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ECOLOGICAL PARAMETERS OF ANNELIDA AT COASTAL MAN-MADE STRUCTURE AREAS IN KUALA NERUS, TERENGGANU, MALAYSIA

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Coastal man-made structures (CMS) are responsible for stabilizing navigation channels, sustaining deepened shipping routes, reducing wave and current actions and ultimately mitigating erosion. Despite previous reports on the CMS impact on marine organisms, the actual repercussions in the local area, remain uncertain. Scientific assessments of the impacts on biological environment, particularly on the Annelida community, are limited. Therefore, this study was carried out to determine the CMS impacts on ecological parameters of Annelida in Kuala Nerus, Terengganu. Seasonal samplings were conducted at four CMS stations of groyne (St. 1), semi-enclosed jetty type breakwater (St. 2), parallel breakwater without tombolo (St. 3), parallel breakwater with tombolo (St. 4), and a control station. These stations encompassed sheltered, exposed and control areas. Triplicate sediment samples for biological and ecological studies were collected using a Ponar grab. A total of 1152 individuals of Annelida belonging to 13 families have been collected from study areas. Station 1 documented the highest Annelida population (3695 ind./m²), followed by station 2 (1550.72 ind./m²) and station 4 (1413.04 ind./m²). Oweniidae dominated the Annelida

population (42.88%), followed by Spionidae (8.85%) and Dorvilleidea (8.33%). The sheltered stations recorded higher Annelida density ($2526.570 \text{ ind./m}^2 \pm 1976.25 \text{ ind./m}^2$) than the exposed ($1397.101 \pm 671.34 \text{ ind./m}^2$) and control stations ($1130.435 \text{ ind./m}^2$). The Kuala Nerus coastal area is governed by sandy sediment with relatively stable TOM and heavy metal contents. The current speed and significant wave height are lower at the sheltered sites than at the exposed and control sites. The control station recorded the deepest depth, followed by station 1 of the groyne area. The present study also revealed two new Annelida species: *Galathowenia minuta* n. sp. and *Owenia unipinnata* n. sp. Both species contribute to a more stable sediment, reducing erosion rate and supporting a variety of benthic organisms in an area. In conclusion, CMS in Kuala Nerus plays a crucial role in shaping the Annelida community structure. By altering the wave height and current speed, CMS modifies sediment composition and distribution, affecting TOM and heavy metal content and significantly impacting the Annelida community structure in Kuala Nerus.

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PARAMETER EKOLOGI ANELIDA DI KAWASAN STRUKTUR BUATAN MANUSIA DI PERSISIRAN KUALA NERUS, TERENGGANU, MALAYSIA

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Struktur buatan manusia di kawasan pesisir pantai (CMS) berperanan untuk menstabilkan saluran navigasi, mengekalkan laluan kapal yang dalam, mengurangkan tindakan ombak dan arus, serta mengurangkan hakisan. Walaupun terdapat laporan terdahulu mengenai kesan CMS terhadap organisma marin, kesan sebenar di kawasan tempatan masih belum pasti. Penilaian saintifik terhadap kesan CMS ke atas persekitaran biologi, khususnya terhadap komuniti Annelida, adalah terhad. Oleh itu, kajian ini dijalankan untuk menentukan kesan CMS terhadap parameter ekologi Annelida di Kuala Nerus, Terengganu. Pengambilan sampel bermusim dijalankan di empat stesen CMS iaitu groin (St. 1), pemecah ombak jenis jeti separa tertutup (St. 2), pemecah ombak selari tanpa tombolo (St. 3), pemecah ombak selari dengan tombolo (St. 4), dan satu stesen kawalan. Stesen-stesen ini merangkumi kawasan terlindung, terdedah, dan kawalan. Sampel sedimen tripliket untuk kajian biologi dan ekologi diambil menggunakan Ponar. Sebanyak 1152 individu Annelida daripada 13 Famili telah dikumpulkan dari kawasan kajian. Stesen 1 merekodkan populasi Annelida tertinggi (3695 ind./m²), diikuti oleh stesen 2 (1550.72 ind./m²) dan stesen 4 (1413.04 ind./m²). Oweniidae mendominasi populasi Annelida (42.88%), diikuti oleh Spionidae

(8.85%) dan Dorvilleidae (8.33%). Stesen-stesen terlindung mencatatkan kepadatan Annelida yang lebih tinggi (2526.570 ± 1976.25 ind./m²) berbanding dengan stesen terdedah (1397.101 ± 671.34 ind./m²) dan stesen kawalan (1130.435 ind./m²). Kawasan pantai Kuala Nerus didominasi oleh sedimen berpasir, dengan kandungan TOM dan logam berat yang agak stabil. Kelajuan arus dan tinggi ombak yang ketara adalah lebih rendah di lokasi terlindung, berbanding dengan lokasi terdedah dan kawalan. Stesen kawalan mencatatkan kedalaman yang paling dalam, diikuti oleh stesen 1 di kawasan struktur groin. Kajian ini juga mendedahkan dua spesies baru Annelida, iaitu *Galathowenia minuta* n. sp. dan *Owenia unipinnata* n. sp. Kedua-dua spesies ini menyumbang kepada sedimen yang lebih stabil, mengurangkan kadar hakisan dan menyokong pelbagai organisma bentik di sesuatu kawasan. Kesimpulannya, CMS di Kuala Nerus memainkan peranan penting dalam membentuk struktur komuniti Annelida. Dengan mengubah tinggi ombak dan kelajuan arus, CMS mengubah komposisi dan taburan sedimen, dengan itu, mempengaruhi kandungan TOM dan logam berat, dan secara signifikan memberi kesan kepada struktur komuniti Annelida di Kuala Nerus.