FATIN ADLINA BINTI MD NASIR MASTER OF SCIENCE 2020

THE INFLUENCE OF SEASONAL VARIATION TOWARDS NUTRIENT DISTRIBUTION AND BEHAVIOUR IN KELANTAN RIVER ESTUARY, MALAYSIA

FATIN ADLINA BINTI MD NASIR

MASTER OF SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

2020

THE INFLUENCE OF SEASONAL VARIATION TOWARDS NUTRIENT DISTRIBUTION AND BEHAVIOUR IN KELANTAN RIVER ESTUARY, MALAYSIA

FATIN ADLINA BINTI MD NASIR

Thesis Submitted in Fulfilment of the Requirements for the Degree of Master of Science in the Institute of Oceanography and Environment Universiti Malaysia Terengganu

AUGUST 2020

DEDICATION

I dedicate this thesis to my beloved parents and siblings whose endless love, sacrifice and words of encouragement have motivated me to push myself to the limit in completing my study. I also dedicate this work to my supervisor, Professor Chm Dr. Suhaimi bin Suratman, whose guidance, patience and insights helped me throughout this study, especially his confidence in me. Finally, I dedicate this thesis to my friends for their continuous support and understanding.

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfilment of the requirements for the degree of Master of Science

THE INFLUENCE OF SEASONAL VARIATION TOWARDS NUTRIENT DISTRIBUTION AND BEHAVIOUR IN KELANTAN RIVER ESTUARY, MALAYSIA

FATIN ADLINA BINTI MD NASIR

August 2020

Main Supervisor: **Professor Chm Dr. Suhaimi bin Suratman, Ph.D**

School/ Institute: **Institute of Oceanography and Environment**

Nutrients input to estuarine has increased significantly globally, due to the rising of human populations and this results in eutrophication. This study was designed to determine the spatial and temporal distributions of nutrients in Kelantan River estuary during different monsoon seasons and to identify the potential sources and sinks of nutrients in the estuary. The general water quality variables such as salinity, temperature, pH, dissolved oxygen (DO) and total suspended solids (TSS) were monitored *in situ*. Surface and bottom water samples were collected at 16 sampling points using "Van Dorn Sampler" and were analysed colorimetrically. The results indicate there was a signicant effect of monsoon season on the general water quality of the water column. This study also reveals that the concentrations of nitrate and ammonia in surface and bottom water were highest during the monsoon season, with the range of 16.13-20.39 (mean 17.52 ± 1.42) µM and 11.63-22.75 (mean 17.55 ± 2.43) µM for nitrate and 25.57-88.97 (mean 58.43 ± 21.14) µM and 1.30-99.08 (mean 47.25 ± 32.67) µM for ammonia, respectively. For particulate organic nitrogen (PON) and dissolved organic nitrogen (DON), the concentrations were highest during the pre-monsoon season while the concentrations of nitrite, dissolved inorganic phosphate (DIP), total particulate phosphate (TPP) and dissolved organic phosphate (DOP) were highest during the post monsoon season. Kelantan River estuary also recorded higher nutrient concentrations in the middle part of the estuary and at the upstream areas, which suggest that the anthropogenic inputs and agricultural factors take place in these

areas. For the behavior of nutrients, all nutrients behaved conservatively in the surface water during the monsoon season and the inconsistent behaviors were observed for the other surveys in the surface and bottom water. The non-conservative behavior with addition trend was contributed by the freshwater run-off, desorption process and re-suspension of sediment, meanwhile the removal trend in the estuary was influenced by the adsorption process and the dilution of saline water. This study suggests that the distribution and behavior of nutrients are mainly influenced by the monsoonal changes, as the freshwater inflow and saltwater intrusion control the nutrients in this estuary.

Abstrak tesis yang dikemukan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

PENGARUH KEPELBAGAIAN MUSIM TERHADAP TABURAN DAN PERLAKUAN NUTRIEN DI MUARA SUNGAI KELANTAN, MALAYSIA

FATIN ADLINA BINTI MD NASIR

Ogos 2020

Penyelia Utama : Profesor Chm Dr. Suhaimi bin Suratman, Ph.D

Pusat Pengajian/Institut: Institut Oseanografi dan Sekitaran

Kemasukan nutrien ke muara telah meningkat secara mendadak di seluruh dunia, disebabkan penambahan populasi manusia dan mengakibatkan eutrofikasi. Kajian ini telah direka bentuk bagi mengenal pasti taburan reruang dan bermusim nutrien di muara Sungai Kelantan semasa musim monsoon berbeza dan mengenal pasti sumber yang menyumbang dan menyingkirkan nutrien di muara ini. Parameter am kualiti air seperti saliniti, suhu, pH, oksigen terlarut (DO) dan jumlah pepejal tak terlarut (TSS) dipantau secara *in situ*. Sampel air di permukaan dan lapisan bawah dikumpul di 16 titik persampelan menggunakan pensampel *Van Dorn* dan dianalisis secara kaedah berwarna. Hasil pemantauan ini menunjukkan terdapat kesan monsun yang signifikan ke atas parameter am kualiti air untuk turus air. Kajian ini juga mendedahkan bahawa kepekatan nitrat dan ammonia di permukaan dan lapisan air bawah adalah tertinggi semasa musim monsun, masing-masing dengan julat 16.13-20.39 (purata 17.52 ± 1.42) μM dan 11.63-22.75 (purata 17.55 ± 2.43) μM bagi nitrat dan 25.57-88.97 (purata 58.43 ± 21.14) μM dan 1.30-99.08 (purata 47.25 ± 32.67) μM, bagi ammonia. Bagi nitrogen organik partikulat (PON) dan nitrogen organik terlarut (DON), kepekatan didapati paling tinggi sewaktu musim pra-monsun. Sementara itu, kepekatan nitrit, fostat tidak organik terlarut (DIP), fostat partikulat keseluruhan (TPP) dan fostat organik terlarut (DOP), diperhatikan paling tinggi sewaktu musim pasca-monsun. Muara Sungai Kelantan juga mencatatkan kepekatan nutrien yang lebih tinggi di bahagian tengah muara dan hulu sungai, yang mencadangkan terdapat

kemasukan antropogenik dan faktor pertanian di kawasan ini. Bagi tingkah laku nutrien, kesemua nutrien berkelakuan konservatif di permukaan air pada musim monsun dan tingkah laku yang tidak konsisten diperhatikan di permukaan dan lapisan bawah air pada musim lain. Tingkah laku tidak konservatif dengan tren penambahan disumbangkan oleh proses larut lesap air tawar, proses penjerapan dan dijerap serta pelepasan sedimen, manakala tingkah laku yang tidak konservatif dengan tren penyingkiran di muara pula telah dipengaruhi oleh proses penjerapan dan larutan air masin. Hasil kajian ini mencadangkan bahawa taburan dan tingkah laku nutrien dipengaruhi oleh perubahan musim monsun disebabkan oleh kemasukan air tawar dan pergerakan air masin yang mengawal nutrien di muara.