UNIVERSITI PUTRA MALAYSIA

COMPOSITION AND DISTRIBUTION OF COPEPOD POPULATIONS IN A TROPICAL ESTUARY

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FP 2013 106

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SERDANG, SELANGOR

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NORHISYAM BIN MOHD NOR

160295

This project report is submitted in partial fulfillment of the requirements for the degree of Bachelor of Agriculture (Aquaculture)

DEPARTMENT OF AQUACULTURE

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SERDANG, SELANGOR

2013

CERTIFICATION OF APPROVAL

DEPARTMENT OF AQUACULTURE

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This is certifying that I have examined the final project report and all corrections have been made as recommended by the panel of examiners. This report complies with the recommended format stipulated in the AKU4999 project guidelines, Department of Aquaculture, Faculty of Agriculture, Universiti Putra Malaysia.

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ABSTRACT

The purpose of this study was to analyze the copepod composition and distribution in a tropical estuary in Pendas river, Johor Malaysia. Samples were collected monthly for six month period at three stations in this study area located at an elevation of 5 m above sea level with coordinates 1°22'60" N and 103°37'59" E. Physico-chemical parameters in the study site such as salinity, dissolved oxygen (DO), pH, temperature, conductivity and total dissolved solid (TDS) were measured *in situ* using multiparameter water probe YSI professional model 556. Composite samples of chlorophyll *a*, and water samples for total nitrogen and total phosphorus analyses were collected by using Niskin water sampler. Copepod samples were collected using plankton net with 140 µm mesh towed horizontally at each station. A total of nine copepod genera from nine families were identified at the study site (river, estuary, strait). Copepod communities were dominated by adult copepod from the family Acartidae, Paracalanidae and Oithonidae in the study site. Copepod from genera *Acartia* sp were found alternately dominating copepod population at the river stations throughout the sixth month whereas in the estuary and strait stations, *Paracalanus* sp constantly dominated the total copepod populations. Species diversity index was highest ($p < 0.05$) in the strait compared to estuary and river sites.

ABSTRAK

Tujuan kajian ini adalah untuk menganalisis komposisi kopepod dan taburannya di muara tropika di sungai Pendas, Johor Malaysia. Sampel telah dikumpulkan setiap bulan untuk tempoh enam bulan yang terletak di ketinggian 5 meter di atas paras laut dengan koordinat 1 ° 22'60 "N dan 103 ° 37'59 " E. Parameter fiziko-kimia di dalam kawasan kajian seperti kemasinan, oksigen terlarut pH, suhu, konduktiviti dan jumlah pepejal terlarut (TDS) diukur secara *in situ* menggunakan probe air multiparameter YSI model profesional 556. Sampel komposit klorofil, jumlah nitrogen dan jumlah analisis fosforus telah dikumpulkan dengan menggunakan 'Niskin water sampler'. Sampel kopepod telah dikumpulkan menggunakan 'plankton net' dengan 140 µm ditarik secara mendatar di setiap stesen. Sebanyak Sembilan genus kopepod dari sembilan keluarga telah dikenal pasti di kawasan kajian (sungai, muara, selat). Kopepod komuniti dikuasai oleh kopepod dewasa dari famili Acartidae, Paracalanidae dan Oithonidae di tapak kajian. Kopepod dari genus *Acartia* sp. ditemui mendominasi kopepod komuniti di tapak sungai sepanjang enam bulan berbanding di muara dan selat yang didominasi oleh *Paracalanus* sp. Indeks kepelbagaian spesies yang tertinggi ($p < 0.05$) dicatatkan di selat berbanding dengan muara dan sungai.

ACKNOWLEDGEMENT

Bismillahirahmanirahim.

I would like to express my deepest gratitude to my supervisor Prof Dr. Fatimah Md. Yusoff for her expertise and consistent constructive advice, ideas, intelligent counsel, motivation, suggestion encouragement and guidance for the successful completion throughout the course of this Final Year Project (FYP). The blessing, help and guidance given by her from time to time shall carry me a long way in the journey of life on which I am about to embark.

My sincere thanks also to express a deep sense of gratitude to Siti Balqis bt Abd Razak and NurSuhayati bt Abu Seman, for their valuable information, advice, comments and guidance, which helped me in completing this task through various stages.

My appreciation and thanks to Mohd Faizul Mohmud and Nurzawani Azuwa for their willingness to help me when I need it. I thank almighty, my parents, sisters and brother for their constant encouragement without which this Final Year Project would not be possible.

Thank you so much.

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CHAPTER 1

INTRODUCTION

The term “plankton” is derived from the Greek word planoas, which means to wander. It is used to refer to suspended organisms, with limited locomotion abilities (Johnson and Allen, 2005; Miller and Kendall, 2009). The planktonic community consists of both primary producers and heterotrophic consumers. Phytoplankton refers to photosynthetic protists and bacteria that act as primary producers, while zooplankton refers to the consumers, consisting of protozoa and animals (Johnson and Allen, 2005). Zooplankton are an important entity of the marine food web, production of fishes and other animals and links between phytoplankton production at higher trophic levels (Park and Marshall, 2000). Zooplankton, micronekton, and epipelagic animals are usually distributed unevenly both vertically and horizontally. They are a key component of marine ecosystems. Zooplanktons are found in all ocean zones, particularly the pelagic and littoral zones in the ocean, and also in ponds, lakes, and rivers. They are microscopic invertebrate animals that are weak swimmers and usually drift along with the currents.

Zooplankton are tiny (0.02 - 2000 µm) animals and can be divided in two groups such as small microzooplankton (2 – 200 µm) and larger mesozooplankton (200 - 2000 µm) (Sieburth *et al*., 1978). They range in size from single-celled organisms to larger multi-celled organisms typically 1 to 2 millimetres (0.039 to 0.079 in). Life history is a common approach for describing zooplankton. Zooplanktons that spend their entire life as plankton are called holoplankton. Examples of holoplankton include cladocerans, rotifers, jellyfish and copepods.

Copepods are a group of small crustaceans that are found in the sea and nearly every freshwater habitat. In addition, copepods are often the main food of small or young fish and shrimps in the water body such as riverine, estuarine and marine. Copepods are the most common and abundant holoplanktonic organisms worldwide. This is due to different sizes of foods they are eating and each copepod species will distribute itself at different depths in the water column at different times.

Estuarine zooplankton including copepods could be divided into groups based on salinity regime. Salinity is considered the most influential factor affecting zooplankton structure in estuaries (Johnson and Allen, 2005). Salinity tolerances are species dependent, with some species able to tolerate wide salinity ranges, while others have narrow ranges. Furthermore, a preliminary work on Terengganu River estuary, in the east coast of Peninsular Malaysia also showed that the copepod assemblage correlated with the salinity gradient found in the estuary (Zaleha *et al.*, 2003). For example, an estuarine harpacticoid copepod *Amphiascus tenuiremis* proved the influence of salinity changes to their population density in a laboratory culture experiment, indicating their existence in the natural environment might be limited to certain salinity regime (Richmond *et al.*, 2007).

However, there are no previous studies of copepod abundance at these three different zones of a tropical riverine system (riverine, estuarine, marine). Hence, a spatial and temporal patterns in copepod zooplankton composition and abundance with different salinity gradient at three different areas (riverine, estuarine, seas) need to be studied. Thus, Pendas river was chosen in order to achieve the following objectives:

1. To determine the composition and abundance of copepod zooplankton along the salinity gradient (marine, brackish, fresh water) in Pendas river

2. To correlate the water quality in Pendas river with the zooplankton abundance and biodiversity.

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