

**ECOLOGY OF BIVALVES IN THE LAGOON AREA OF
SETIU WETLAND, TERENGGANU, MALAYSIA**

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To my mother, Rabiah Hamzah,
To my late father, Yahya Tahir,
To my families,
To my best friend,
Thank you for your support ♥♥♥

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu
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A study on ecology of bivalves in the lagoon area of Setiu Wetland, Terengganu was conducted in two months interval for a year (July, September, November 2011 and January, March, May 2012). The study was conducted in order to determine the taxonomic classification of bivalves; to determine their spatial and temporal abundance; and to determine the relationship between the abundance of bivalve and environmental parameters in the lagoon area of Setiu Wetland. There were several distinguished lagoon habitats, which were ranged from brackish and freshwater of subtidal area to the intertidal habitat of mangrove forest (mixed mangrove trees and *Nypa* stands) and adjacent area of exposed muddy-sandy intertidal flat. Eleven sampling stations (St.) were selected along the lagoon (from Beting Lintang at the northern to Kg. Penarik at the southern). St. 1, St. 2, St. 3, St. 4, St. 5 and St. 7 were located at the brackish subtidal area while St. 9, St. 10, and St. 11 at the freshwater subtidal area. However,

St. 6 and St. 8 were located at the mangrove intertidal area of the lagoon. At each sampling station, there was a 50 m line of transect with four points (10m distance between each point) was set up. The bivalve samples were collected by handpicking within a quadrat of 0.5 m x 0.5 m (five replicates).

A total of 10,845 individual of bivalves were collected and classified into 11 families and 21 genera. Corbulidae was found to be the most abundant family, which contributed 77% from the total number of bivalves, followed by Veneridae (7%) and Myochamidae (7%). For other families the percentage abundance were less than 1%. There were 34 identified species, 16 of the species were Family Veneridae. In overall, *Potamocorbula fasciata* was found to be the most abundant species (77% out of total bivalve abundance), followed by *Myadora* sp. (7%) and *Scapharca cornea* (4%). In term of bivalve occurrence, 30 species were found in subtidal area, 6 species in intertidal area, while another 2 species occurred in both subtidal and intertidal areas. The higher number of species occurred at St. 3 (23 species), St. 5 (18 species), and St. 4 (15 species) whereas all of the stations were located in brackish subtidal area. The lowest species number were at St. 11 (1 species) of freshwater subtidal area. Temporally, the highest number of bivalves species found were in May 2012 (25 species) and the lowest were in July 2011 (13 species).

The total density of bivalves were also higher at stations located in the brackish subtidal area compared to freshwater subtidal stations. The mean total density of bivalves were significantly highest at St. 1 (261 ± 154

individuals/m²), followed by St. 3 (52±51 individuals/m²) (p<0.05), whereas the lowest mean density (<1 individuals/m²) were at St. 10 and St. 11. The density of bivalves at St. 6 and St. 8 (intertidal stations) were 7±2 and 9±5 individuals/m² respectively. The mean density of bivalves did not differ significantly among sampling months (p>0.05). Relatively, the density was highest in November 2011 (57±136 individuals/m²) (Northeast Monsoon) and lowest in July 2011 (6±7 individuals/m²) (Southwest monsoon). Generally, diversity of bivalves were higher at brackish subtidal area compared to freshwater subtidal and mangrove intertidal areas. The diversity of bivalves were highest at St. 4 of brackish subtidal area (1.88) and lowest at St. 11 of freshwater subtidal area (0). The evenness of bivalves were highest in brackish subtidal station (St. 10, 0.95) and the lowest were in freshwater subtidal area (St. 11, 0). Temporal comparison among sampling months indicated the diversity and evenness of bivalves were highest in July 2011 (2.07 and 0.81 respectively). The lowest diversity and evenness of bivalves were in November 2011 (0.56 and 0.18 respectively).

Density, diversity, and evenness of bivalves were correlated with sediment characteristics, total organic matter as well as *in situ* parameters (salinity, temperature, pH, and DO). The density, diversity, and evenness of bivalves not had significant correlation with sediment characteristics and total organic matter (p>0.05). The density, diversity, and evenness also had no significant correlation with *in situ* parameters (salinity, temperature, pH, and DO) (p>0.05) except for diversity that had significant correlation with salinity (p<0.01). Density and diversity of bivalves were higher at the brackish

subtidal area where the salinity was higher and the percentage of total organic matter was lower, with the sandy sediment.

The density and diversity of bivalves were higher in the brackish subtidal area compared to freshwater subtidal and mangrove intertidal area. There were no significant correlation between the density, diversity, and evenness with the sediment characteristics and total organic matter. The diversity of bivalves in the lagoon area of Setiu Wetland can be considered as high because it only covered a small area.

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EKOLOGI BIVALVIA DI KAWASAN LAGUNA TANAH BENCAH SETIU,

TERENGGANU, MALAYSIA

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November 2013

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Satu kajian mengenai ekologi Bivalvia di kawasan laguna Tanah Bencah Setiu, Terengganu telah dijalankan pada setiap 2 bulan selama setahun (Julai, September, November 2011 dan Januari, Mac, Mei 2012). Kajian ini dilakukan untuk menentukan klasifikasi taksonomi Bivalvia; untuk menentukan taburan tempat dan masa bagi Bivalvia; untuk menentukan hubungan antara kepadatan Bivalvia dengan parameter sekitaran air di kawasan laguna Tanah Bencah Setiu. Terdapat beberapa perbezaan habitat laguna, iaitu dari kawasan subtidal air payau dan air tawar ke kawasan habitat pasang surut kawasan hutan paya bakau (campuran pokok-pokok bakau dan nipah) dan berdekatan dengan kawasan rata yang terdedah kepada zon pasang surut. Terdapat 11 stesen pensampelan telah dipilih di sepanjang laguna (dari Beting Lintang di utara laguna ke Kg. Penarik di selatan laguna). St. 1, St. 2, St. 3, St. 4, St. 5, dan St. 7 terletak di kawasan marin subtidal, St. 9, St. 10, dan St. 11 terletak di kawasan subtidal air tawar,

manakala St. 6 dan St. 8 terletak di kawasan hutan paya bakau pasang surut laguna. Terdapat 50 m garis transek dengan empat titik dibuat di setiap stesen pensampelan (10 m jarak untuk setiap titik). Sampel Bivalvia yang terdapat dalam kuadrat (0.5 m x 0.5 m) dikutip dengan menggunakan tangan sebanyak lima replikasi di setiap titik.

Sebanyak 10, 845 individu Bivalvia telah dikutip. Bivalvia terdiri daripada 11 famili dan 21 genera. Corbulidae adalah famili tertinggi iaitu 77% daripada purata jumlah kepadatan Bivalvia, diikuti oleh Veneridae (7%) dan Myochamidae (7%). Kebanyakan famili yang lain mempunyai peratus yang kurang daripada 1%. Terdapat 34 spesis taxonomi yang telah dikenalpasti iaitu 16 spesis daripadanya adalah daripada Famili Veneridae. Secara keseluruhannya, *Potamocorbula fasciata* merupakan spesis tertinggi (77% daripada jumlah kebanyakan Bivalvia), diikuti oleh *Myadora* sp. (7%), dan *Scapharca cornea* (4%). Dari segi kawasan kehadiran Bivalvia, 30 spesis ditemui di kawasan subtidal, 6 spesis ditemui di kawasan pasang surut, manakala 2 spesis boleh didapati di kedua-dua kawasan. Bilangan spesis tertinggi ditemui adalah di St. 3 (23 spesis), St. 5 (18 spesis), dan St. 4 (15 spesis) manakala yang terendah adalah di St. 11 (1 spesis). Bilangan tertinggi Bivalvia spesis yang ditemui adalah pada bulan Mei 2012 (25 spesis) dan yang terendah adalah pada bulan Julai 2011 (13 spesis).

Purata kepadatan Bivalvia dikumpul sepanjang tempoh pensampelan adalah 33 ± 17 individual/m². St. 1 mempunyai purata kepadatan Bivalvia tertinggi yang signifikan (261 ± 154 individual/m²) ($p < 0.05$), diikuti oleh St. 3 (52 ± 51

individual/m²) yang kedua-dua stesen itu terletak di kawasan subtidal air payau. St. 10 dan St. 11 mempunyai purata kepadatan terendah (<1 individual/m²) yang kedua-duanya terletak di kawasan subtidal air tawar. Kepadatan Bivalvia di St. 6 dan St. 8, yang kedua-dua terletak di kawasan pasang surut adalah 7 ± 2 dan 9 ± 5 individual/m². Purata kepadatan Bivalvia tidak mempunyai perbezaan yang signifikan antara bulan pensampelan ($p>0.05$). Kepadatan Bivalvia tertinggi adalah pada bulan November 2011 (57 ± 136 individual/m²) (Monsun Timur Laut) dan paling rendah pada bulan Julai 2011 (6 ± 7 individual/m²) (Monsun Barat Daya). Amnya, kepelbagaian adalah lebih tinggi di kawasan subtidal air payau berbanding dengan subtidal air tawar dan kawasan pasang surut paya bakau. Kepelbagaian Bivalvia tertinggi adalah di St. 4 yang terletak di kawasan subtidal air payau (1.88) dan yang terendah di St. 11 yang terletak di kawasan subtidal air tawar (0). Nilai keserasian tertinggi adalah di St. 10 dan terendah di St. 11 (0.95 dan 0 masing-masing). Kepelbagaian dan keserasian Bivalvia tertinggi adalah pada bulan Julai 2011 (2.07 dan 0.81 masing-masing). Kepelbagaian dan keserasian Bivalvia paling rendah adalah pada bulan November 2011 (0.56 dan 0.18 masing-masing).

Kepadatan, kepelbagaian, dan keserasian berhubung dengan karakter tanah, kandungan bahan organik, dan juga parameter sekitaran air (kemasinan, suhu, pH, dan oksigen terlarut). Kepadatan, kepelbagaian, dan keserasian Bivalvia tidak mempunyai korelasi yang signifikan dengan karakter tanah dan kandungan bahan organik ($p>0.05$). Kepadatan, kepelbagaian, dan keserasian Bivalvia juga tidak berkorelasi signifikan

dengan parameter sekitaran air (kemasinan, suhu, pH, dan oksigen terlarut) ($p > 0.05$) kecuali kepelbagaian yang mempunyai signifikan korelasi dengan kemasinan ($p < 0.01$). Kepadatan dan kepelbagaian Bivalvia tertinggi di kawasan subtidal air payau di mana mempunyai kemasinan yang tinggi, kandungan bahan organik (%) yang rendah, dan berpasir.

Kepadatan dan kepelbagaian Bivalvia lebih tinggi di kawasan subtidal air payau berbanding kawasan subtidal air tawar dan kawasan pasang surut paya bakau. Kepadatan, kepelbagaian, dan keserasian tidak mempunyai hubungan yang signifikan dengan karakter tanah dan kandungan bahan organik. Kepelbagaian Bivalvia di kawasan laguna Tanah Bencah Setiu boleh dianggap sebagai tinggi kerana kajian ini hanya meliputi kawasan yang terhad.