

BATHYMETRY STUDY OF KUALA TERENGGANU RIVER
ESTUARY USING ECHO SOUNDER

MCHD ZULFADLI BIN AB RAHIM

DEPARTMENT OF MARINE SCIENCE
FACULTY OF MARINE STUDY AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

LP
26
FMSM
2
2007

2007

4N 5203

1100054354

Perpustakaan Sultanah Nur Zahirah (UMT)
Universiti Malaysia Terengganu



LP 26 FMSM 2 2007



1100054354

Bathymetry study of Kuala Terengganu river estuary using echo
sounder / Mohd Zulfadli Ab Hamid.

PERPUSTAKAAN SULTANAH NUR ZAHIRAH
UNIVERSITI MALAYSIA TERENGGANU (UMT)
21030 KUALA TERENGGANU

1100054354		

Tihat cahalah

PERPUSTAKAAN SULTANAH NUR ZAHIRAH UMT

BATHYMETRY STUDY OF KUALA TERENGGANU RIVER ESTUARY USING
ECHO SOUNDER

By

Mohd Zulfadli bin Ab Hamid

Research report is submitted in partial fulfillment of
The requirement for the degree of
Bachelor of Science (Marine Science)

Department of Marine Science
Faculty of Maritime Studies and Marine Science
UNIVERSITI MALAYSIA TERENGGANU
2007

1100054354

This Project report should be cited as:

Zulfadli, A. H., 2007. Bathymetry Study of Kuala Terengganu River Estuary Using Echo Sounder, pp51. Undergraduate thesis, Bachelor of Science (Marine Science), Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

No part of this project may be reproduced by any mechanical, photographic, or electronic process, or in the form of photographic, recording, nor may it be stored in retrieval system, transmitted, or otherwise copied for public or private use, without written permission from the author and the supervisor of this project.



**DEPARTMENT OF MARINE SCIENCE
FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU**

**APPROVAL AND CERTIFICATION FORM
RESEARCH PROJECT I AND II**

I certify that the research report entitled: **BATHYMETRY STUDY IN KUALA TERENGGANU RIVER ESTUARY USING ECHO SOUNDER** by **MOHD ZULFADLI BIN AB HAMID**, Matric No. **UK 9800** have been read and all corrections recommended by the examiners have been done. This research report is submitted to the Department of Marine Science in partial fulfillment of the requirements for the degree of **Bachelor of Science in Marine Science**, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

Approved by:



Supervisor

Name: Prof Madya Dr.Khalid bin Samo

Stamp: **PROF. MADYA DR. KHALID SAMO**
Pensyarah
Jabatan Teknologi Maritim
Fakulti Pengajian Maritim dan Sains Marin
Universiti Malaysia Terengganu
(UMT)

Date: _____



Head of Department

Name : **DR. RAZAK ZAKARIYA**
Ketua Jabatan Sains Marin

Stamp : **Fakulti Pengajian Maritim dan Sains Marin**
Universiti Malaysia Terengganu
(UMT)

Date: 9/1/08

TABLE OF CONTENTS

CONTENTS	PAGE
APPROVAL FORM	i
ACKNOWLEDGEMENT	ii
LIST OF TABLES	iii
LIST OF FIGURES	iv
LIST OF ABBREVIATIONS	v
LIST OF APPENDICES	vi
ABSTRACT	vii
ABSTRAK	viii
1.0 INTRODUCTION	1
1.1 Objectives	6
1.2 Justifications	6
2.0 LITERATURE REVIEW	7
2.1 Bathymetry	8
2.2 Acoustic survey	8
2.3 Sonar Instrumentation	8
2.3.1 <i>Echo Sounder</i>	9
2.3.2 <i>Sonarlite Portable Echo Sounder</i>	10
2.3.3 <i>Scientific Echo Sounder</i>	11
2.3.4 <i>Analog Systems (Principle of Operation)</i>	11
2.3.5 <i>Digital Systems (Principle of Operation)</i>	12
2.3.6 <i>Resolution of Echo Sounder</i>	13

2.3.7	<i>Transmission of Sound in Water</i>	14
2.4	Active Sonar	17
2.5	Computer Processing	17
2.6	Sediment	18
2.6.1	<i>Sediment Mapping</i>	18
2.7	Sounding	19
2.7.1	<i>Line Spacing</i>	20
2.7.2	<i>Line Direction</i>	21
2.7.3	<i>Scale Survey</i>	21
2.8	Tidal Consideration	22
2.9	Hydrography	22
3.0	Global Positioning System (GPS)	22
3.0	METHODOLOGY	23
3.1	Study Area	23
3.2	Study Area Description	24
3.3	Materials	24
3.3.1	<i>Survey Equipment</i>	24
3.4	Geophysical Survey Data Acquisition	27
3.4.1	<i>Bathymetric Data Collection</i>	27
3.4.2	<i>Echo Sounder Marine Geophysical Instruments</i>	28
3.4.3	<i>Transducer</i>	31
3.4.4	<i>Beam Width of Echo Sounder</i>	31
3.4.5	<i>Basic Operation and Acoustic Sampling</i>	31
3.5	Data Processing	32
3.5.1	<i>Tidal Circulation and Data Correction</i>	33
3.6	Flowchart of Geophysical Method	34
3.7	Output	35

4.0	RESULT	36
4.1	Coordinate of Track line Survey	36
4.2	Output	37
4.2.1	<i>Three-Dimensional Bathymetric Map</i>	37
4.2.2	<i>Contour Map</i>	37
4.2.3	<i>3-D Wireframe Map</i>	38
4.2.4	<i>Shaded-Relief Map</i>	38
5.0	DISCUSSION	39
6.0	CONCLUSION	42
	REFERENCES	44
	APPENDICES	46
	CURRICULUM VITAE	51

ACKNOWLEDGEMENT

Thank you God, Allah S.W.T for the great bless and for the great opportunity that I've finally completed my final year project.

First and foremost, I would like to thank Assoc. Prof. Dr. Khalid bin Samo, my supervisor for being generous in sharing his knowledge and also exposing me to what this project is all about. His guidance and patience has made my research possible and successful.

Secondly, I would like to thank Dr. Nor Antonina binti Abdullah for her advice and invaluable opinions for my project. My appreciation also goes to Mr Fathy Kamel and Mr Roslan INOS officer`s for sharing their experiences and assist in this project. Thank also goes to the Institute Oceanography (INOS) staff for allowing me to use their facilities especially laboratory to access and to analysis data with surfer programme.

My deep gratitude goes to my family, my parents and special person, Ieda for their unconditional love and support. Thanks also to my housemates: Din, Jeni, Jahid, Roy, Fahmi, Wan and Kamal who tolerated me emotionally during my hard days in completing this project.

Last but not least, in order not to leave anyone out, thank you to all who were involved directly or indirectly during the completion of my project.

Finally, without the ingenuity and assistance of boat crew, this work would not have been possible. I would record their condolences for the demise of Mr. Manaf in assistance me in this survey.

LIST OF TABLES

TABLE		PAGE
3.1	Specification of Sonarlite Portable Echo Sounder	25
4.1	Coordinate of track line survey	36

LIST OF FIGURES

FIGURE		PAGE
2.1	Digital/Analog echo sounder electronic block diagram	13
2.2	Acoustic transmission pattern from echo sounder transducer and effect of beam width	15
2.3	Block diagram showing the main components of an echo sounder	16
2.4	Principle of active sonar	17
2.5	Survey Line spacing	21
3.1	Study area of Kuala Terengganu river estuary	23
3.2	Sonarlite portable echo sounder equipment set-up drawing	30
3.3	Track line coordinates	36
3.4	Three-Dimensional bathymetric map	37
3.5	Contour map	37
3.6	Wireframe map	38

LIST OF ABBREVIATIONS

m	meter
Hz	hertz
KHz	kilo Hertz
%	percentage
LED	Light Emitting Diod
DA	Digital Analog
AD	Analog Digital
GPS	Global Positioning System
DGPS	Differential Global Positioning System
°	degree
N	North
E	East
km ²	kilometer square
Sec	second
CMU	Control Measurement Unit
3-D	three-dimensional
MCD	Marine Chart Datum

LIST OF APPENDICES

APPENDIX		PAGE
1	List of materials and instruments used in the survey	45
2	The total coverage consisted of individual sector generate by each 'ping'	45
3	Flowchart of methodology	46
4	Surfer Programming	47
5	Swath versus single transducer surveys	47
6	The process of hydrographic surveying	48
7	Application of acoustics in earth- and marine science	48
8	Instruments	49

ABSTRACT

An echo-sounder was run along a shipping route of Kuala Terengganu river estuary in 16th February, 2007 to study the bathymetric image and its characteristics. The echo-sounder image indicates the depth over a 100m width, along the surveyed route varies from 2m to 5m. Data were collected starting along a predetermined transects with the respective depths to be recorded in a laptop. Results from analysis using Surfer 8 software programs indicate the deepest part and the shallowest part of the estuary. Hydro-acoustic method was an effective way to map and monitor important physical and geological parameters such as bathymetry and bottom characteristics. The image data that have been produced indicates that some areas have been dredged perhaps to deepen the channel prior to the Monsoon Cup competition-an international event. Frequent survey should be carried out in the area to ensure the channel has sufficient depth for safe navigation or international event such as monsoon cup competition.

Kajian Profil Kedalaman dan Dasar Muara Sungai Kuala Terengganu Menggunakan Penduga Gema

ABSTRAK

Satu penduga gema telah dijalankan sepanjang laluan perkapalan di muara sungai Kuala Terengganu pada 16 Februari, 2007 untuk mengkaji profil kedalaman dan ciri-ciri dasarnya. Imej penduga gema menunjukkan kedalaman lebih 100m keluasan, sepanjang laluan kajian, berbeza-beza daripada 2m kepada 5m. Data dikumpul di sepanjang kedudukan transet yang telah ditetapkan dengan kedalaman masing-masing yang akan direkodkan ke dalam sebuah komputer riba. Keputusan dari analisis menggunakan perisian Surfer 8 menunjukkan bahagian paling dalam dan bahagian paling cetek muara sungai tersebut. Kaedah Hidro-akustik merupakan satu cara yang berkesan untuk membuat pemetaan dan mengawasi parameter fizikal dan geologi yang penting seperti batimetri dan ciri-ciri dasar. Data imej yang telah dihasilkan menunjukkan bahawa beberapa kawasan tersebut mungkin telah dikorek bagi mendalamkan muara sungai tersebut sebelum pertandingan piala monsun yang merupakan satu acara antarabangsa yang dijalankan di muara sungai tersebut. Kajian patut kerap diadakan dalam kawasan muara sungai tersebut bagi menjamin muara sungai Kuala Terengganu mempunyai kedalaman yang mencukupi bagi pelayaran yang selamat atau bagi acara-acara antarabangsa seperti pertandingan piala monsun.