Dampak kegiatan di daerah sempadan sungai pada kualitas air dan keanekaragaman makroinvertebrata bentos kali Surabaya

Daru Setyo Rini, author

Abstrak

Kali Surabaya adalah sumber air baku PDAM Surabaya yang mengalir sepanjang 41 km melewati wilayah Mojokerto, Gresik, Sidoarjo, dan Surabaya. Kegiatan manusia di sekitar sungai dan konversi lahan sempadan sungai telah memberikan dampak buruk pada ekosistem sungai. Pemanfaatan lahan sempadan Kali Surabaya telah mengkonversi sebagian besar wilayah sempadan menjadi kawasan terbangun dan menghilangkan fungsinya sebagai penyangga ekosistem Kali Surabaya. Konversi tanah sempadan ini disebabkan oleh lemahnya pengawasan pemerintah (Gubemur, DPU Pengairan Propinsi Jawa Timur, dan Perum Jasa Tirta) pada penggunaan daerah sempadan Kali Surabaya. Lemahnya pemantauan dan pengawasan pada pembuangan limbah menyebabkan industri terus membuang limbahnya yang tidak diolah ke Kali Surabaya. Selama ini tidak ada tindak lanjut pada hasil pemantauan rutin, sehingga industri yang limbahnya terpantau jauh melampaui ambang batas, tetap melanggar baku mutu limbah cair pada pemantauan bulan berikutnya.

Tujuan penelitian ini adalah untuk membandingkan kualitas air dan keanekaragaman makroinvertebrata bentos Kali Surabaya di sekitar sempadan bagian hulu dengan kegiatan utama pertanian, bagian tengah dengan kegiatan utama industri dan bagian hilir dengan kegiatan utama permukiman. Penelitian ini juga mengkaji pelaksanaan kebijakan pengelolaan bahan sempadan dan pengendalian pencemaran air Kali Surabaya oleh Pemerintah Daerah Propinsi Jawa Timur.

Metode penelitian yang digunakan adalah deskriptif analitik dan pengambilan sampel dilakukan pada dua waktu pemantauan yaitu 25 Mei 2002 yang mewakili akhir musim hujan dan 21 Agustus 2002 yang mewakili akhir musim kemarau. Sampel air dan makroinvertebrata diambil dari 7 stasiun pengambilan sampel yaitu Sumberame dan Sumengko (Kali Surabaya bagian hulu), Driyorejo, Kali Tengah dan Karang Pilang (Kali Surabaya bagian tengah), serta Pereng dan Jambangan (Kali Surabaya bagian hilir).

Nilai Indeks Canberra yang mengindikasikan tingkat kesamaan kualitas air memperlihatkan adanya 3 kelompok kualitas air. Pada 25 Mei 2002 kelompok kualitas air terburuk ditemukan di Kali Tengah dan Jambangan, kualitas air menengah ditemukan di Karang Pilang dan Pereng dan kualitas air yang masih baik ditemukan di Sumberame, Sumengko, dan Driyorejo. Pada 21 Agustus 2002 kelompok kualitas air terburuk ditemukan di Kali Tengah, kualitas air menengah ditemukan di Karang Pilang dan Jambangan, sedangkan kualitas air yang masih baik ditemukan di Sumberame, Sumengko, Driyorejo, dan Pereng. Analisis statistika dengan uji Mann-Whitney dengan a 0,05 memberikan kesimpulan bahwa jumlah bahan pencemar organik (nilai BOD dan COD) pada Kali Surabaya bagian hulu berbeda nyata dengan jumlah bahan organik pada Kali Surabaya bagian tengah dan permukiman, sedangkan jumlah bahan pencemar organik pada Kali Surabaya bagian tengah tidak berbeda nyata dengan jumlah bahan organik pads Kali Surabaya bagian hilir.

Meskipun pengukuran fisika kimia memperlihatkan kualitas air pada Kali Surabaya bagian hulu masih baik, nilai indeks diversitas makroinvertebrata menandakan kualitas air Kali Surabaya bagian hulu telah mengalami tingkat pencemaran ringan. Hal ini berarti bahwa makroinvertebrata memberikan respon yang lebih peka dibandingkan pengukuran parameter fisika kimia, sehingga dapat dijadikan indikator untuk menilai kualitas air.

Pada pemantauan 25 Mei 2002, indeks diversitas makroinvertebrata terendah dijumpai di Jambangan, sedangkan pada pemantauan 21 Agustus 2002, indeks diversitas terendah dijumpai di Kali Tengah. Analisis statistik dengan uji korelasi Spearman Rank memberikan kesimpulan bahwa indeks diversitas memiliki korelasi negatif yang cukup kuat dengan BOD (nilai koefisien korelasi -0,653) dan korelasi negatif lemah dengan COD (nilai koefisien korelasi -0,339).

Komunitas makroinvertebrata pada Kali Surabaya bagian hulu dicirikan oleh tingginya persentase species tidak toleran pada pencemaran organik dari jenis larva serangga, keong (gastropoda) prosobranchia, kerang dan udang air tawar. Pada Kali Surabaya bagian tengah terjadi penurunan persentase species tidak toleran dan kenaikan persentase species toleran yaitu cacing Tubifex lubifex, Lumbriculus variegalus dan Chironomus sp. Pada Kali Surabaya bagian hilir persentase species toleran sangat tinggi dan hampir tidak dijumpai jenis makroinvertebrata tidak toleran. Species toleran yang banyak dijumpai adalah cacing Tubifex lubifex.

Berdasarkan hasil pengukuran kualitas air dan pemantauan makroinvertebrata bentos dapat disimpulkan bahwa tingkat pencemaran air Kali Surabaya berkisar antara tercemar ringan hingga tercemar berat dengan pencemaran terberat dijumpai di Kali Tengah (Kali Surabaya bagian tengah). Kegiatan industri di sempadan sungai dan pembuangan limbah industri ke Kali Surabaya perlu mendapat prioritas dalam pengendalian dan pengawasan pencemaran air di Kali Surabaya, terutama di Kali Tengah yang memberikan beban pencemaran terberat.

Untuk memulihkan ekosistem Kali Surabaya dari kerusakan, pemerintah harus memperketat pengawasan pada industri khususnya di Kali Tengah dan mewajibkan semua industri untuk mengolah limbahnya hingga memenuhi baku mutu limbah cair. Disamping itu perlu dilakukan penertiban bangunan liar di sempadan sungai yang melanggar ketentuan dan mengembalikan peruntukannya sebagai kawasan lindung.

Upaya penertiban harus dilakukan secara manusiawi dan didahului dengan sosialisasi kepada semua masyarakat pengguna lahan sempadan yang akan ditertibkan. Pemerintah perlu memikirkan solusi untuk menyediakan lahan pengganti bagi permukiman penduduk sempadan sungai atau membangun sistem pengolahan limbah terpadu untuk mengolah limbah industri dan domestik sebelum dibuang ke Kali Surabaya.

Pembersihan bangunan liar di sempadan harus disertai dengan rehabilitasi tanah sempadan untuk dilanjutkan dengan kegiatan reboisasi dan membuat hutan kota yang dapat dijadikan wahana ekowisata dan sarana pendidikan lingkungan bagi masyarakat untuk meningkatkan kepedulian masyarakat agar ikut partisipasi

aktif dalam melestarikan fungsi Kali Surabaya sebagai sumber air baku untuk air minum warga Surabaya.
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The Impact of Human Activity at Riparian Area on Water Quality and Benthic Macro-invertebrate Diversity of Surabaya RiverSurabaya River is a source of raw water supply for local potable water company (PDAM) in Surabaya. It flows along 41 km from Mojokerto passes through Gresik, Sidoarjo and Surabaya to the Strait of Madura. The utilization of riparian land of Surabaya River seems to be uncontrolled, most part of the riparian land has been converted into a developed area and its function as a buffer of Surabaya River ecosystem have been gradually destroyed. The increase in riparian land conversion was largely caused by lack of control from the provincial government (East Java Governor, Provincial Office of Public Work Department for Water and Irrigation, and Perum Jasa Tirta I).

The present study aims to assess water quality and diversity of benthic macro-invertebrate community of Surabaya River near the riparian area that is being used as agricultural, industrial and residential land. The present study also aims to assess the effectiveness of local government policy on the riparian land management and water quality control. The study was an analytical descriptive research. Water and substrate samples were collected from Surabaya River on 25th May 2002 represented the end of rainy season and 215 August 2002 represented the end of dry season.

Water samples and macro-invertebrates were collected from seven sampling stations along Surabaya River i.e. Sumberame and Sumengko (up-stream section of Surabaya River), Driyorejo, Kali Tengah, and Karang Pilang (middle section), Pereng and Jambangan (down-stream section).

The management of Surabaya River is conducted separately by governments of 4 municipalities along the river. There is lack of coordination and there is no integrated planning in the Surabaya River management. The local government control to the utilization of riparian zone and water pollution control in Surabaya River is still ineffective. Therefore, the improper uses of riparian land were still increasing and the water quality was declining. This condition threatens the sustainability of river function as source of raw water for drinking water company. The houses built on the riparian land were also not safe for the inhabitants, since the land is labil and some houses on the riparian land have collapsed lately.

The monitoring program seems to be only formality without any evaluation and follow-up action to the wastewater and water quality monitoring results. The industrial wastewaters that exceed the wastewater standard will still exceed the standard on the next monitoring results. There is no sufficient control to the wastewater disposal into Surabaya River.

The water assessment results showed that on 25th May 2002, the worst water quality of Surabaya River were found in Kali Tengah (middle section of Surabaya River) and Jambangan (down-stream of Surabaya River). On that day, presumably there were no waste disposal activity in Kali Tengah, hence the water quality in Kali Tengah was quite good and almost the same with water quality in Jambangan. On 2151 August 2002, it was presumed that there were waste disposal activities in Kali Tengah so that the water quality in Kali Tengah was the worst as compared to other stations in Surabaya River. The worst water quality was indicated by high values of BOD, COD, TOC, TSS and DHL in Kali Tengah on 21" August

2002.

The water quality of up-stream section of Surabaya River complied with the water quality standard of Class 1 according to PP No.81/2001 (can be used as raw water for drinking water), while the water quality at middle and down-stream section of Surabaya River exceeded that water quality standard.

The Mann-Whitney Test result with a 0,05 showed that the organic content (measured as BOD and COD) at up-stream section of Surabaya River was significantly different from those at the middle and down-stream section of Surabaya River. In contrast, the organic content at middle section of Surabaya River was not different significantly from that at and down-stream section.

Although the measurement of physical and chemical parameters of water sampled showed that the water quality at up-stream section of Surabaya River was still in good condition and complied the water quality standard of class 1, the biodiversity index of benthic macro-invertebrate community indicated the occurrence of mild water pollution. The result suggests that benthic community monitoring is more sensitive than the physical and chemical measurement. It can be used as bio-indicator of water quality in the habitat.

On 25th May 2002, the lowest diversity index was found at Jambangan while on 21s` August 2002 the lowest diversity index was found at Kali Tengah. The correlation coefficient index of Spearman rank showed a significant relation of diversity index to BOD and COD concentration. The diversity index has a moderately strong negative correlation with BOD content (coefficient correlation - 0,653) and it has a weak negative correlation with COD content (coefficient correlation - 0,339).

Macro-invertebrate community at up-stream section of Surabaya River was characterized by the high percentage of sensitive species such as insect larva, prosobranchia gastropod, mussels and decapods. At middle section of Surabaya River, the percentage of sensitive species decreased and the percentage of tolerant species, such as Tubifex tub fex, Lumbriculus variegatus and Chironamus sp. increased. At down-stream section of Surabaya River, the tolerant species were predominant so high and only few sensitive species were found in this area. The most abundant tolerant species was Tubifex lubifex.

In order to restore the ecosystem of Surabaya River, the government should increase the wastewater disposal control and command all industries to treat their wastewater. The illegal uses of the riparian zone should be terminated and the illegal buildings should be cleared from that protected area. The riparian land then should be rehabilitated and replanted with local vegetation species and a plan to convert the zone into a city riparian forest as a public park should be initiated. The city riparian forest should be supported by Surabaya River information centre as a facility to environmental education program. This centre will act as training facility to increase the understanding and awareness of the people in conserving the Surabaya River Ecosystem as a whole unit that interfered by their activity so that the river function as a source of raw water for drinking water will keep in sustainability.