

Table S1. Water quality and atmospheric conditions in Jeonju River on 1 July, 2014 (Data according to website of the Water Environment Information System (WEIS; <http://water.nier.go.kr/publicMain/mainContent.do>) and <https://www.google.co.kr/maps?hl=en&tab=w11>).

Parameter	Value	References
Observing date	2014.07.01	-
pH	7.5	WEIS
Temperature (°C)	26	WEIS
Dissolved oxygen (mg/L)	7	WEIS
COD (mg/L)	6	WEIS
BOD (mg/L)	2	WEIS
Maximum depth (m)	0.8	WEIS
NO3 (mg/L)	0.384	WEIS
NH3 and NH4 (mg/L)	0.182	WEIS
Total Phosphorus (mg/L)	0.074	WEIS
Total Nitrogen (mg/L)	1.241	WEIS
Chl a (mg/m ³)	12	WEIS
PO4 (mg/L)	0.054	WEIS
Latitude	35.9	Google maps
Wind Velocity (m/s)	1.39	WEIS
Mean Light Intensity (Ly/d)	307	WEIS
Mean Evaporation Capacity	46.8	WEIS

Table S2. Density of diatoms, ash-free dry mass (AFDM) and dry mass (DM) in Jeonju River.

Species Name	Density in Jeonju River (cells/cm ³)	AFDM of One Individual (ng C/cell)	AFDM Density of Species in the Site (mg C/L)	DM Density of Species in the Site (mg/L)
<i>Cocconeis placentula</i>	249	4.40×10^{-2}	1.10×10^{-2}	3.04×10^{-2}
<i>Cyclotella meneghiniana</i>	249	8.02×10^{-3}	2.00×10^{-3}	5.55×10^{-3}
<i>Cymbella cistula</i>	12724	6.10×10^{-3}	7.76×10^{-2}	2.16×10^{-1}
<i>Fragilaria elliptica</i>	1497	1.63×10^{-2}	2.43×10^{-2}	6.76×10^{-2}
<i>Fragilaria ulna</i>	1746	1.63×10^{-2}	2.84×10^{-2}	7.88×10^{-2}
<i>Gomphonema lagenula</i>	249	1.63×10^{-2}	4.05×10^{-3}	1.12×10^{-2}
<i>Melosira varians</i>	20958	1.29×10^{-2}	2.71×10^{-1}	7.53×10^{-1}
<i>Navicula minima</i>	4740	1.80×10^{-2}	8.51×10^{-2}	2.36×10^{-1}
<i>Navicula pupula</i>	499	5.68×10^{-3}	2.83×10^{-3}	7.87×10^{-3}
<i>Navicula subminuscula</i>	1497	1.80×10^{-2}	2.69×10^{-2}	7.47×10^{-2}
<i>Nitzschia amphibia</i>	7235	1.99×10^{-2}	1.44×10^{-1}	3.99×10^{-1}
<i>Nitzschia inconspicua</i>	249	1.99×10^{-2}	4.95×10^{-3}	1.37×10^{-2}
<i>Nitzschia palea</i>	2495	2.91×10^{-2}	7.26×10^{-2}	2.02×10^{-1}

<i>Reimeria sinuata</i>	249	1.63×10^{-2}	4.05×10^{-3}	1.12×10^{-2}
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Table S3. Density of invertebrates and DM in Jeonju River.

Species Name	Density in Jeonju river (individuals/m ²)	DM of individual species (g/individual)	DM density of species in the site(g/m ²)	Length-Weight coefficient a	Length-Weight coefficient b	Reference for Length-Weight coefficient
<i>Acentrella gnom</i>	222	8.04×10^{-4}	1.79×10^{-1}	0.00962	2.75	[26]
<i>Acentrella sibirica</i>	19	8.04×10^{-4}	1.53×10^{-2}	0.00962	2.75	[26]
<i>Antocha KUa</i>	7	2.07×10^{-3}	1.45×10^{-2}	0.0305	2.62	[29]
<i>Asellus hilgendorffii</i>	74	2.97×10^{-3}	2.20×10^{-1}	0.0054	2.948	[23]
<i>Baetiella tuberculata</i>	252	4.25×10^{-3}	1.07×10^{-1}	0.00525	2.73	[30]
<i>Baetis fuscatus</i>	1066	6.72×10^{-3}	7.16×10^{-1}	0.00438	2.689	[25]
<i>Caenis nishinoae</i>	104	6.58×10^{-2}	6.84	4	2.02	[28]
<i>Calopteryx japonica</i>	4	3.22×10^{-1}	1.29	0.0078	2.792	[24]
<i>Chaetogaster limnaei</i>	15	0	0	0	0	No matched species
<i>Cheumatopsyche brevilineata</i>	1188	5.23×10^{-3}	6.21	0.00848	2.79	[30]
<i>Chironomidae</i> sp.	311	3.92×10^{-3}	1.22	0.001696	3.23	[30]
<i>Euthraulus alticulus</i>	4	2.56×10^{-3}	1.03×10^{-2}	0.0071	2.832	[24]
<i>Dugesia japonica</i>	440	0	0	0	0	No matched species
<i>Ecdyonurus kibunensis</i>	93	7.07×10^{-4}	6.57×10^{-2}	0.00664	2.9	[30]
<i>Ecdyonurus levis</i>	85	5.27×10^{-3}	4.48×10^{-1}	0.00664	2.9	[30]
<i>Epeorus pellucidus</i>	144	1.01×10^{-2}	1.45	0.00664	2.9	[30]
<i>Ephemera orientalis</i>	4	1.01×10^{-1}	4.04×10^{-1}	0.117	2.257	[27]
<i>Serratella setigera</i>	48	7.64×10^{-4}	3.67×10^{-3}	0.00103	2.676	[24]
<i>Erpobdella lineata</i>	52	0	0	0	0	No matched species
<i>Hydropsyche kozhantschikovi</i>	52	1.62×10^{-2}	8.43×10^{-1}	0.00848	2.79	[30]
<i>Hydropsyche valvata</i>	104	1.62×10^{-2}	1.69	0.00848	2.79	[30]

<i>Hydroptila KUa</i>	4	1.82×10^{-4}	7.27×10^{-4}	0.00848	2.79	[24]
<i>Labiobaetis atrebatinus</i>	26	2.81×10^{-3}	7.29×10^{-2}	0.00848	2.79	[30]
<i>Limnodrilus gotoi</i>	26	0	0	0	0	No matched species
<i>Nigrobaetis bacillus</i>	285	7.56×10^{-4}	2.15×10^{-1}	0.00848	2.79	[30]
<i>Physa acuta</i>	74	1.26×10^{-2}	9.35×10^{-1}	0.07	2.67	[30]
<i>Mataeopsephus Kua</i>	4	6.13×10^{-4}	2.45×10^{-3}	0.0077	2.91	[24]
<i>Rhoenanthus coreanus</i>	7	1.08×10^{-1}	7.58×10^{-1}	0.0071	2.832	[24]
<i>Toryx tagoi</i>	4	0	0	0	0	No matched species
<i>Teloganopsis punctisetae</i>	433	6.77×10^{-4}	2.93×10^{-1}	0.0071	2.832	[24]

Table S4. Density of fish and DM in Jeonju River.

Species Name	Density in BJeonjuCh eon5 Point (individual s/12000m ²)	WM of Individual Species (g/individual)	DM Density of Species in the Site (g/m ²)	Wet to Dry Coefficient (g/g)	Reference for Length-Weight coefficient
<i>Carassius auratus</i>	4	2.35×10^{-2}	1.57×10^{-2}	5	FishBase
<i>Pseudogobio esocinus</i>	45	3.30×10	2.48×10^{-2}	5	FishBase
<i>Squalidus gracilis</i>	15	6.09	2.06×10^{-3}	3.7	FishBase
<i>Zacco platypus</i>	47	3.01×10	3.19×10^{-2}	3.7	FishBase

Table S5. Acute toxicity values for the species in Jeonju River (some data according to the website <https://cfpub.epa.gov/ecotox/search.cfm>, while the other data calculated by the Interspecies Correlation Estimation (ICE) on <https://www3.epa.gov/webice/iceDownloads.html>).

Species Name (AQUATO X)	LC50 (μg/L)	Experiment time (h)	LC50 Reference	EC50 Growth (μg/L)	Experiment Time (hours)	EC50 Reference	Note (Toxicity Record in AQUATO X)
Golden Shiner	1.60×10^4	24	ECOTOX, adult	8.04×10^3	168	ECOTOX	Minnow
Minnow	1.60×10^4	24	ECOTOX, adult	8.04×10^3	168	ECOTOX	Minnow
Stoneroller	1.60×10^4	24	ECOTOX, adult	8.04×10^3	168	ECOTOX	Minnow
Mayfly(Baetis)	6.49×10^4	48	[35]	3.26×10^4	48	using Minnow LC50/EC50 ratio	Chironomid
Caddisfly	5.80×10^4	96	ECOTOX	2.9×10^4	96	using	Stonefly

Asian mud snail	5.56×10 ⁴	96	ECOTOX, physa snail		96	Minnow LC50/EC50 ratio using Minnow LC50/EC50 ratio	Ostracod
Chironomid	6.49×10 ⁴	48	[35]	3.26×10 ⁴	48	Minnow LC50/EC50 ratio using Minnow LC50/EC50 ratio	Chironomid
Odonata	5.80×10 ⁴	96	ECOTOX	2.9×10 ⁴	96	Minnow LC50/EC50 ratio	Stonefly
Isopod	1.35×10 ³	24	ICE model Fathead minnow; 0.95 confidence interval is [358.4,5081]	6.78×10 ²	24	using Minnow LC50/EC50 ratio	Amphipod
Riffle beetle	1.35×10 ³	24	ICE model Fathead minnow; 0.95 confidence interval is [358.4,5081]	6.78×10 ²	24	using Minnow LC50/EC50 ratio	Amphipod

Table S6. Toxicity data of toluene for aquatic plants (data according to the website <https://cfpub.epa.gov/ecotox/search.cfm>).

Species Name (AQUATOX)	LC50 (µg/L)	Experiment time (hours)	LC50 Reference	EC50 Photosynthesis (µg/L)	Experiment time (h)	EC50 Reference	Note (Toxicity record in AQUATOX)
Melosira	1.51×10 ⁴	95	[36], algae	2.00×10 ⁴	3	ECOTOX, diatom	Diatoms
Navicula	1.51×10 ⁴	95	[36], algae	2.00×10 ⁴	3	ECOTOX, diatom	Peri, Cyclotell
Nitzschia	1.51×10 ⁴	95	[36], algae	2.00×10 ⁴	3	ECOTOX, diatom	Diatoms

Table S7. Species matching of local species to that in the library of AQUATOX (animals).

Species group	Species Name	Matched Species in AQUATOX (1)	Matched Species in AQUATOX (Final)
Fish	<i>Carassius auratus</i>	Golden Shiner	Golden Shiner

	<i>Pseudogobio esocinus</i>	Stoneroller	Stoneroller
	<i>Squalidus gracilis</i>	Minnow	Minnow
	<i>Zacco platypus</i>	Minnow	Minnow
	<i>Acentrella gnom</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Acentrella sibirica</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Antocha KUa</i>	Chironomid	Chironomid
	<i>Asellus hilgendorffii</i>	Isopod	Isopod
	<i>Baetiella tuberculata</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Baetis fuscatus</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Caenis nishinoae</i>	Tricorythodes	Mayfly(Baetis)
	<i>Calopteryx japonica</i>	Odonata	Odonata
	<i>Chaetogaster limnaei</i>	-	-
	<i>Cheumatopsyche brevilineata</i>	Caddisfly	Caddisfly
	<i>Chironomidae sp.</i>	Chironomid	Chironomid
	<i>Euthraulus altiocus</i>	Tricorythodes	Mayfly(Baetis)
	<i>Dugesia japonica</i>	-	-
	<i>Ecdyonurus kibunensis</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Ecdyonurus levis</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Epeorus pellucidus</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Ephemera orientalis</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Serratella setigera</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Erpobdella lineata</i>	-	-
	<i>Hydropsyche kozhantschikovi</i>	Caddisfly	Caddisfly
	<i>Hydropsyche valvata</i>	Caddisfly	Caddisfly
	<i>Hydroptila KUa</i>	Caddisfly	Caddisfly
	<i>Labiobaetis atrebatinus</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Limnodrilus gotoi</i>	-	-
	<i>Nigrobaetis bacillus</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Physa acuta</i>	Asian mud snail	Asian mud snail
	<i>Mataeopsephus Kua</i>	Riffle beetle	Riffle beetle
	<i>Rhoenanthus coreanus</i>	Mayfly(Baetis)	Mayfly(Baetis)
	<i>Toryx tagoi</i>	-	-
	<i>Teloganopsis punctisetae</i>	Mayfly(Baetis)	Mayfly(Baetis)

Table S8. Species matching of local species to that in the library of AQUATOX (diatoms) (Peri-Navicula and Peri-Nitzschia were also converted into Phyto-Navicula and Phyto-Nitzschia).

Species group	Species Name	Matched Species in AQUATOX (1)	Matched Species in AQUATOX (Final)
	<i>Cocconeis placentula</i>	Periphyton,Cocconeis	Peri, Navicula
	<i>Cyclotella meneghiniana</i>	Cyclotella nana	Peri, Navicula
	<i>Cymbella cistula</i>	Periphyton,Cocconeis	Peri, Navicula
	<i>Fragilaria elliptica</i>	Peri, Fragilaria	Peri, Navicula
	<i>Fragilaria ulna</i>	Peri, Fragilaria	Peri, Navicula
	<i>Gomphonema lagenula</i>	Peri, Navicula	Peri, Navicula
Diatoms	<i>Melosira varians</i>	Melosira varians (Additional species, Phyto and Peri)	Melosira varians (Additional species, Phyto and Peri)
	<i>Navicula minima</i>	Peri, Navicula	Peri, Navicula
	<i>Navicula pupula</i>	Peri, Navicula	Peri, Navicula
	<i>Navicula subminuscula</i>	Peri, Navicula	Peri, Navicula
	<i>Nitzschia amphibia</i>	Peri, Nitzschia	Peri, Nitzschia
	<i>Nitzschia inconspicua</i>	Peri, Nitzschia	Peri, Nitzschia

Table S9. Segmentation of the total stretch of the target site.

Segment	A	B (Accident Point)	C	D	E
Range	S1 to S2	S2 to S3	S3 to S4	S4 to S5	S5 to S6
Distance from S1	0–560 m	560–1.2 km	1.2–1.78 km	1.78–2.34 km	2.34–2.86 km
Surface area	41,745 m ²	47,902 m ²	55,253 m ²	54,513 m ²	30,245 m ²

Table S10. Boundary conditions of Jeonju River.

River	Observation Site	Flow Rate (m ³ /s)			Reference	Date
		High Water Flow (95th)	Median Water Flow (185th)	Low Water Flow (275th)		
Mankyeong	Daecheon	15.032	10.444	7.002	WEIS	2017
Sam	Hyoja	16.032	10.444	7.002	WEIS	2017

Table S11. Toluene spill accident (perturbed) scenarios for the AQUATOX – environmental fluid dynamic source code (EFDC) model.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Quantity of Total Spilled Toluene (kg)	3.0×10	3.0×10^2	3.0×10^3	3.0×10^4
Concentration of Inflow Toluene (µg/L)	8.7×10^8	8.7×10^8	8.7×10^8	8.7×10^8
Volume of Inflow Loading (m ³ /day)	3.4×10^{-2}	3.4×10^{-1}	3.4	3.4×10

Table S12. Food preference ratio table for the species in Jeonju River.

Species name	Mayfly (Baetis)	Riffle beetle	Caddisfly	Isopod	Chironomid	Asian mud snail	Odonata	Golden Shiner	Minnow	Stoneroller
R detr sed				7.8%	1.0%					
L detr sed	5.3%	5.3%		54.7%	99.0%	100.0%				23.3%
R detr part									4.1%	
L detr part			16.7%					7.9%	4.1%	
Eunotia 002	15.8%	31.6%		6.2%					9.2%	10.0%
Peri, Navicula	15.8%	31.6%		6.2%					9.2%	10.0%
Peri, Nitzschia	15.8%	31.6%		6.2%					9.2%	10.0%
Eunotia 002_Phy	15.8%		16.7%	6.2%					9.2%	
Phyto, Nitzschia	15.8%		16.7%	6.2%					9.2%	
Phyto, Navicula	15.8%		16.7%	6.2%					9.2%	
Mayfly (Baetis)							33.3%	23.8%	7.2%	
Riffle beetle								23.8%	7.2%	
Caddisfly								23.8%	7.2%	
Isopod							33.3%	10.3%	5.0%	
Chironomid			33.3%				33.3%	10.3%	5.0%	
Asian mud snail										
Odonata									4.6%	46.7%
Golden Shiner										
Minnow										
Stoneroller										

Table S13. Egestion fraction table for the species in Jeonju River.

Species name	Mayfly (Baetis)	Riffle beetle	Caddisfly	Isopod	Chironomid	Asian mud snail	Odonata	Golden Shiner	Minnow	Stoneroller
R detr sed				1.00	1.00					
L detr sed	0.50	0.53		0.60	0.50	0.16				0.50
R detr part									1.00	
L detr part			0.30					0.50	0.80	
Eunotia 002	0.30	0.16		0.30					0.20	0.30
Peri, Navicula	0.30	0.16		0.30					0.20	0.30
Peri, Nitzschia	0.30	0.16		0.30					0.20	0.30
Eunotia 002_Phy	0.30		0.16	0.30					0.20	
Phyto, Nitzschia	0.30		0.16	0.30					0.20	
Phyto, Navicula	0.30		0.16	0.30					0.20	
Mayfly (Baetis)							0.15	0.16	0.16	
Riffle beetle								0.16	0.16	
Caddisfly								0.16	0.16	
Isopod							0.15	0.16	0.16	
Chironomid			0.15				0.15	0.16	0.16	
Asian mud snail										
Odonata									0.16	0.16
Golden Shiner										
Minnow										
Stoneroller										

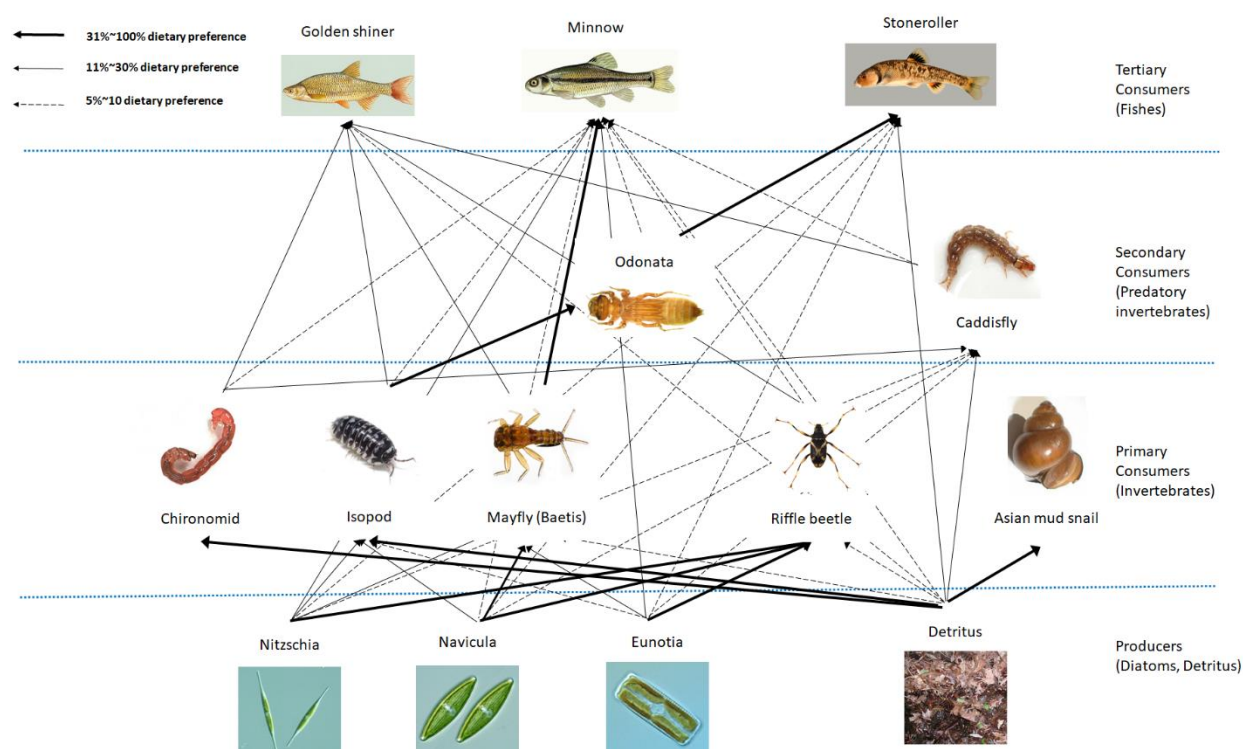
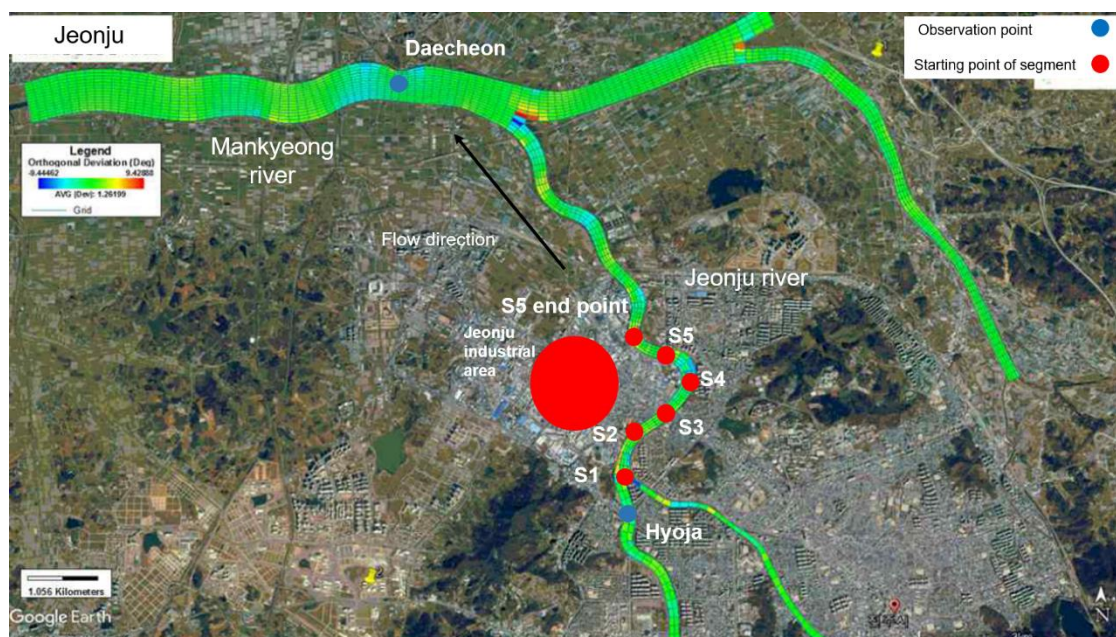


Figure S1. The aquatic species and food web in Jeonju River.**Figure S2.** The EFDC map of Jeonju River.

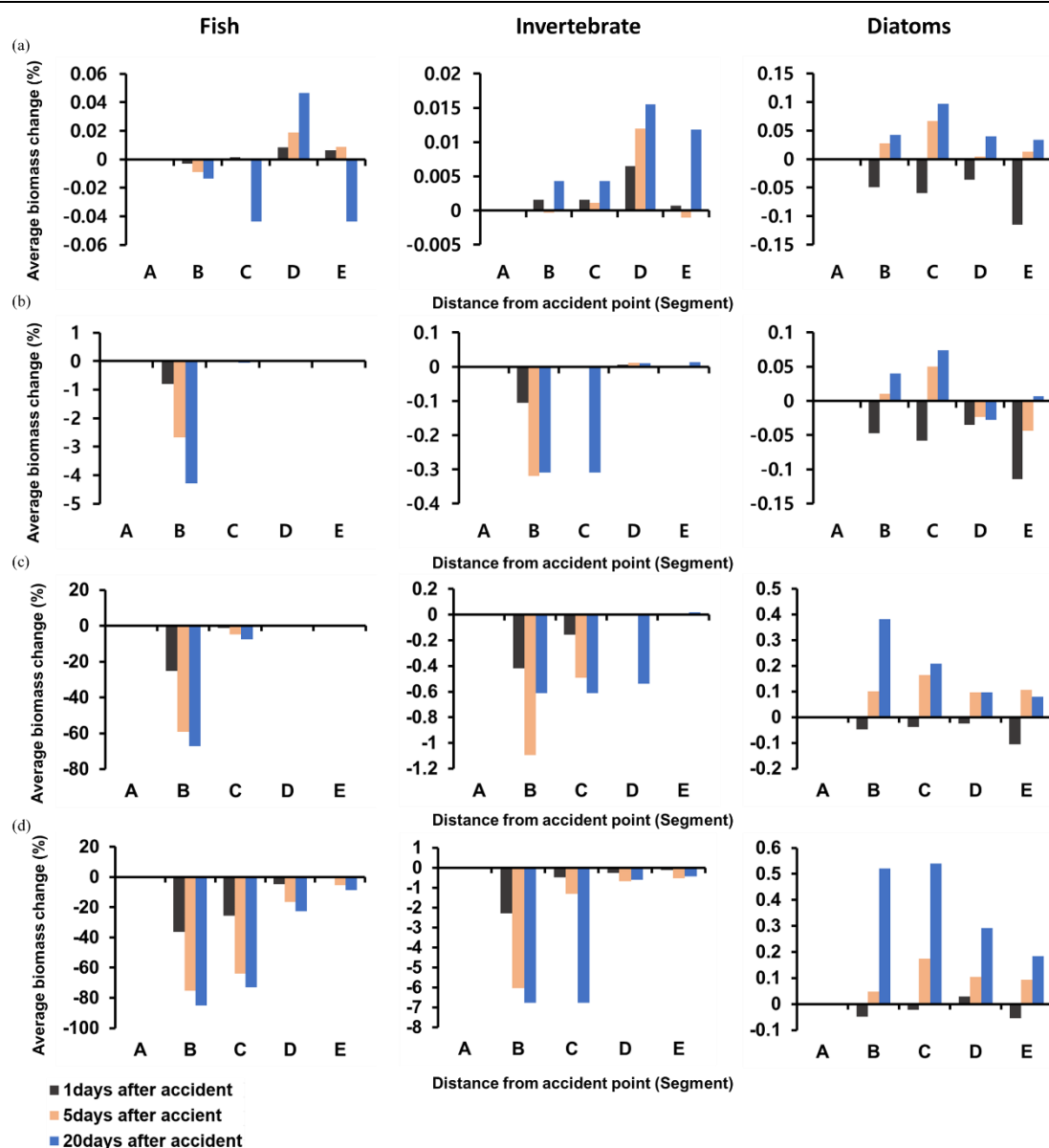


Figure S3. The relative variation of the average biomass of fish, invertebrates, and diatoms compared to the control (%) for 1–20 days after a (a) 30 kg, (b) 300 kg, (c) 3000 kg, and (d) 30,000 kg spill of toluene in Jeonju River.

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