

ECOLOGY OF GASTROPOD IN SETIU LAGOON,
TERENGGANU, MALAYSIA

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DEDICATION

*I dedicated this thesis to
my mother, Che Gayah binti Ali and my father, Zakaria bin Wahab.*

ABSTRACT

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

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Lagoon area of Setiu Wetland, Terengganu may function as important habitats for Gastropods, yet little ecological research on this organism have been conducted in this area. This study was conducted in order to determine the biodiversity, distribution and habitat preferences of gastropods in the lagoon area of Setiu Wetland. The correlations between the abundance of gastropods and environmental parameters were also determined.

Eleven stations were selected along the lagoon area from the northern part of the lagoon (Beting Lintang) to Southern part of the lagoon (Penarik) approximately 20km. The selected stations representative of various habitats in ranged between freshwater and brackish water of subtidal to the intertidal

habitats of mangrove area. The lagoon area was divided into three zones; northern zone was located at Beting Lintang where three stations were located (freshwater habitat; ST1, ST2, ST3); middle zone at Pengkalan Gelap, which was the estuary or the river mouth (four stations; ST4, ST5, ST6, ST7, ST8) and southern zone was located at Penarik which connected to the Chalok river and Setiu River (three stations; ST9, ST10, ST11). A transect line with 50 m long with 10 m interval was made at each sampling station. The gastropods samples within a quadrat of 0.25 m² were collected by hand picking. Sampling was designed to pass through major seasonal event in Setiu Wetland for one year time and sampling was carried out in two months interval for one year time; Northeast monsoon (November 2011, January 2012, Mar 2012) and Southwest monsoon (July 2011, September 2011, May 2012).

A total of 34628 individuals of gastropods were collected and classified into 14 different families which commonly found in many tropical wetland ecosystems. Potamididae was found to be the most abundant family (34% of total number of gastropods), followed by Thiaridae (27%), Neritidae (25%), Batillariidae (7%), and Cerithiidae (6%) and others (1%). Up to 38 species of gastropods were found and identified. *Cerithidea cingulata* was the most dominant species (29% of total gastropods), followed by *Clithon oualaniensis* (17%), *Thiara riqueti* (15%), *Thiara tuberculata* (10%), *Batillaria zonalis* and *C. faba* (7% each). The percentage abundance of other species were lower than 7%.

The mean density of gastropods were highest (333 individuals/m²) at station 4 (lagoon subtidal area). However, at this station, the gastropods community only dominated by three species which were *Cerithidea cingulata*, *Clithon oualaniensis* and *Batillaria zonalis*. In addition, the low value of biodiversity indices of this station (Richness (D) = 0.72±0.17; Shannon-wiener (H') = 1.27±0.25; Evenness (J') = 0.69±0.07) could suggest that this habitat might be less preferred by many gastropods species.

For the station located at mangrove intertidal area (ST6 and ST8), the mean density for both stations were low (83 individuals/m², 35 individuals/m² respectively). Even though this stations have low density, the diversity in both station were found significantly higher (station 8: D=2.10±0.27; H'=1.63±0.26) (station 6: (D=1.83±0.28; H'=1.47±0.23) and might suggest that this habitat have higher biodiversity if compared to other habitat and preferred by gastropods community. This might be influenced by the high percentage of organic matters found in the sediment of this habitat as shown by significant relationship trend of organic materials. Station 11 (freshwater subtidal area) has no individuals discovered on the sediment of station 11 which was muddy and has high organic matter in the sediment.

In the lagoon area of Setiu Wetland, 5 species (*Clithon oualaniensis*, *C. faba*, *Faunus ater*, *Cerithidea cingulata*, and *C. djadjariensis*) of gastropods were found at almost all stations except in station 11 indicated that they have

wide distribution in the lagoon area of Setiu Wetland. However certain species such as *Thiara riqueti*, *Batillaria zonalis*, *Thiara tuberculata* and *Nassarius jacksonianus* only dominated at freshwater and brackish water subtidal habitat (ST1, ST2, ST3, ST4, ST5, ST7, ST9, and ST10) indicated that this species might only limited to the habitat. On the other hand, there are species that could be found at specific area. Whereas only 1 species were found only in freshwater subtidal habitat (*Septaria lineata*), 9 species were occurred in brackishwater subtidal habitat (*Neritina virginea*, *Cerithium coralium*, *Nassarius olivaceus*, Unidentified Fascioliidae, *Chicoreus capucinus*, *Natica tigrina*, *N. gualtieriana*, Unidentified Ranellidae and *Ellobium aurismidae*) and most gastropods species (18 species) found only in intertidal mangrove habitat (*Dostia violacea*, *D. cornucopia*, *Neritina jovis*, *N. coromandeliana*, *Vittina variegata*, Unidentified Neritidae, *Cerithidea quadrata*, *Telescopium telescopium*, Unidentified Potamididae, *Littoraria carinifera*, *Littoraria scabra*, *Assiminia* sp., Unidentified Vermitidae, *Cassidula aurisfelis*, *C. nucleus*, *C. angulifera*, *Ellobium aurisjudae* and *Pythia trigona*). These indicate that this species are exclusive to freshwater subtidal habitat, brackish water subtidal habitat and intertidal mangrove habitat. This might be caused by the differences of the sediment characteristics, organic matter, temperature, pH, and salinity. This study found that different species of gastropods might have different habitat preferences as indicated by their abundance in different stations.

The changes in seasonal did not have any significance different to the abundance and biodiversity of the gastropods species ($P>0.05$). This showed that, gastropods can tolerate to any changes in their habitat environment. Baseline ecological studies of gastropods community structure are important for monitoring, management and conservation of the lagoon area of Setiu Wetland, Terengganu, Malaysia.

ABSTRAK

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

EKOLOGI GASTROPOD DI LAGUN SETIU, TERENGGANU, MALAYSIA

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Kawasan Lagun Tanah bench Setiu, Terengganu mungkin berfungsi sebagai habitat penting untuk gastropod, namun hanya sedikit penyelidikan ekologi terhadap organisma ini telah dijalankan di kawasan ini. Kajian ini telah dijalankan untuk menentukan keutamaan biodiversiti, taburan dan habitat gastropod dalam kawasan lagun Tanah bench Setiu. Korelasi antara kelimpahan gastropod dan parameter alam sekitar juga telah ditentukan.

Sebelas stesen telah dipilih sepanjang kawasan lagun dari bahagian utara lagun (Beting Lintang) ke bahagian selatan lagun (Penarik) iaitu kira-kira 20km. Stesen yang dipilih mewakili pelbagai habitat antaranya adalah kawasan yang sentiasa ditenggelami air ketika pasang surut 'subtidal' dan juga kawasan

air pasang surut (intertidal) di kawasan bakau. Selain itu, kawasan lagun ini juga boleh dibahagikan kepada tiga zon, zon utara terletak di Beting Lintang (habitat air tawar; ST1, ST2, ST3); zon tengah di Pengkalan gelap, yang merupakan muara sungai (empat stesen; ST4, ST5, ST6, ST7, ST8) dan zon selatan terletak di Penarik yang bersambung dengan sungai Chalok dan Sungai Setiu (tiga stesen; ST9, ST10, ST11). Satu garis transek 50 m panjang dengan 10 m selang telah dibuat pada setiap stesen. Sampel gastropod yang didapati dalam kuadrat 0.25 m² dikumpul. Persampelan dijalankan dalam tempoh selang dua bulan dalam masa satu tahun; Monsun Timur Laut (November 2011, Januari 2012, Mac 2012) dan Monsun Barat Daya (Julai 2011, September 2011, Mei 2012).

Sebanyak 34628 individu telah berjaya dikumpulkan. Empat belas famili gastropod telah dikenalpasti, terdiri daripada 38 spesies gastropod. Potamididae ditemui sebagai famili gastropod yang paling banyak (34% daripada jumlah bilangan gastropod), diikuti oleh Thiaridae (27%), Neritidae (25%), Batillaridae (7%), Cerithiidae (6%) dan lain-lain (1%). *Cerithidea cingulata* adalah spesies yang paling banyak dijumpai (29% daripada jumlah gastropod), diikuti oleh *Clithon oualaniensis* (17%), *Thiara riqueti* (15%), *Thiara tuberculata* (10%), *Batillaria zonalis* dan *C. faba* (7%). Peratusan spesies lain yang dijumpai adalah lebih rendah daripada 7%.

Kepadatan min gastropod tertinggi (333 individu/m²) dicatatkan di stesen 4 ('subtidal' air payau). Walau bagaimanapun, di stesen ini, hanya tiga spesies yang dijumpai iaitu *Cerithidea cingulata*, *Clithon oualaniensis* dan *Batillaria zonalis*. Di samping itu, stesen ini mempunyai nilai indeks biodiversity yang rendah (Richness (D) = 0.72 ± 0.17 ; Shannon-Weiner (H') = 1.27 ± 0.25 ; Evenness (J') = 0.69 ± 0.07). Oleh itu, habitat ini mungkin kurang digemari oleh kebanyakan spesies gastropod.

Bagi stesen yang terletak di kawasan pasang surut bakau (ST6 dan ST8), min kepadatan bagi kedua-dua stesen adalah rendah (83 individuals/m²; 35 individuals/m²). Walaupun stesen ini mempunyai kepadatan yang rendah, biodiversiti di kedua-duanya stesen ini didapati jauh lebih tinggi (stesen 8: D = 2.10 ± 0.27 ; H' = 1.63 ± 0.26 (stesen 6: (D = 1.83 ± 0.28 ; H' = 1.47 ± 0.23). Habitat ini mempunyai biodiversiti yang lebih tinggi jika dibandingkan dengan habitat lain. Ini kerana kemungkinan stesen ini dipengaruhi oleh peratusan bahan organik yang terdapat dalam sedimen. Tiada individu gastropod dijumpai di stesen 11. Stesen 11 mempunyai sedimen berlumpur dan tinggi bahan organiknya.

Di kawasan lagun Tanah bencha Setiu, 5 spesies (*Clithon oualaniensis*, *C. faba*, *Faunus ater*, *Cerithidea cingulata*, and *C. djadjariensis*) gastropod telah dijumpai di hampir semua stesen kecuali di stesen 11. Ini menunjukkan bahawa species gastropod ini mempunyai taburan yang luas. Walau

bagaimanapun spesies tertentu seperti *Thiara riqueti*, *Batillaria zonalis*, *Thiara tuberculata* dan *Nassarius jacksonianus* hanya dijumpai di kawasan air tawar dan air payau subtidal (ST1, ST2, ST3, ST4, ST5, ST7, ST9, dan ST10). Ini menunjukkan bahawa spesies ini mungkin hanya terhad kepada habitat tersebut sahaja. Sebaliknya, terdapat spesies yang boleh didapati di kawasan tertentu sahaja. Hanya 1 spesies telah dijumpai di habitat air tawar subtidal (*Septaria lineata*), 9 spesies dijumpai di habitat air payau subtidal (*Neritina virginea*, *Cerithium coralium*, *Nassarius olivaceus*, Fasciolariidae (tidak dapat dicamkan), *Chicoreus capucinus*, *Natica tigrina*, *N. gualtieriana*, Ranellidae (tidak dapat dicamkan) dan *Ellobium aurismidae*) dan 18 spesies ditemui hanya di dalam habitat bakau (*Dostia violacea*, *D. cornucopia*, *Neritina jovis*, *N. coromandeliana*, *Vittina variegata*, Neritidae (tidak dapat dicamkan), *Cerithidea quadrata*, *Telescopium telescopium*, Potamididae (tidak dapat dicamkan), *Littoraria carinifera*, *Littoraria scabra*, *Assiminia* sp., Vermitidae (tidak dapat dicamkan), *Cassidula aurisfelis*, *C. nucleus*, *C. angulifera*, *Ellobium aurisjudae* dan *Pythia trigona*). Ini menunjukkan bahawa spesies ini adalah eksklusif kepada habitat air tawar subtidal, air payau subtidal dan habitat bakau. Ini mungkin disebabkan oleh perbezaan ciri-ciri sedimen, bahan organik, dan kemasinan. Kajian ini mendapati bahawa spesies gastropod yang berbeza mungkin mempunyai pilihan habitat berbeza.

Perubahan musim didapati tidak mempunyai kesan yang signifikan kepada biodiversiti spesies gastropoda ($P > 0.05$). Ini menunjukkan bahawa,

gastropod boleh bertahan dengan sebarang perubahan dalam persekitaran habitat mereka. Kajian asas ekologi gastropod adalah penting bagi pemantauan, pengurusan dan pemuliharaan kawasan lagun Wetland Setiu, Terengganu, Malaysia.