SPATIAL VARIABILITY OF Chlorophyll-a IN TERENGGANU WATERS FROM MODIS

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Spatial Variability of Chlorophyll-*a* in Terengganu Waters from MODIS

By

Abd. Hadi bin Abd. Latif

Research Report submitted in partial fulfillment of
the requirement for the degrees of
Bachelor of Science (Marine Science)

Department of Marine Science
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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:

Spatial variability of Chlorophyll-*a* in Terengganu waters from MODIS by **ABD.HADI BIN ABD.LATIF** Matric No **UK 14987** 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 of Bachelor of Science (Marine Science), Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

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-Thank You-

TABLE OF CONTENTS

Pusat Pembelajaran Digital Sultanah Nur Zahirah (UMT)
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LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

SYMBOL	DEFINITION
Chl-*a*	Chlorophyll-*a*
CZCS	Coastal Zone Sanner
CDOM	Coloured Dissolved Organic Matter
DO	Dissolved Oxygen
EOS	Earth Observing System
eq	equation
IOP	Inherent Optical Properties
L	liter
mg/L	milligram per liter
ml	milliliter
MODIS	Moderate Resolution Imaging Spectrometer
NASA	National Aeronautics and Space Administration
na	not available
nm	nautical miles
TM	Thematic Mapper
TOA	Top of Atmosphere
SST	Sea Surface Temperature
$^{\circ}$ C	Degree Celcius

LIST OF APPENDICES

ABSTRACT

Application of remote sensing technology for regular monitoring of the near shore and offshore parameters in Terengganu waters is still limited. The objectives of this study are to determine the Chlorophyll-*a* (Chl-*a*) distribution in Terengganu coastal and offshore waters using MODIS data and to find the relationship between *in-situ* and MODIS Chl-*a* data. The coastal waters was defined as waters < 20 nm from shoreline while offshore waters > 20 nm. Chlorophyll-a *in-situ* measurements were conducted on the 13-16 May 2009 and 6-9 July 2009. A standard empirical Chl-*a* OC-3M algorithm were used to analyzed the MODIS Level 2 and Level 3 images. The Chl-*a* images obtained from NASA and georeferenced to Kuala Terengganu's region using EPOC module. The study reported Chl-*a* are found to be higher in coastal waters compared to offshore area. The range of *in-situ* Chl-*a* concentration in Kuala Terengganu coastal waters is between 0.31 mg / L to 2.07 mg / L for the month of May while July is 0.25 mg / L and 1.22 mg / L. For offshore area, the Chl-*a* concentration in May is 0.30mg / L to 2.65 and in July, as 0.14 mg / L to 0.84 mg / L. The higher concentration of Chl-*a* is found to be associated with shallow continental shelf which is near coastal region of Kuala Terengganu, where the ocean depth is about 10 m up to 60 m from the coast towards the deep ocean. The comparison between *in-situ* and MODIS Chl-*a* concentration data shows high correlation with R^2= 0.898. This high correlation between MODIS and *in-situ* Chl-*a* concentration value emphasized that MODIS data can be use to determine and monitoring the near shore and offshore Chl-a in Terengganu waters.

ABSTRAK

Aplikasi teknologi penderiaan jarak jauh untuk memantau secara teratur parameter air di kawasan pantai dan luar pantai di perairan Terengganu masih lagi terhad. Terdapat dua tujuan dalam kajian yang dijalankan ini iaitu untuk menentukan peredaran Klorofil-*a* (Chl-*a*) di pesisir dan luar pantai perairan Terengganu menggunakan data MODIS dan mencari hubungan antara data lapangan (*in-situ*) dan data MODIS Chl-*a*. Dalam kajian ini juga, persisiran ditakrifkan sebagai linkungan 20 batu nautika(bn) dari daratan (4 stesen terdahulu) sementara kawasan luar pantai diwakili oleh 3 stesen terakhir iaitu jarak melebihi 25 bn dari daratan. Kerja lapangan dilakukan pada 13-16 Mei 2009 dan 6-9 Julai 2009. Empiris biasa iaitu *C*hl-*a* OC-3M algoritma digunakan untuk menganalisis imej MODIS Level 2 dan Level 3. Imej *Chl-a* diperolehi daripada NASA dan rujukan geografi di perairan Kuala Terengganu dilakukan menggunakan modul EPOC. Manakala, perisian untuk menganalisis digital imej yang telah digunakan untuk mengambil maklumat daripada MODIS adalah ENVI 4.5 (Environment for Visualization of Images). Mengikut kajian yang dilakukan, julat kepekatan Chl-a lapangan di perairan pantai Kuala Terengganu untuk bulan Mei adalah diantara 0.31 mg / L to 2.07 mg / L manakala untuk bulan Julai adalah 0.14 mg / L to 0.84 mg / L. Manakala kawasan luar pantai pula adalah 0.30mg / L to 2.65 mg / L pada bulan Mei dan 0.14 mg / L to 0.84 mg / L pada bulan Julai 2009 . Perbandingan antara in-situ dan MODIS *Chl-a* data menunjukkan hubungan antara kedua-dua data sebagai R^2= 0.898. Kepekatan Chl-*a* yang dicatatkan berkaitan dengan bentuk permukaan pelantar yang cetek iaitu berhampiran kawasan persisiran pantai Kuala Terengganu, di mana kedalaman laut sekitar 10 m

hingga 60 m dari pantai ke arah laut dalam. Korelasi yang tinggi diantara nilai kepekatan Chl-*a* MODIS dan In-situ menekankan bahawa data MODIS boleh digunakan untuk menentukan dan memantau parameter air laut kawasan pantai dan luar pantai.