In is not Out: Closing the Floating Macroplastic Mass Balance for The Hong-Duong Bifurcation in The Red River, Vietnam

Thi Van Le Khoa[1], Tim van Emmerik[1], Ton Hoitink[1], and Pham Nhan[2]

[1]Wageningen University & Research
[2]Hanoi University of Natural Resources and Environment

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Abstract

Regarding transport of macroplastic (>5 mm) in rivers, its division over bifurcations is still an understudied topic. However, this is a critical knowledge to estimate plastic emission to oceans from rivers. To quantify the spatiotemporal variability of plastics in the Hong-Duong bifurcation, we executed a field campaign on a weekly basis and applied visual counting method where we count the floating plastics flowing through three cross sections to determine cross-sectional distribution of floating plastic and classify polymer categories of plastics from bridges located in the Hong-Duong bifurcation. These bridges include Nhat Tan located in northern Hanoi in the Red River, Long Bien is about 8km to the south from Nhat Tan in the Red River, and Dong Tru located in the tributary Duong River (˜7km from Nhat Tan). We aim to determine the spatiotemporal changes of macroplastics across the Hong-Duong bifurcation over the period from May 2021 to November 2021. Until July 2021, we found that the total average macroplastic fluxes at the cross sections in Nhat Tan, Long Bien, and Dong Tru were 698, 159, and 113 items/hour, respectively. Notably, these values do not follow the expected plastic balance between total plastic flux in the parent river and its tributaries, which is likely explained by the accumulation, transport below the surface, or sedimentation of plastics in the space between measurement locations. Additionally, over three months of May, June, and July, the total average plastic fluxes in all cross sections showed an increasing trend (˜10%). Furthermore, we also found that most plastics were distributed in the right side (downstream perspective) of Nhat Tan and Long Bien, while Dong Tru saw the opposite. Regarding the plastic classification, based on the River-OSPAR category, we found that food wrappers, polystyrene fragments, low density polyethylene (LDPE) bags, and polyethylene terephthalate (PET) bottles were the top 4 items. These findings together with the distribution of macroplastics along the cross sections are expected to apply in correlation analyses with hydrodynamic components in the bifurcation to determine their connectivity. This information is crucial for improving the efforts on quantifying macroplastic emissions from the Red River to the ocean which is still unknown up to now.

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Thi Van Le Khoa[1,2], Tim H M van Emmerik[1], Ton Hoitink[1] and Pham Quy Nhan[2], (1)Wageningen University & Research, Environmental Sciences, Wageningen, Netherlands, (2)Hanoi University of Natural Resources and Environment, Water Resources, Hanoi, Vietnam

Abstract Text:

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Submitter's E-mail Address:

khoatvl.hunre@gmail.com

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First Presenting Author
Presenting Author

Thi Van Le Khoa
Primary Email: khoatvl.hunre@gmail.com

Affiliation(s):

Hanoi University of Natural Resources and Environment
Water Resources
Hanoi (Vietnam)

Wageningen University & Research
Environmental Sciences
Wageningen (Netherlands)

Second Author

Tim H M van Emmerik
Primary Email: tim.vanemmerik@wur.nl

Affiliation(s):

Wageningen University & Research
Environmental Sciences
Wageningen (Netherlands)

Third Author

Ton Hoitink
Primary Email: ton.hoitink@wur.nl

Affiliation(s):

Wageningen University & Research
Environmental Sciences
Wageningen (Netherlands)

Fourth Author

Pham Quy Nhan
Primary Email: pqnhan@hunre.edu.vn

Affiliation(s):

Hanoi University of Natural Resources and Environment
Water Resources
Hanoi (Vietnam)

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