

A STUDY ON THE NUTRIENT DISTRIBUTION
IN TERENGGANU RIVER ESTUARY

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**A STUDY ON THE NUTRIENT DISTRIBUTION IN TERENGGANU RIVER
ESTUARY**

By

Wong Tung Yee

**Research Report submitted in partial fulfillment of
The requirement for the degree of
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DEPARTMENT OF MARINE SCIENCE
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**DECLARATION AND VERIFICATION REPORT
RESEARCH PROJECT I AND II**

It is hereby declared and verified that this research report entitled:

A Study on The Nutrient Distribution in Terengganu River Estuary by Wong Tung Yee, Matric No. **UK16448** have been examined and all errors identified have been corrected. This report is submitted to the Department of Marine Science as partial fulfillment towards obtaining the Degree Bachelor of Science (Marine Science), Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

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LIST OF ABBREVIATIONS

°C	-	Degree Celsius
Abs.	-	Absorbance
ANOVA	-	Analysis of variance
APHA	-	American Public Health Association
Avg.	-	Average
AWWA	-	American Waste Water Association
Cond.	-	Conductivity
DO	-	Dissolved oxygen
DOE	-	Department of Environment Malaysia
DON	-	Dissolved organic nitrogen
DOP	-	Dissolved organic phosphorus
EPA	-	United States Environmental Protection Agency
HSD	-	Honestly significant difference
L	-	Liter
mg/L	-	Milligram per liter
MICE	-	Meetings, Incentives, Conventions, Exhibitions
mL	-	Milliliter
N	-	Normality

nm	-	nanometer
ppt	-	Part per thousand
Std. Dev.	-	Standard deviation
TDP	-	Total dissolved phosphorus
Temp.	-	Temperature
P	-	Phosphorus
N	-	Nitrogen
WEF	-	Water Environment Federation
WQC	-	Water quality criteria
WQS	-	Water quality standard

ABSTRACT

Terengganu River estuary is located at Kuala Terengganu, facing the South China Sea. The major sources of water input of the estuary are Nerus River and Terengganu. Over the past 30 years, Kuala Terengganu has undergone significant development with its rapid industrialization and growing economic activity. Terengganu River breakwater project has started in year 2002 and the project is still on-going for the development of Kuala Terengganu City Centre project (KTCC) under East Coast Economic Region (ECER). This study was conducted to assess the nutrient level and distribution in Terengganu River estuary. A total number of ten sampling stations were established in the study area where the physical parameters and nutrient levels of the water were studied. River discharges at three locations were measured too. From the results, the mean concentrations of total dissolved phosphorus, orthophosphate and dissolved organic phosphorus in Terengganu River estuary were 61.74 ± 27.67 $\mu\text{g/L}$, 28.96 ± 4.99 $\mu\text{g/L}$ and 32.77 ± 25.48 $\mu\text{g/L}$ respectively. Results also showed that the mean concentrations of nitrite, nitrate and ammoniacal-nitrogen in the study area were 19.11 ± 8.71 $\mu\text{g/L}$, 30.05 ± 40.69 $\mu\text{g/L}$ and 152.02 ± 53.27 $\mu\text{g/L}$ respectively. Ammoniacal-nitrogen appeared to be the dominant nutrient species in this study, and the distributions of orthophosphate, nitrate and ammoniacal-nitrogen were homogeneous in the study area. TDP and DOP were found to be higher at the

northern part of the estuary (station 3) near to the former river mouth. The concentrations of orthophosphate and nitrite became higher when it goes further upstream. High level of nitrate was found in the bottom layer at station 1, 2 and 3 where there was seawater intrusion. The ammoniacal-nitrogen level was found to be abnormally high at all stations in the study area. The present river discharge of Terengganu River was found to be higher compared to the discharge value in year 2000 when the breakwater was absent. The discharge value measured was 565.540 m³/s while the discharge value in year 2000 was approximately 267.641 m³/s. For the physical parameters, seawater had higher temperature, pH and DO level compared to the freshwater during the sampling. It was ebb tide condition during sampling. However, saline intrusion into the estuary was found at station 1, 2 and 3. This study shows that the nutrient level in Terengganu River estuary has increased significantly compared to the study done in year 2000.

KAJIAN TERHADAP TABURAN NUTRIEN DI MUARA SUNGAI TERENGGANU

ABSTRAK

Muara Sungai Terengganu terletak di Kuala Terengganu, Malaysia dan menghadap Laut China Selatan. Sungai Nerus dan Sungai Terengganu membekalkan sumber air tawar secara berterusan kepada muara Sungai Terengganu. Sejak 30 tahun yang lalu, Kuala Terengganu telah mengalami pembangunan yang signifikan melalui industrilisasi dan pertumbuhan aktiviti ekonomik yang pesat. Projek benteng pemecah ombak Sungai Terengganu dimulakan pada tahun 2002. Sehingga kini, projek tersebut telah melalui beberapa fasa dan akan diteruskan untuk tujuan pembangunan projek Kuala Terengganu City Centre (KTCC) di bawah East Coast Economic Region (ECER). Kajian ini dijalankan untuk mengakses tahap nutrien and taburannya di dalam muara Sungai Terengganu. Sebanyak sepuluh stesen penyampelan telah ditetapkan di mana parameter fizikal dan tahap nutrien dikaji. Jumlah pelepasan air pada tiga lokasi juga diukur. Melalui kajian, kepekatan min untuk TDP, orthofosfat dan DOP masing-masing ialah $61.74 \pm 27.67 \mu\text{g/L}$, $28.96 \pm 4.99 \mu\text{g/L}$ dan $32.77 \pm 25.48 \mu\text{g/L}$. Kajian juga menunjukkan bahawa kepekatan min untuk nitrit, nitrat dan nitrogen-ammonia di muara Sungai Terengganu masing-masing ialah $19.11 \pm 8.71 \mu\text{g/L}$, $30.05 \pm 40.69 \mu\text{g/L}$ dan $152.02 \pm 53.27 \mu\text{g/L}$.

Nitrogen-ammonia muncul sebagai spesis nutrien yang dominan. Taburan orthofosfat, nitrat dan nitrogen-ammonia adalah homogenus di kawasan kajian. TDP dan DOP didapati mempunyai kepekatan yang lebih tinggi di kawasan utara muara Sungai Terengganu (stesen 3) yang berdekatan dengan muara sungai yang dulu. Kepekatan orthofosfat and nitrit adalah lebih tinggi di kawasan hulu. Selain itu, kepekatan nitrat juga didapati tinggi pada lapisan bawah di stesen 1, 2 dan 3 di mana terdapat pencerobosan air masin. Kepekatan nitrogen-ammonia didapati mencapai nilai yang amat tinggi. Jumlah pelepasan air oleh Sungai Terengganu semasa penyampelan didapati mempunyai nilai yang lebih tinggi berbanding dengan jumlah pelepasan air pada tahun 2000 di mana benteng pemecah ombak belum dibina lagi. Sebanyak 565.540 m³/s jumlah air dilepaskan melalui muara Sungai Terengganu pada waktu penyampelan manakala jumlah pelepasan air pada tahun 2000 pula hanya mencatatkan nilai sebanyak 267.641 m³/s. Dari segi fizikal, didapati air laut mempunyai suhu, pH dan kandungan oksigen terlarut yang lebih tinggi berbanding dengan air tawar. Pencerobosan air masin telah dikesan di stesen 1, 2 dan 3 walaupun air sedang dalam keadaan surut semasa penyampelan. Kajian ini menunjukkan bahawa kandungan nutrien di muara Sungai Terengganu telah meningkat dengan signifikannya jika dibandingkan dengan kajian yang dilakukan pada tahun 2000.