ABSTRACT

The study aims to characterise the community of benthic macro-invertebrates and to use the structure metric as a biotic index criterion for assigning water quality classification in a pristine stream of the Endau-Rompin Forest Reserve, Johore, Malaysia. To this end, an inventory of benthic fauna was established; the composition, taxa richness and abundance of the macro-invertebrate populations, particularly the dominant insect groups Ephemeroptera-Plecoptera-Trichoptera (EPT) were studied. The distributional patterns within groups were also analysed and tested statistically for any significant difference. The benthic macro-invertebrate populations of Selai River were sampled in three occasions during dry periods using visual-hand picking and kick-net collection methods at thirteen stations. The organisms were sorted and identified to family and generic levels using standardised identification keys. Physical-chemical parameters and hydrological regime of the organisms' habitats were qualitatively recorded to understand the micro-habitats of the invertebrates. The biological measures including EPT taxa richness and abundance, Hilsenhoff's Family Biotic Index (FBI) and Lenat's Genus Biotic Index (GBI), the Biological Monitoring Working Party (BMWP) scoring systems and some physical-chemical variables were compared and integrated to define the water quality ratings of Selai River.

Selai River, a headwater of Endau River, had a rich and considerably diverse macro-invertebrate population, comprising 129 genera in sixty-seven families in thirteen orders. The community was dominated by the clean-water insect-groups EPT (11.76-32.58 %) and Odonata (11.76 % of the dominants). The One-way ANOVA

results on the abundance data of all benthos indicated subtle difference in the distribution of Plecoptera (F=6.043, p<0.05) and Megaloptera (F=3.458, p<0.05). The cluster analysis based on single linkage clustering model yielded a dendrogram showing four clusters of the thirteen stations: they are groups of lentic, mixed ripples and pools, ripples, and lotic habitats. The FBI values (ranging from 3.2 to 6.2) and those of GBI (ranging from 2.6 to 5.5) fluctuated closely to each other and provide similar indication on the gradient and/or environmental changes along the river. The BMWP values ranged from 43 to 171 scores, depicting the same trend in water quality changes as the FBI and GBI schemes. In comparison with DO, pH, PO_4, NO_3, Si_4 concentrations, conductivity and temperature, these biotic indices were compared and ranked to provide a "median" class for each station. The class categories along the thirteen stations of Selai River varied from Class I (excellent) to Class III (slightly polluted water quality). The classification results, although regarded as conservative, described an acceptable status that is within the National Water Quality Standards for the protection of nature reserve.

Among the indicating insect assemblage, Trichoptera (caddisflies) predominated in richness and abundance and this dominance prompted interest and study on some biological aspects of some hydropsychids, a philopotamid and a stenopsychid which were abundantly collected during this short-term study.

ABSTRAK

Kajian ini bertujuan untuk meninjau komuniti invertebrata-makro "benthic" dan menggunakan struktur metrik sebagai kriteria indeks biotik untuk pengelasan kualiti air sebuah sungai yang tidak tercemar di Hutan Simpanan Endau-Rompin, Johor, Malaysia. Pada akhir kajian, satu senarai fauna "benthic" telah dihasilkan dan komposisi, kekayaan taxa serta lebihan populasi-populasi invertebrata-makro, khususnya, kumpulan serangga dominan iaitu Ephemeroptera-Plecoptera-Trichoptera (EPT) juga dikaji. Corak-corak penyebaran dalam kumpulan juga dianalisis dan diuji secara statistik untuk sebarang perubahan yang penting. Sampel populasi invertebrata-makro "benthic" di Sungai Selai diambil sebanyak tiga kali ketika tempoh kering dengan menggunakan kaedah lihat dan kutip serta persampelan tendang di tiga belas buah stesyen sampel. Kesemua organisma-organisma tersebut diasingkan dan dikenalpasti sehingga ke tahap famili dan genus dengan menggunakan kekunci piawai pengenalpastian. Parameter kimia-fizikal dan juga rejim hidrologikal habitat-habitat organisma dicatat secara kualitatif untuk memahami habitat-mikro invertebrata-invertebrata tersebut. Pengukuran biologi termasuk kekayaan dan lebihan taxa EPT, Indeks Biotik Famili Hilsenhoff (FBI) dan Indeks Biotik Genus Lenat (GBI), sistem pengukuran "Biological Monitoring Working Party" (BMWP) serta sebahagian variasi kimia-fizikal dibanding dan disatukan untuk mentakrifkan kadar kualiti air di Sungai Selai.

Sungai Selai, sebahagian hulu Sungai Endau, kaya dengan pelbagai populasi invertebrata-makro, mengandungi 129 "genera" dalam 67 famili yang terdiri daripada 13 "order". Komuniti tersebut didominasikan oleh kumpulan serangga air-

bersih EPT (11.76-32.58 %) and Odonata (11.76 % daripada yang dominan). Keputusan sehala ANOVA ke atas data lebihan kesemua bentos menunjukkan perbezaan yang tidak ketara dalam penyebaran Plecoptera (F=6.043, p<0.05) dan Megaloptera (F=3.458, p<0.05). Analisis berkelompok berdasarkan model "single linkage clustering" menghasilkan satu dendrogram di mana stesyen-stesyen ini dikelompokkan kepada 4 kelompok: iaitu kumpulan berhabitat air tenang, antara tenang dan berpusar, berpusar, serta air deras. Nilai-nilai FBI (dalam linkungan 3.2 hingga 6.2) dan GBI (dalam linkungan 2.6 hingga 5.5), mempunyai perubahan julat yang ketara namun menghasilkan petunjuk yang sama ke atas perubahan kecerunan dan/atau alam sekitar di sepanjang sungai. Nilai-nilai BMWP dalam linkungan 43 hingga 71 mata, memaparkan haluan yang sama dalam perubahan kualiti air sebagaimana dengan skim FBI dan GBI. Berbanding dengan kepekatan oksigen terlarut (DO), pH, PO_4, NO_3, Si_4, konduktiviti dan suhu, indeks biotik ini dibanding dan ditentukan kedudukannya untuk menyediakan kelas pertengahan untuk setiap stesyen. Kategori kelas kesemua 13 stesyen di sepanjang Sungai Selai berbeza daripada Kelas I (sangat baik) hingga Kelas III (kualiti air yang sedikit tercemar). Keputusan klasifikasi, walau dianggap konservatif, menghuraikan satu status yang berada di dalam linkungan Piawaian Kualiti Air Kebangsaan untuk perlindungan simpanan alam semulajadi.

Di kalangan perkumpulan serangga petunjuk, Trichoptera (caddisflies) adalah dominan dalam kekayaan dan lebihan, dan dominasi ini menarik minat dan kajian ke atas sebahagian aspek biologi sebilangan "hydropsychids", "philopotamid" dan "stenopsychid" yang dikumpul dengan banyak sepanjang kajian jangka-pendek ini.