Pimephales promelas</i>	7d	10	[6]
	mollusk	<i>Bellamya aeruginosa</i>	96h	149.3	[110]
		<i>Bellamya aeruginosa</i>	48h	222.6	[110]
	plant	<i>Lemna minor</i>	24h	0.13	[97]
Norfloxacin	algae	<i>Chlorella vulgaris</i>	72h	10.4	[95, 111]
		<i>Desmodesmus subspicatus</i>	72h	6.8	[95]
		<i>Pseudokirchneriella subcapitata</i>	72h	16.6	[95]
		<i>Pseudokirchneriella subcapitata</i>	72h	1.8	[95]
		<i>Scenedesmus obliquus</i>	96h	38.49	[112]
		<i>Selenastrum capricornutum</i>	72h	16.6	[111]
	bacteria	<i>Anabaena</i> sp CPB4337	72h	5.6	[109]
		<i>Vibrio fischeri</i>	15min	23.6	[109]

Continuation S3

fluoroquinolone	group	organism	duration	EC50 (mg/L)	references
	crustacean	<i>Ceriodaphnia dubia</i>	21d	4	[104]
	mollusk	<i>Bellamya aeruginosa</i>	48h	141.3	[110]
		<i>Bellamya aeruginosa</i>	96h	104.5	[110]
	plant	<i>Lactuca sativa</i>	5d	336	[113]
Enrofloxacin	algae	<i>Anabaena flosaquae</i>	72h	0.17	[97]
		<i>Chlorella vulgaris</i>	96h	0.12	[113]
		<i>Desmodesmus subspicatus</i>	3d	5.57	[91, 114]
		<i>Microcystis aeruginosa</i>	24h	0.05	[97, 114]
		<i>Microcystis aeruginosa</i>	72h	0.07-0.11(0.092)	[96, 97]
		<i>Pseudokirchneriella subcapitata</i>	3d	3.1	[114]
		<i>Pseudokirchneriella subcapitata</i>	24h	3.1	[97]
		<i>Pseudokirchneriella subcapitata</i>	96h	5.18	[115]
	bacteria			2.97	[92, 97]
		<i>Cyanobacteria</i>		0.01	[92]
	crustacean	<i>Ceriodaphnia dubia</i>	21d	5	[104]
		<i>Daphnia magna</i>	48h	16.72	[116]
		<i>Daphnia magna</i>	21d	24-36(30)	[105]
		<i>Daphnia magna</i>	48h	28.59	[106]
		<i>Moina macrocopa</i>	48h	71	[92]
		<i>Moina macrocopa</i>	48h	69	[92]
				79.5	[92]
	fish				
	plant	<i>Lemna minor</i>	7d	0.11	[91]
		<i>Lemna minor</i>	7d	0.114	[114]

Continuation S3

fluoroquinolone	group	organism	duration	EC50 (mg/L)	references
		<i>Lemna minor</i>	24h	0.11	[97]
		<i>Lemna minor</i>	7d	0.107	[114]
Lomefloxacin	algae	<i>Microcystis aeruginosa</i>	24h	0.19	[97]
	bacteria	<i>Vibrio fischeri</i>	24h	0.022	[109]
	plant	<i>Lemna minor</i>	24h	0.11	[97]
Marbofloxacin	crustacean	<i>Ceriodaphnia dubia</i>	21d	17	[104]
Enoxacin	bacteria	<i>Vibrio fischeri</i>	24h	0.049	[109]
Levofloxacin	algae	<i>Microcystis aeruginosa</i>	24h	0.008	[97]
	bacteria	<i>Streptococcus pneumoniae</i>	24h	3.57	[117]
	crustacean	<i>Ceriodaphnia dubia</i>	21d	11	[104]
		<i>Daphnia magna</i>	21d	6	[104]
		<i>Daphnia magna</i>	48h	>40	[116]
	plant	<i>Lemna gibba</i>	14d	1.15	[118]
Moxifloxacin	algae	<i>Chorella sorokiniana</i>	96h	28.42	[119]
		<i>Microcystis aeruginosa</i>	96h	60.34	[120]
		<i>Scenedesmus dimorphus</i>	96h	26.37	[119]
	crustacean	<i>Ceriodaphnia dubia</i>	21d	26.00	[104]
		<i>Daphnia magna</i>	21d	7.00	[104]
	mollusk	<i>Glochidia</i>	24h	120.00	[121]
Flumequine	algae	<i>Dunaliella salina</i>	7d	18	[122]
		<i>Microcystis aeruginosa</i>	24h	1.96	[97]
		<i>Microcystis aeruginosa</i>	24h	>8.8	[123]
		<i>Pseudokirchneriella subcapitata</i>	24h	5	[97]

Continuation S3

fluoroquinolone	group	organism	duration	EC50 (mg/L)	references
		<i>Pseudokirchneriella subcapitata</i>	24h	≈16	[123]
		<i>Pseudokirchneriella subcapitata</i>	96h	2.6	[124]
		<i>Selenastrum capricornutum</i>	7d	5	[122]
	bacteria	<i>Pseudomonas putida</i>	16h	0.82	[124]
		<i>Vibrio fischeri</i>	30min	12.10-15.34	[125]
		<i>Vibrio fischeri</i>	15min	11	[124]
	crustacean	<i>Daphnia magna</i>	48h	25.35	[116]
		<i>Daphnia magna</i>	24h	59	[124]
	mollusk	<i>Arbacia lixula</i>	72h	75.4	[126]
		<i>Paracentrotus lividus</i>	48h	31.01	[126]
	plant	<i>Lemna minor</i>	24h	2.47	[97]
		<i>Lemna minor</i>	7d	3	[124]

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