Dissolved inorganic nitrogen in a tropical estuary at Malaysia: transport and transformation

Shan Jiang[1*], Moritz Müller[2], Jie Jin[1], Ying Wu[1], Kun Zhu[1], Guosen Zhang[1], Aazani Mujahid[3], Tim Rixen[4], Mohd Fakharuddin Muhamad[3], Edwin Sien Aun Sia[2], Faddrine Holt Ajon Jang[2], Jing Zhang[1]

1. State Key Laboratory of Estuaries and Coastal Research, East China Normal University, China
2. Faculty of Engineering, Computing and Science Swinburne, University of Technology, Sarawak campus, Malaysia
3. Faculty of Resource Science & Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
4. Leibniz Center for Tropical Marine Research, Fahrenheitstr. 6, 28359 Bremen, Germany

Correspondence:

Shan Jiang
Email: sjiang@sklec.ecnu.edu.cn

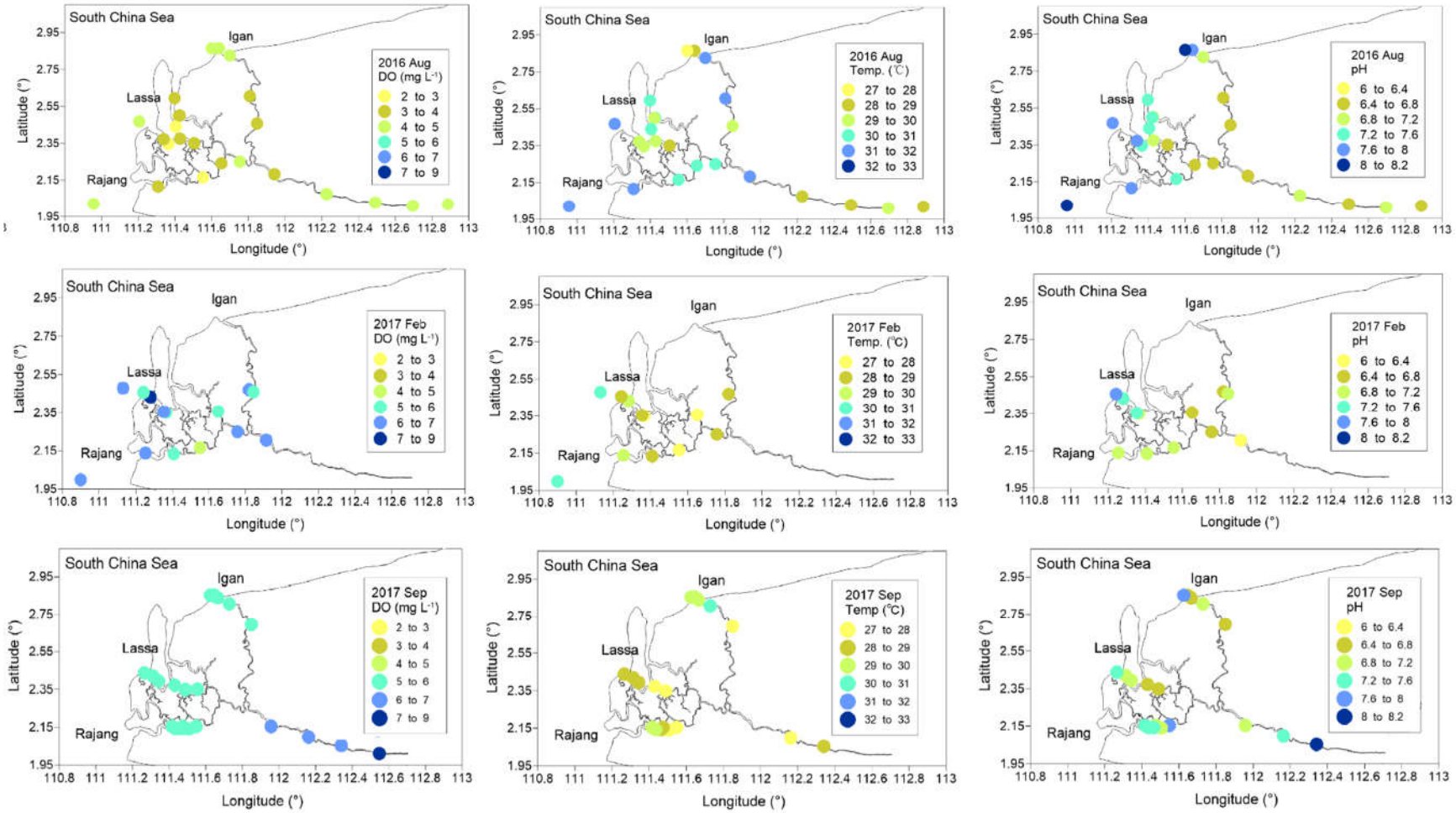

Fig. S1 DO, water temperature and water pH in Rajang River and adjacent coastal ocean in three cruises.

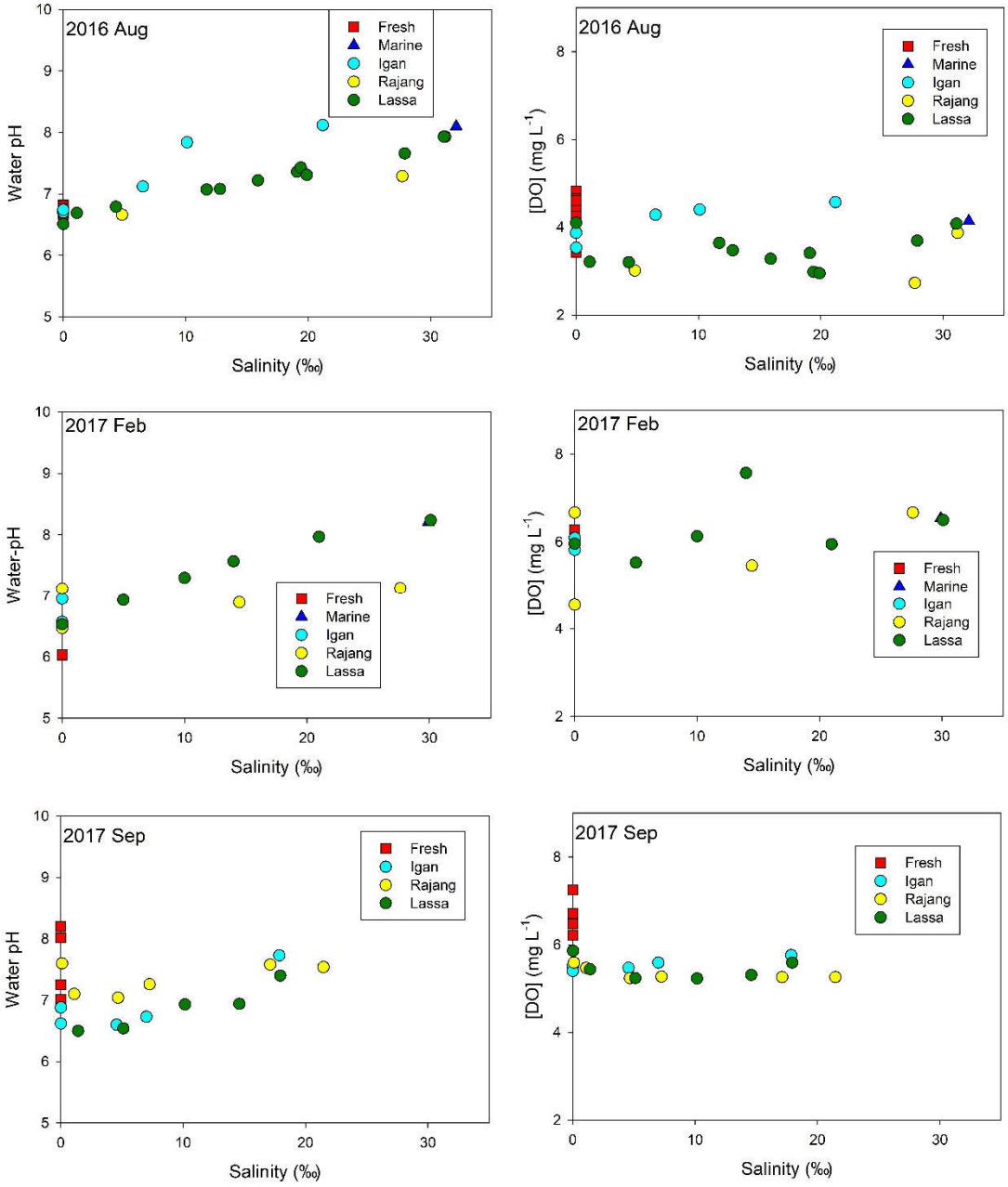

Fig. S2 Distribution of water pH and DO along salinity gradient in three cruises.

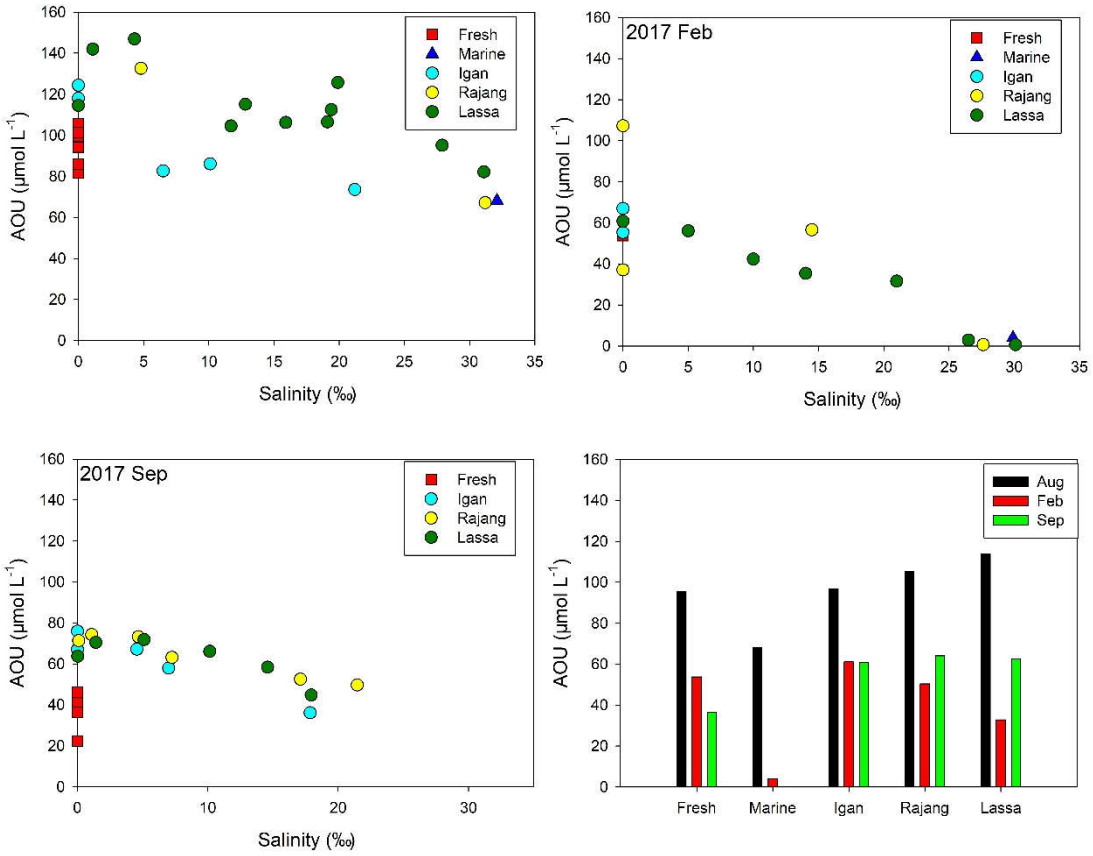

Fig. S3 Apparent oxygen utilization (AOU) along the salinity gradient and mean values in fresh river water, marine water, as well as three tributaries.

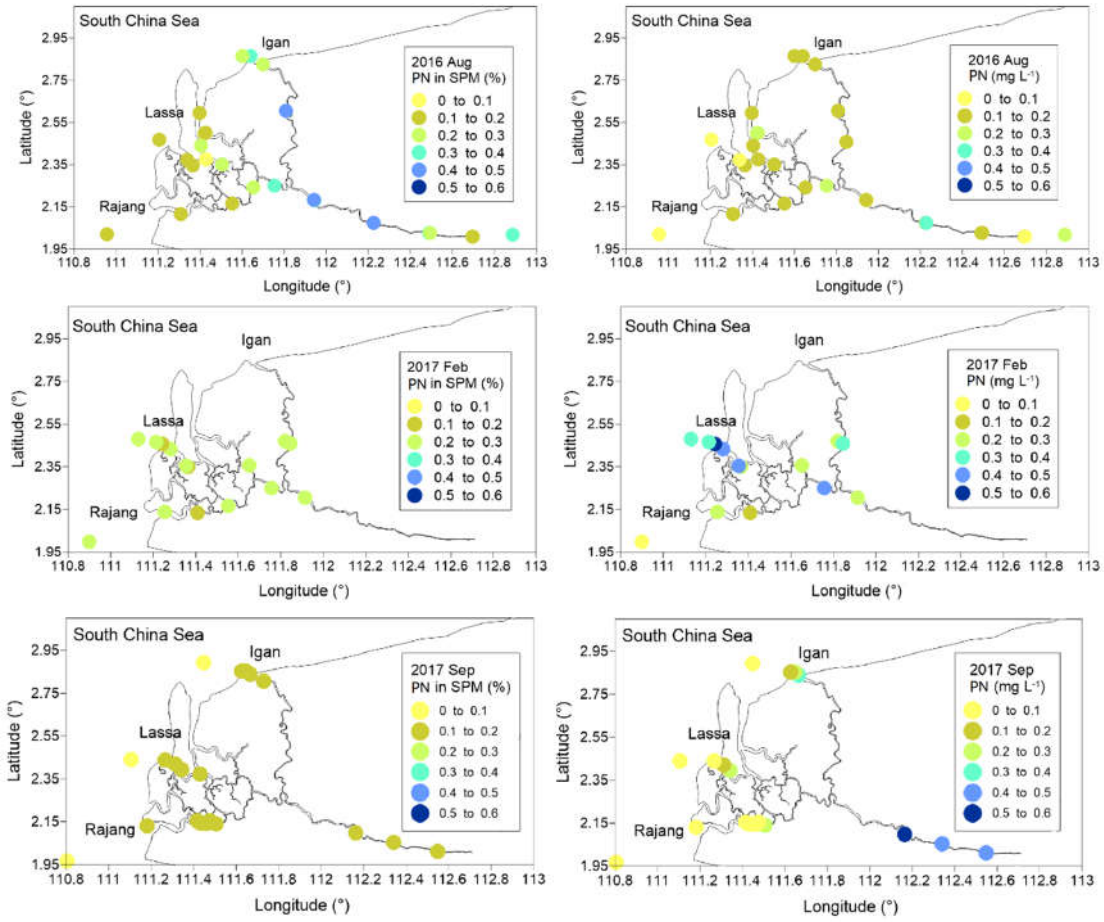

Fig. S4 Composition of particle nitrogen (PN) in suspended particle matter (SPM) and PN concentration in Rajang River and adjacent coastal ocean

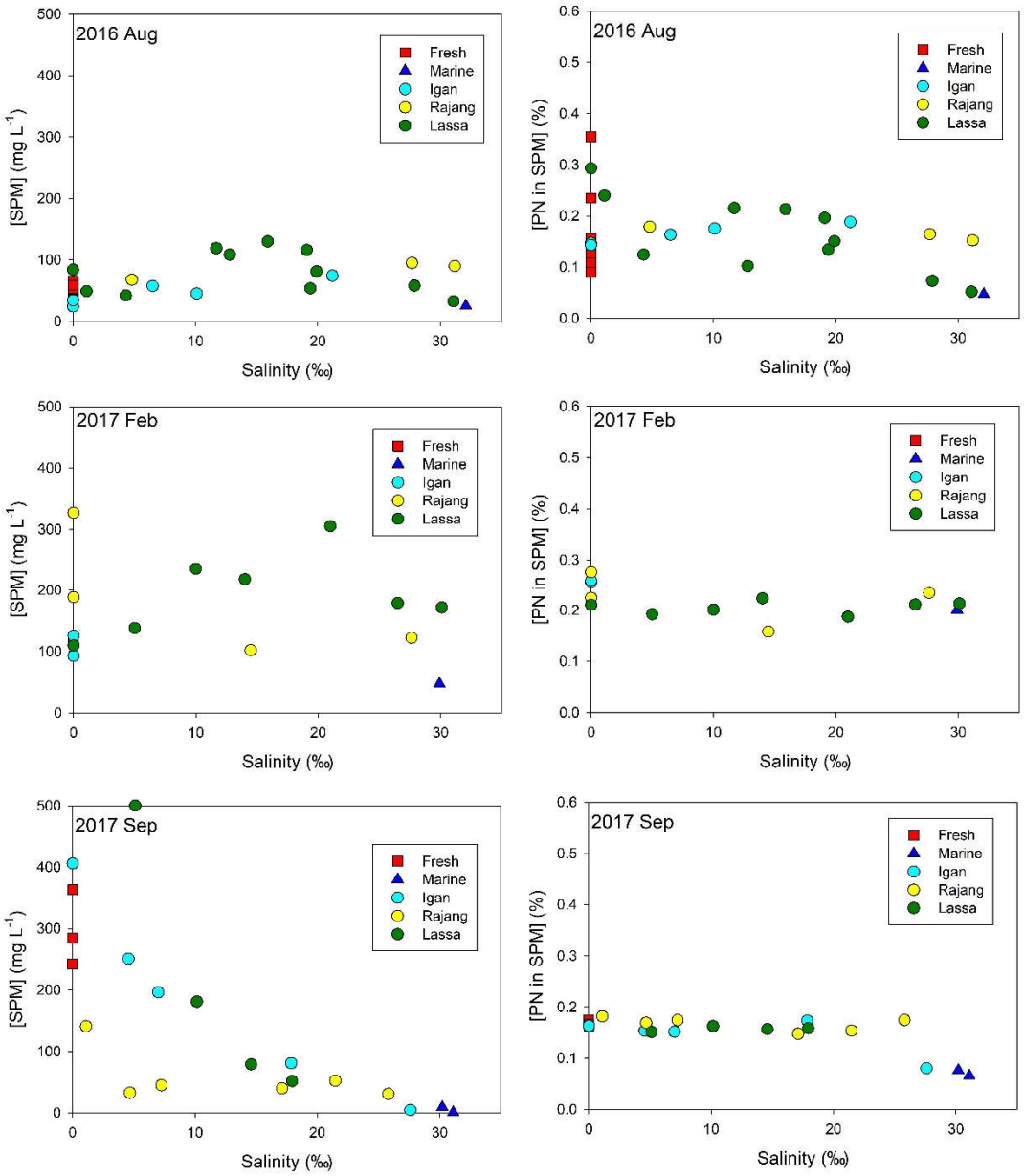

Fig. S5 Distribution of SPM and PN content along the salinity gradient

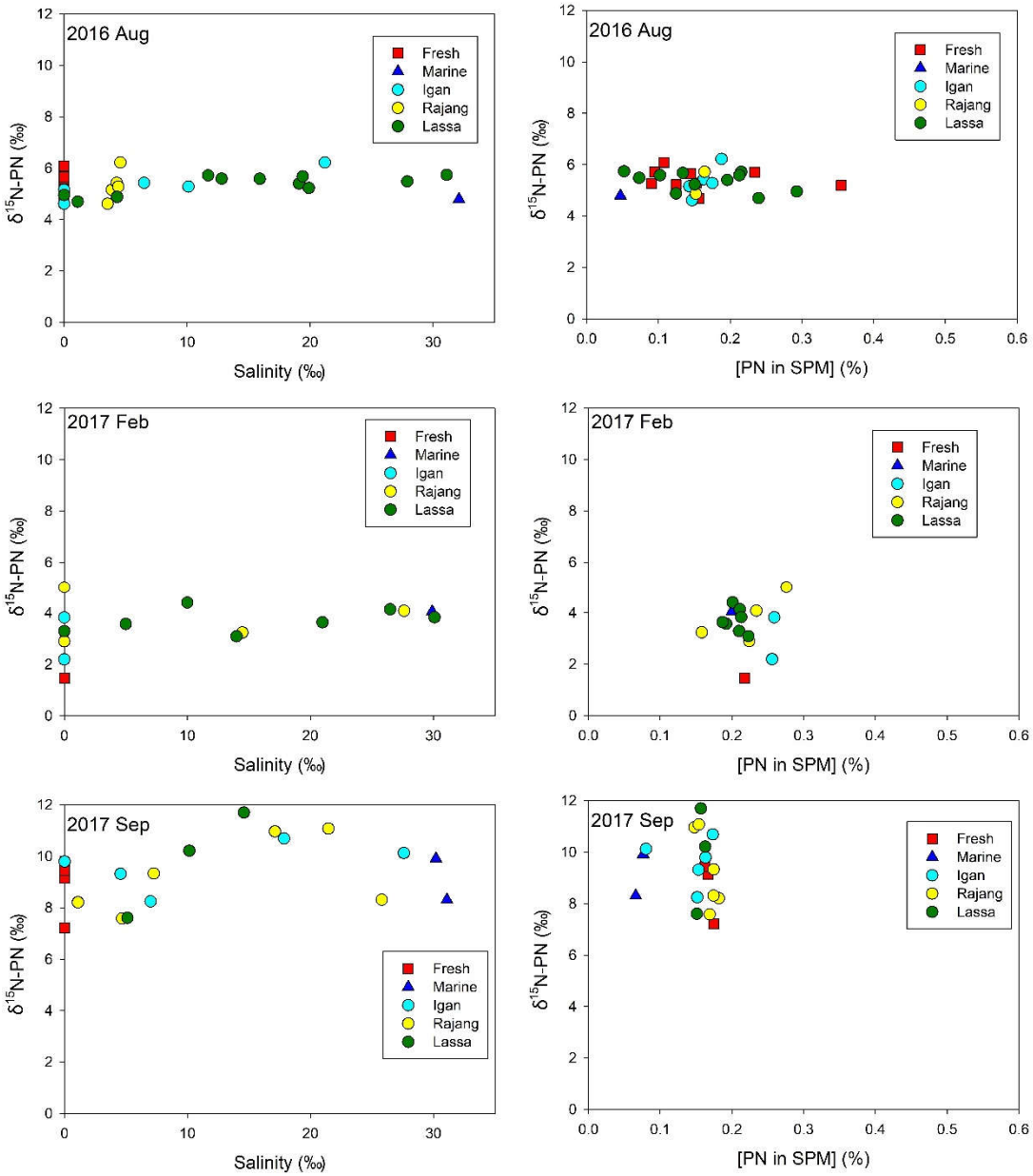

Fig. S6 Distribution of δ^{15}N-PN along the salinity gradient and the correlation between δ^{15}N-PN and PN in SPM.

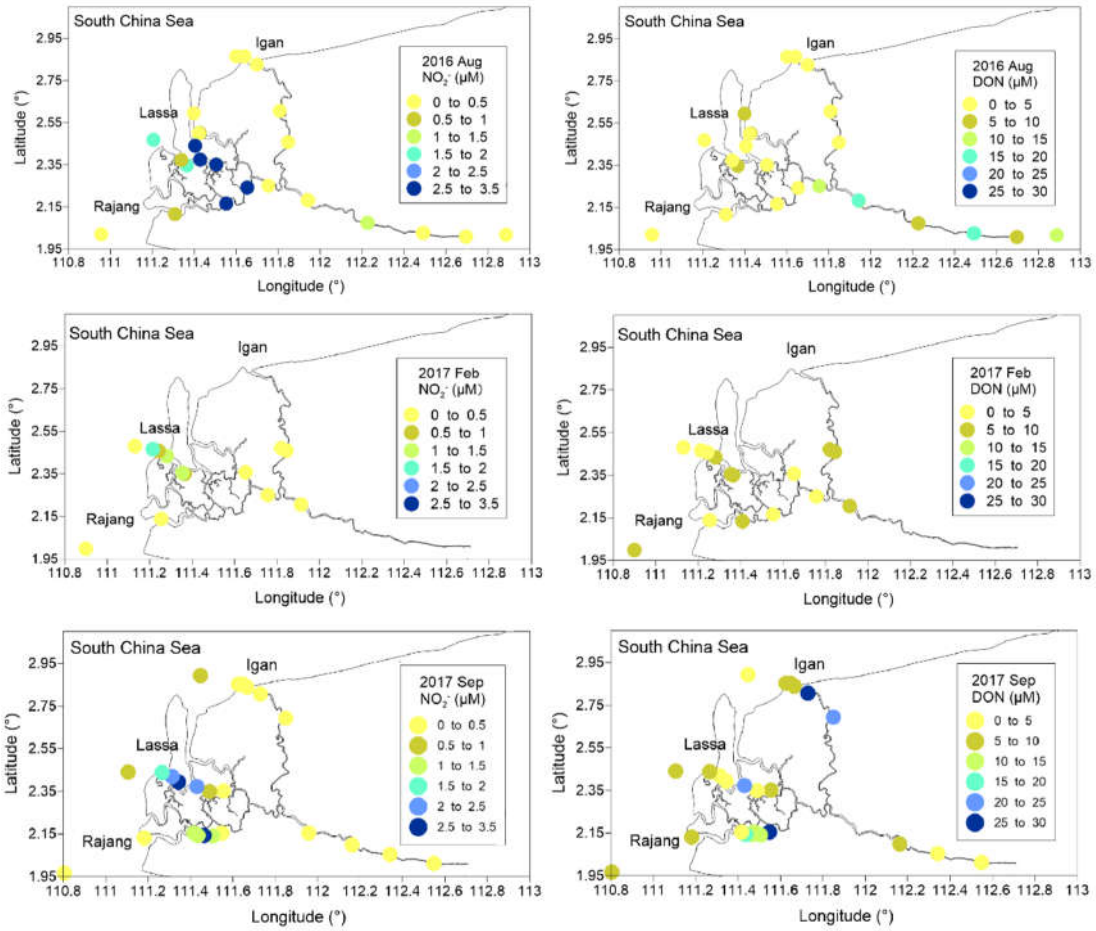

Fig. S7 Concentration of NO_2^- and DON in Rajang River and coastal ocean.

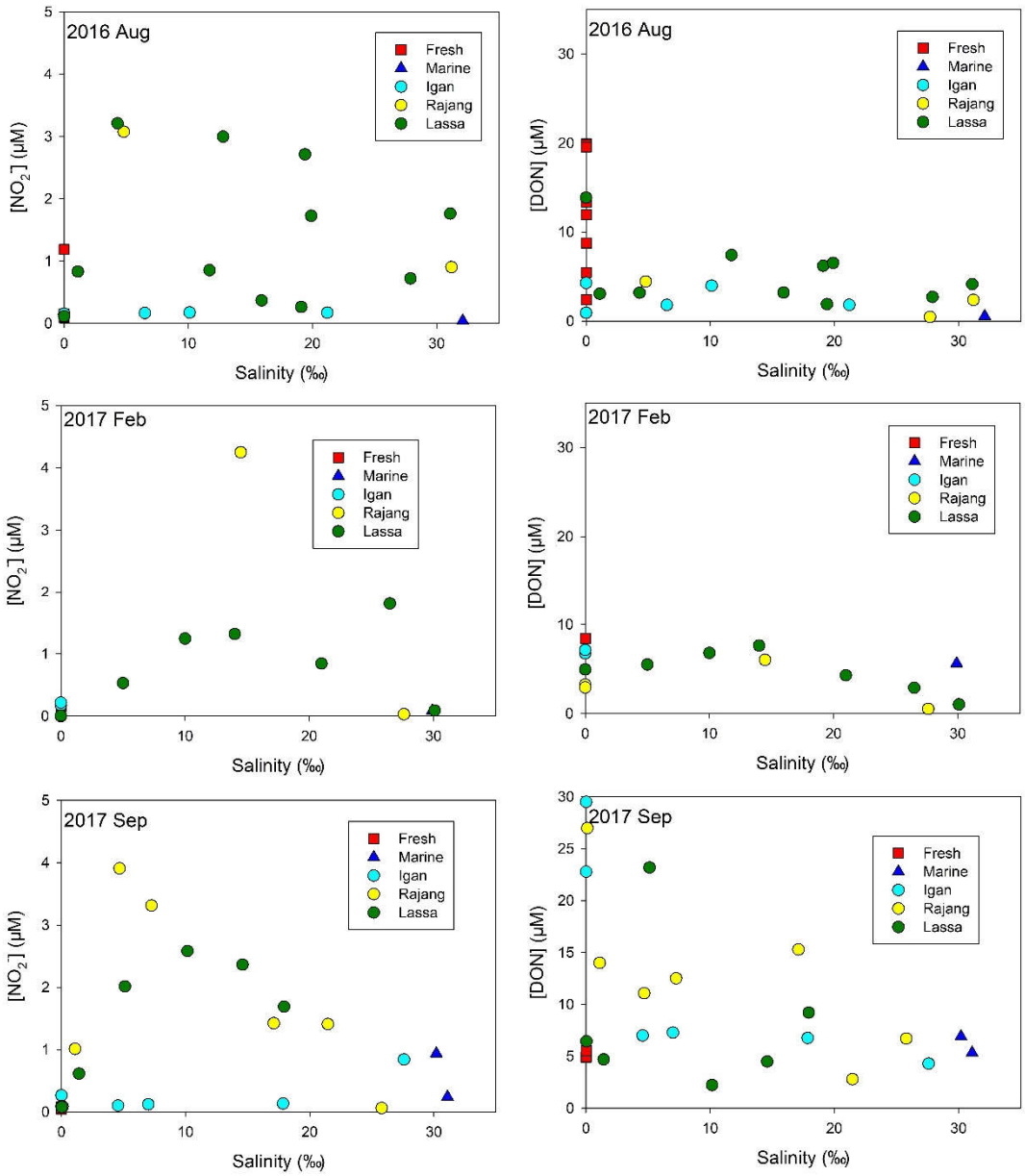

Fig. S8 Distribution of NO_2^- and DON concentration along the salinity gradient.

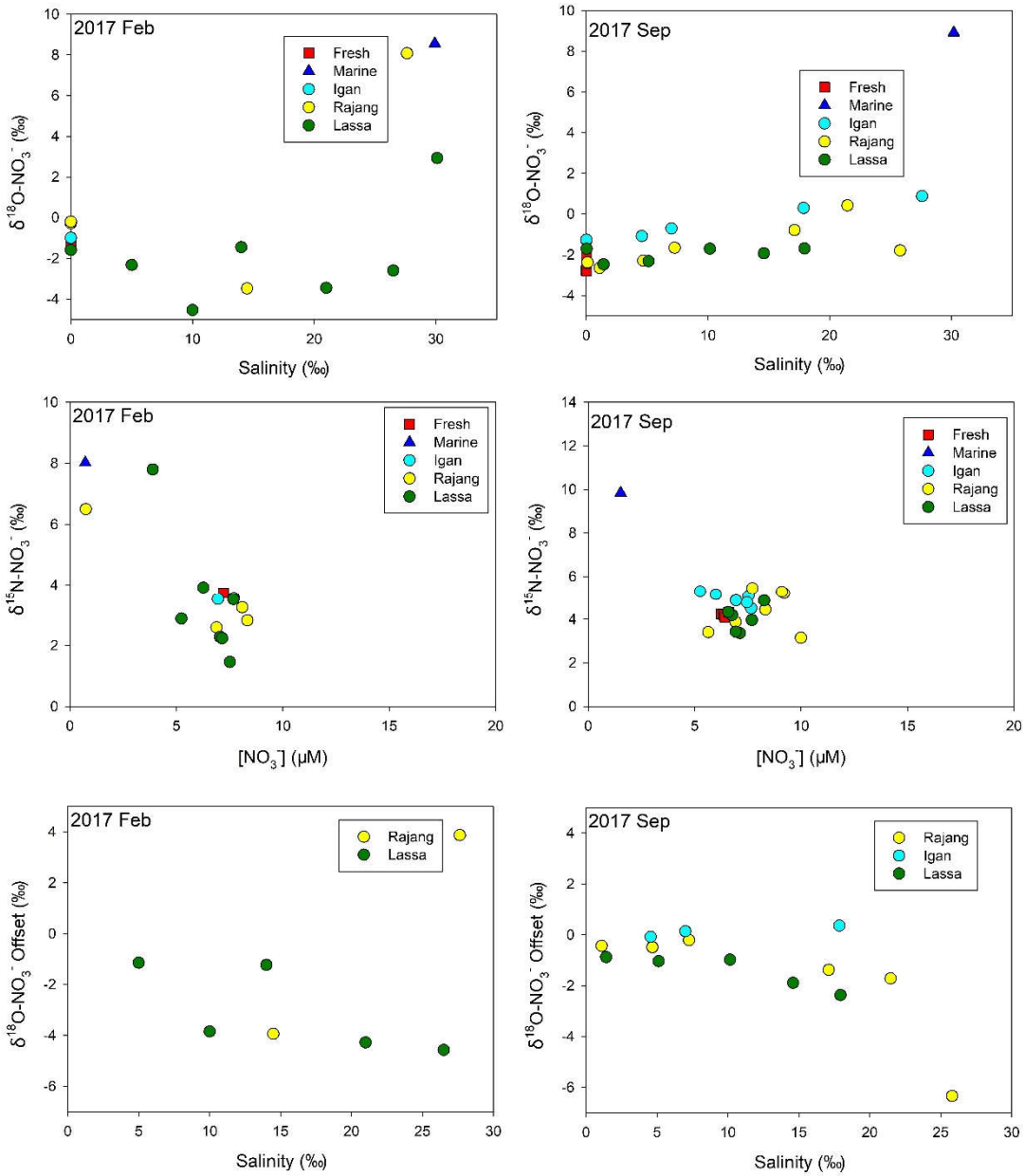

Fig. S9 Distribution of $\delta^{18}O\text{-}NO_3^-$ along the salinity gradient; correlation between $\delta^{15}N\text{-}NO_3^-$ and NO_3^- concentration; and distribution of $\delta^{18}O\text{-}NO_3^-$ offset along the salinity gradient.

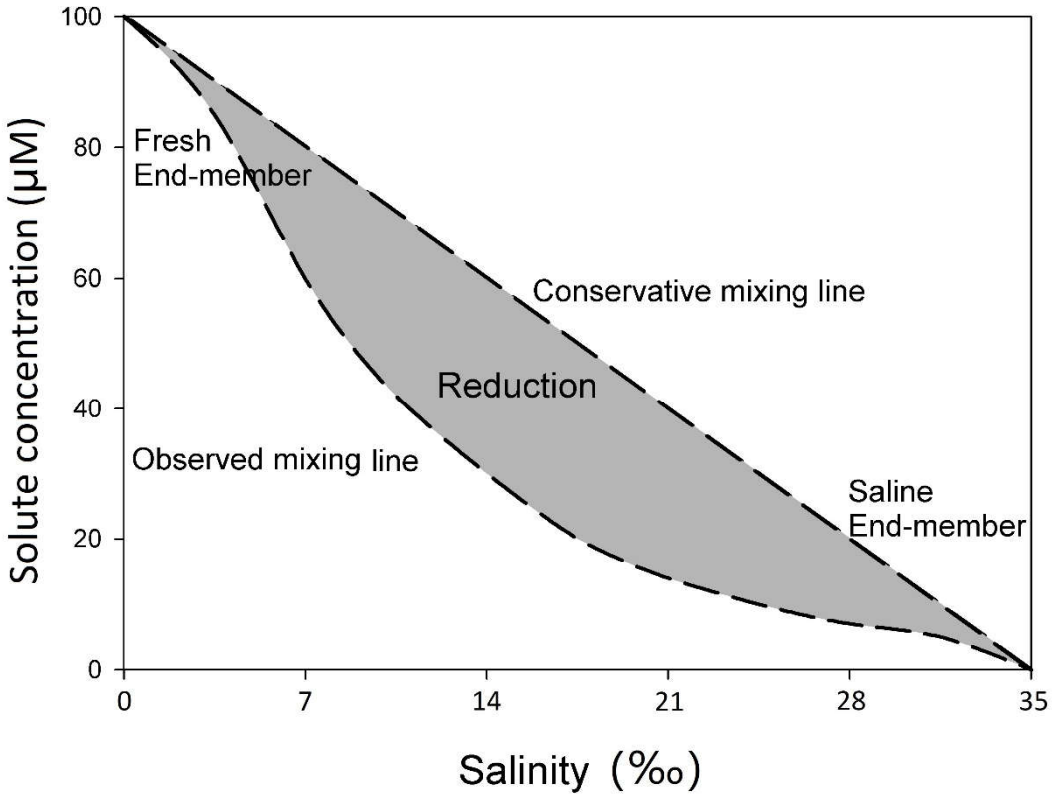

Fig. S10 Sketch for the calculation process of the reaction factor (reduction pattern). The calculation is based on the integration of conservative mixing and observed mixing along the salinity gradient. In particular, an integration for the conservative mixing line from fresh river (salinity: 0) to saline water (salinity: 35 here) is conducted, which offers the area of the triangle region (A_{con}). Subsequently, the other integration for the observed mixing line along the salinity gradient is conducted, generating a smaller area (A_{obs}) than the conservative integration (difference is the shadow region in the figure) in the reduction scenario. Afterwards, A_{obs} is divided by A_{con}, producing the reaction factor (without unit). Notably, in the reduction scenario, the reaction factor is < 1, while the addition leads to >1 factors.

Table S1 Reaction factors (f) of NO_3^-, NO_2^- and NH_4^+ in different tributaries among three cruises. If f >1, solute addition occurs and vice versa. The value of f is proportional to magnitude of addition or removal. In the table, flux (t N d^{-1}) is the magnitude of riverine flux to the coastal sea based on the mean factor (the average among Rajang, Lassa and Igan tributaries), river water concentrations (Fig. S9-S11) and Rajang discharge rate.

	Rajang	Lassa	Igan	Flux
August 2016				
NH_4^+	1.06	1.41	1.21	24.7
NO_2^-	13.1	6.94	1.17	6.28
NO_3^-	3.13	3.08	1.26	46.3
February 2017				
NH_4^+	0.92	0.95	----	20.1
NO_2^-	9.61	4.75	----	8.14
NO_3^-	1.21	1.59	----	73.3
September 2017				
NH_4^+	1.02	1.21	1.05	4.57
NO_2^-	3.63	3.45	0.68	1.16
NO_3^-	1.52	1.48	2.32	82.4