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**COMMUNITY ECOLOGY OF POLYCHAETA
(ANNELIDA) IN SOFT BOTTOM
MACROBENTHOS OF SOUTHERN SOUTH
CHINA SEA (OFFSHORE PAHANG,
TERENGGANU AND SABAH)**

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**Thesis Submitted in Fulfillment of the Requirement for the
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DEDICATIONS

“Say: If the sea were ink for the words of my Lord, the sea would surely be consumed before the words of my Lord are exhausted, though We were to bring the like of that (sea) to add” [Al-Kahfi: 109].

Dedicated this thesis to:

My all: Abah & Mak.

My anchor throughout the storm & turbulence:

Shahrul, Shahira, Shahila, Shahiqa.

I owe you guys, big time.

Thanks a lot.

May Allah bless.

Love you til Jannah ♥♥♥.

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu
in fulfillment of the requirement for the degree of Master of Science

**COMMUNITY ECOLOGY OF POLYCHAETA (ANNELIDA) IN SOFT
BOTTOM MACROBENTHOS OF SOUTHERN SOUTH CHINA SEA
(OFFSHORE PAHANG, TERENGGANU AND SABAH)**

NOOR SHAHIDA BINTI ROSLI

May 2015

Supervisor : Assoc. Prof. Zainudin b. Bachok, Ph.D.

Institute : Institute of Oceanography and Environment

Polychaete is among the largest and most diverse benthic animal in many marine ecosystems. However, in Malaysia the study on community ecology of polychaete from soft bottom habitats, especially at the offshore areas of southern South China Sea has not been widely explored. Thus, this study specifically embarks on the following objectives; 1) To determine the community structure (density, diversity and evenness) of polychaetes in soft bottom macrobenthos; 2) To determine the taxonomy and classification of polychaetes in the study area; and 3) To determine the relationship between polychaetes community structure and sediment parameters.

The study was conducted in April and July 2011 for one off sampling. There were 43 sampling stations located at three different areas which were the offshore areas of Pekan (Pahang)-Dungun (Terengganu), Kuala Terengganu

(Terengganu) and Kudat-Balambangan Island (Sabah). Offshore of Pekan-Dungun consisted of 19 stations (A1 to A19), Kuala Terengganu consisted of 11 stations (B1 to B11) while Kudat-Balambangan Island consisted of 13 stations (C1 to C13). At each sampling station, sediment samples for polychaetes (n=5), particle size analysis (PSA) (n=3) and total organic carbon (TOC) (n=3) were taken by Smith McIntyre grab (0.1 m²). Sediment for polychaetes was sieved through a set of wire mesh sieves (5.0, 3.0 and 0.5 mm) and polychaetes retained on the sieve were collected, fixed with 10% buffered formalin and were brought back to the laboratory together with the sediment for PSA and TOC for further analysis.

Overall, a total of 12,477 individuals of polychaetes were recorded and classified into 47 families and 217 genera. Spionidae was found to be the most dominant family, which contributed 17.7% from the total number of polychaetes, followed by Nephtyidae (7.5%), Paraonidae (6.3%) and Capitellidae (6.1%). The other 43 families had percentage abundance less than 1%. There were 368 identified species in which 27 of them came from Family Spionidae. In overall, *Aonidella cirrobranchiata* (Family Spionidae) was the most abundant species (6.8% out of total polychaete abundance), followed by *Driloneries* sp. (Family Oeonidae) (5.2%) and *Micronephthys sphaerocirrata* (Family Nephtyidae) (5.1%). The classification structure of polychaete families at the offshore areas of Pekan-Dungun, Kuala Terengganu and Kudat-Balambangan Island were constructed. The schematic scientific illustration for most abundant species of polychaetes,

Aonidella cirrobranchiata was produced in order to describe their taxonomical characteristics.

In terms of polychaete occurrence, the cumulative number of polychaete species was found to be parallel with the increasing number of sampling stations. In general, the cumulative number of species relatively highest at the offshore area of Pekan-Dungun (302 species, 19 stations), followed by Kudat-Balambangan Island (190 species, 13 stations) and Kuala Terengganu (172 species, 11 stations). Comparison between sampling stations showed that the highest number of polychaete species (>81 species) occurred at stations A1, A4, A5 and A12, whereas the lowest number (<31 species) was found to be at stations A14, B8 and B10.

The mean total density of polychaetes did not differ significantly between stations located at Kudat-Balambangan Island (670 ± 213 individuals/m²) and Pekan-Dungun (612 ± 215 individuals/m²) ($p > 0.05$), however the mean total density for both areas was significantly higher compared to sampling station at offshore Kuala Terengganu (420 ± 167 individuals/m²) ($p < 0.05$). The comparison among each sampling station showed that the mean total density of polychaetes was significantly highest at station C2 (1044 ± 234 individuals/m²), followed by C10 (1022 ± 266 individuals/m²) and C12 (974 ± 414 individuals/m²), whereas the significantly lowest mean total densities were at station B10 (252 ± 32 individuals/m²), B1 (276 ± 76 individuals/m²) and B2 (286 ± 54 individuals/m²) ($p < 0.05$).

Despite the differences of cumulative number of species and the mean total densities of polychaetes, the mean value of diversity (3.88 to 5.65) differ significantly ($p < 0.05$) however evenness index (0.72 to 0.92) did not differ significantly ($p > 0.05$) between the study areas off Pekan-Dungun, Kuala Terengganu and Kudat-Balambangan Island. Throughout all sampling stations, the significantly highest mean value of diversity and evenness was found to be same stations of A9, while the lowest value of both parameters was at station C10.

In general, the density of polychaetes has a significant correlation ($p < 0.05$) with the percentage of silt and organic carbon in the sediment, whereas their diversity did not correlate significantly ($p < 0.05$) with any type of particle size characteristics and organic carbon content in the sediment. On the other hand, the evenness of polychaete community was weakly correlated (correlation of coefficient between 0.2 and 0.4) with sediment characteristics but only for the percentage of sand and silt in the sediment.

In this study, the occurrence of the high number of identified species was relatively highest at the stations where the sediment type was dominated by silty-clay, silty-clay-loam and silt-loam (all stations except B5, C3, C4, C7, C10, C12 and C13). In addition, throughout the sampling areas, the mean total density of polychaetes relatively highest for the stations which are nearer to the shore and depths below 60 m (station A1, A2, A3, A4, A5, A6, C2, C7, C8, C9, C10, C12 and C13). This indicated that the areas with those kinds of sediment types, depths and the locations of specific stations, which

are closer to the shoreline might be the preferable habitats for polychaete. The data obtained from this study might contribute as additional information on the biodiversity of polychaetes community, their abundance and distribution at the offshore areas of southern South China Sea and eventually provide significant baseline information for sustainable management of South China Sea Large Marine Ecosystem (LME).

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan ijazah Master Sains.

**EKOLOGI KOMUNITI POLYCHAETA (ANNELIDA) DALAM
MAKROBENTOS DASAR LEMBUT DI SELATAN LAUT CHINA SELATAN
(LUAR PESISIR PAHANG, TERENGGANU DAN SABAH)**

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Mei 2015

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Haiwan poliket adalah kumpulan haiwan yang paling banyak dan pelbagai di kalangan haiwan benthik ekosistem marin. Walau bagaimanapun, di Malaysia kajian berkaitan ekologi komuniti poliket (Annelida) dari habitat lembut selatan Laut China Selatan (kawasan luar pesisir) tidak diterokai secara meluas. Oleh itu, kajian ini dijalankan dengan memberi tumpuan kepada objektif seperti berikut: 1) Untuk menentukan struktur komuniti (kepadatan, kepelbagaian dan kesamarataan) poliket dalam makrobentos dasar lembut; 2) Untuk menentukan klasifikasi taksonomi poliket di kawasan kajian; 3) Untuk menentukan hubungan antara struktur komuniti poliket dengan parameter sekitaran.

Kajian ini telah dijalankan pada bulan April dan Julai 2011 dengan satu kali pensampelan. Terdapat 43 stesen pensampelan yang terletak di tiga

kawasan yang berbeza iaitu kawasan luar pesisir Pekan (Pahang)-Dungun (Terengganu), Kuala Terengganu (Terengganu) dan Kudat-Pulau Balambangan. Kawasan luar pesisir Pekan-Dungun terdiri daripada 19 stesen (A1 hingga A19), Kuala Terengganu terdiri daripada 11 stesen (B1 hingga B11) manakala Kudat-Pulau Balambangan terdiri daripada 13 stesen (C1 hingga C13). Pada setiap stesen pensampelan, sampel sedimen untuk poliket (n=5), analisis saiz butiran (PSA) (n=3) dan jumlah karbon organik (TOC) (n=3) diambil dengan menggunakan pencekau Smith McIntyre (0.1 m²). Sedimen untuk poliket telah ditapis melalui set ayak dawai (5.0, 3.0, dan 0.5 mm) dan poliket yang terdapat pada set ayak diambil dan diawet dengan 10% formalin dan dibawa ke makmal bersama-sama dengan sampel PSA dan TOC untuk kajian selanjutnya.

Secara keseluruhan, sebanyak 12,477 individu poliket telah direkod dan dikelaskan kepada 47 famili dan 217 genera. Famili Spionidae didapati paling dominan dan menyumbang sebanyak 17.7% daripada jumlah poliket, diikuti oleh Nephtyidae (7.5%), Paraonidae (6.3%) dan Capitellidae (6.1%). 43 famili yang lain mempunyai peratusan kebanyakan kurang daripada 1%. Terdapat 368 spesies telah dikenalpasti di mana 27 daripada mereka adalah dari famili Spionidae. Secara keseluruhan, spesies *Aonidella cirrobranchiata* dari famili Spionidae merupakan spesies paling banyak (6.8% daripada jumlah keseluruhan poliket) di sepanjang tempoh kajian, diikuti oleh *Driloneries* sp. (5.2%) dari famili Oeonidae dan *Micronephthys sphaerocirrata* (5.1%) dari famili Nephtyidae. Struktur klasifikasi poliket di kawasan luar pesisir Pekan-Dungun, Kuala Terengganu dan Kudat-Pulau

Balambangan telah dibina. Lukisan skematik saintifik bagi spesies poliket terbanyak, *Aonidella cirrobranchiata* telah dihasilkan untuk menerangkan ciri taksonominya.

Bagi kehadiran poliket, bilangan kumulatif spesies poliket didapati berkadar langsung dengan pertambahan bilangan stesen pensampelan. Secara keseluruhan, bilangan kumulatif spesies adalah tertinggi di kawasan luar pesisir Pekan-Dungun (302 spesies, 19 stesen), diikuti dengan Kudat-Pulau Balambangan (190 spesies, 13 stesen) dan Kuala Terengganu (172 spesies, 11 stesen). Perbandingan di antara stesen pensampelan mendapati bilangan tertinggi spesies poliket (>81 spesies) didapati di stesen A1, A4, A5 dan A12, manakala bilangan terendah (<31 spesies) didapati di stesen A14, B8 dan B10.

Purata kepadatan poliket tidak berbeza secara beerti di antara stesen yang terletak di Kudat-Pulau Balambangan (670 ± 213 individu/m²) dan Pekan-Dungun (612 ± 215 individu/m²) ($p > 0.05$), tetapi purata kepadatan bagi kedua-dua kawasan adalah tinggi secara beerti berbanding stesen pensampelan di luar pesisir Kuala Terengganu (420 ± 167 individu/m²) ($p < 0.05$). Perbandingan di antara setiap kawasan pensampelan mendapati purata kepadatan poliket adalah tertinggi secara beerti di stesen C2 (1044 ± 234 individu/m²), diikuti oleh C10 (1022 ± 266 individu/m²) dan C12 (974 ± 414 individu/m²), manakala terendah secara beerti di stesen B10 (252 ± 32 individu/m²), B1 (276 ± 76 individu/m²) dan B2 (286 ± 54 individu/m²) ($p < 0.05$).

Walaupun terdapat perbezaan bilangan kumulatif spesies dan purata kepadatan poliket, purata nilai kepelbagaian (3.88 hingga 5.65) adalah berbeza secara beerti ($p < 0.05$) manakala indeks kesamarataan (0.72 hingga 0.92) tidak berbeza secara beerti ($p > 0.05$) di antara kawasan kajian di luar pesisir Pekan-Dungun, Kuala Terengganu dan Kudat-Pulau Balambangan. Pada keseluruhan stesen pensampelan, purata nilai kepelbagaian dan kesamarataan tertinggi terdapat di stesen yang sama iaitu A9, manakala nilai terendah bagi kedua-dua parameter adalah pada stesen C10.

Secara keseluruhan, kepadatan poliket adalah berkorelasi secara beerti ($p < 0.05$) dengan peratusan lumpur dan karbon organik di dalam sedimen, manakala kepelbagaian mereka tidak berkorelasi secara beerti ($p < 0.05$) dengan sebarang jenis ciri saiz butiran dan kandungan karbon organik di dalam sedimen. Walau bagaimanapun, kesamarataan komuniti poliket mempunyai korelasi lemah (koefisi korelasi di antara 0.2 dan 0.4) dengan ciri-ciri sedimen tetapi hanya pada peratusan pasir dan lumpur di dalam sedimen.

Di dalam kajian ini, kehadiran bilangan spesies dikenalpasti tertinggi di stesen yang mempunyai sedimen yang didominasi oleh lumpur-tanah liat, lumpur-tanah liat-tanah subur dan lumpur-tanah subur (semua stesen kecuali B5, C3, C4, C7, C10, C12 and C13). Tambahan pula di keseluruhan kawasan pensampelan, purata kepadatan poliket adalah paling tinggi di stesen yang terhampir dengan pesisir dan mempunyai kedalaman kurang dari 60 m (stesen A1, A2, A3, A4, A5, A6, C2, C7, C8, C9, C10, C12 and

C13). Ini menunjukkan bahawa kawasan yang mempunyai ciri-ciri jenis sedimen, kedalaman dan lokasi spesifik stesen, iaitu terhampir dengan garis pesisir berkemungkinan menjadi habitat terbaik untuk pertumbuhan komuniti poliket. Data yang diperolehi dari kajian ini berkemungkinan menyumbang kepada pertambahan informasi berkaitan kepelbagaian biologi komuniti poliket, kepadatan dan taburan mereka di kawasan luar pesisir selatan Laut China Selatan dan akhirnya menyediakan informasi garis pangkal yang signifikan untuk pengurusan berterusan Laut China Selatan sebagai Ekosistem Marin Terbesar (LME).