FISHERIES AND POPULATION DYNAMICS OF SCADS, *DECAPTERUS SPP.* (PISCES : CARANGIDAE), IN THE EAST COAST OF PENINSULAR MALAYSIA

WIJOPRIONO

MASTER OF SCIENCE
UNIVERSITI PUTRA MALAYSIA
1997

PDF processed with CutePDF evaluation edition www.CutePDF.com

QL 2642

PERPUSTAKAAN
UNIVERSITI PUTRA MALAYSIA TERENGGANU

123443

tesis
QL 618.3 .W5 1997

1000387083
Fisheries and population dynamics of scads, decapterus spp. (pisces: carangidae), in the east coast of peninsular Malaysia / Wijopriono

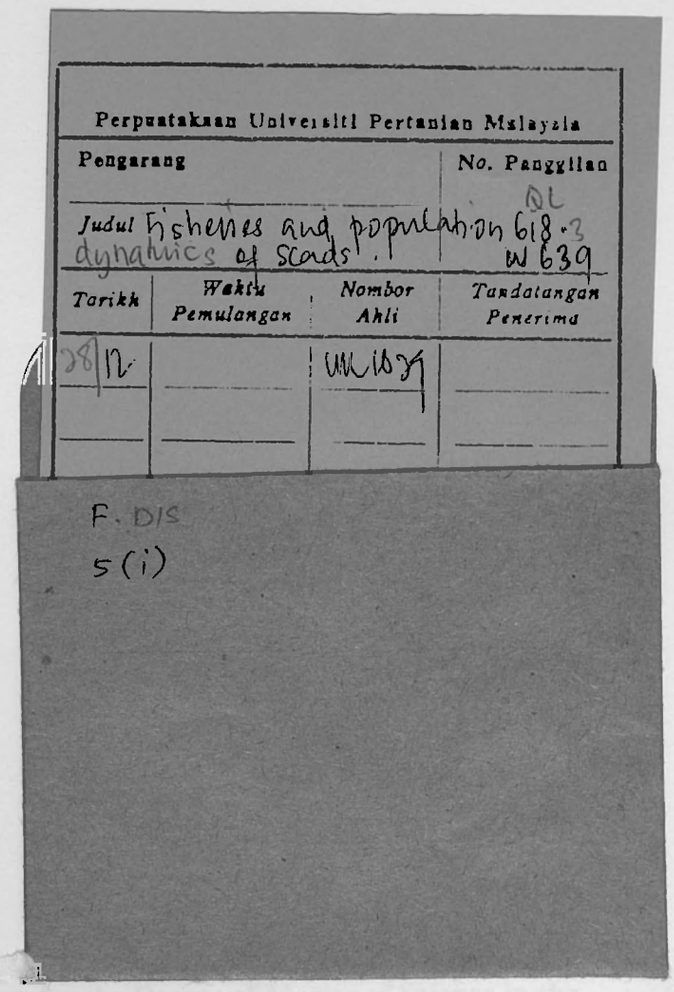
PERPUSTAKAAN SULTANAH NUR ZAHIRAH
UNIVERSITI MALAYSIA TERENGGANU (UMT)
21030 KUALA TERENGGANU

Lihat sebelah

HAK MILIK
PERPUSTAKAAN KUSTEM

RS
2642

FISHERIES AND POPULATION DYNAMICS OF SCADS, *DECAPTERUS SPP.*(PISCES : CARANGIDAE), IN THE EAST COAST OF PENINSULAR MALAYSIA


Perpustakaan Universiti Pertanian Malaysia
Pengarang
No. Panggilan
QL
Judul Fisheries and population dynamics of scads.
618.3
W639
Tarikh | Waktu Pemulangan | Nombor Ahli | Tandatangan Penerima
28/11
F. DIS
5(i)

MASTER OF SCIENCE
UNIVERSITI PUTRA MALAYSIA
1997

1000387083

FISHERIES AND POPULATION DYNAMICS OF SCADS, *DECAPTERUS SPP.*(PISCES : CARANGIDAE), IN THE EAST COAST OF PENINSULAR MALAYSIA

By

WIJOPRIONO

Thesis Submitted in Fulfilment of the Requirements for the Degree of Master of Science in the Faculty of Applied Science and Technology Universiti Putra Malaysia Terengganu

September 1997

DEDICATION

This work is dedicated to my parents
my sons, Siswoyo Budi Priono and Jodi Ashar Priono
and my wife, Dwi Irianingsih

ACKNOWLEDGEMENTS

Bismillahhirrahmanirrahim. My thanks to Allah, the Almighty for giving me life without which this thesis will never be carried out. Thanks to Allah who has given me an opportunity to contribute this knowledge to other people.

Firstly, I would like to express my most sincere gratitude and deep appreciation to the Chairman of my Supervisory Committee, Associate Professor Dr. Hj. Mohd. Zaki Mohd. Said for his encouragement and his invaluable contribution throughout my Master's programme. Without his constant guidance and careful supervision this thesis will never be completed. I also would like to extend my gratitude to the other members, Professor Dr. Mohd. Azmi Ambak and Mr. Mohd. Zaidi Zakaria for their meaningful comments and constructive ideas during the period of candidature.

I wish to express my deep gratitude to the Agency for Agricultural Research and Development, Director of Center Research Institute for Fisheries and Director of Research Institute for Marine Fisheries for granting permission and encouraging me to pursue this master's degree programme.

I would like to take this opportunity to affirm my heartfelt gratitude to Jabatan Perikanan Terengganu for providing support data while conducting research. I am also indebted to Mr.Mohammad Muda and crew members of TRF 2057 and TRF 696 purse seiners for their invaluable assistance and their hospitality

throughout my sampling periods. Acknowledgements are also dedicated to all members of Postgraduate for their moral support.

Here also, I would like to express my gratitude to Dr. Siti Aishah Abdullah for editing this thesis thoroughly and Mr. Subarjo Merehojono for his assistance in solution of computer problems

Finally, These acknowledgements are dedicated to my parents, my wife, Dwi Irianingsih, and my sons, Siswoyo Budi Priono and Jodi Azhar Priono, for their strong moral support, patience and understanding in my absence.

PERPUSTAKAAN
UNIVERSITI PUTRA MALAYSIA TERENGGANU

TABLE OF CONTENTS

		Page
ACKNOWLEDGEMENTS		iii
LIST OF TABLES		viii
LIST OF FIGURES		x
LIST OF PLATES		xii
ABSTRACT		xiii
ABSTRAK		xvi
CHAPTER		
I	INTRODUCTION	1
	Background of the Study	1
	Research Problems and Objectives	2
II	LITERATURE REVIEW	5
	The Scad Fishery	5
	Taxonomy of the Scads	8
	Decapterus macrosoma Bleeker, 1851	9
	Decapterus russelli Ruppell, 1828	9
	Length-Weigtht Relationship	10
	Fish Population Dynamics	14
	Growth and Mortality Parameters	15
	Spawning and Recruitment	18
III	DESCRIPTION OF THE STUDY AREA	20
	Introduction	20
	Climate	21
	Hydrology	23
	Currents	23
	Temperature and Salinity	24

Fisheries 25

IV FISHERIES AND SOME BIOLOGICAL ASPECTS OF THE SCADS 28

Introduction 28
Materials and Methods 29
Sampling Procedure 29
The Fishery 30
Catch and Effort 30
Distribution and Abundance 31
Aspects of Biology 32
Sex Ratio, Length-Weight Relationship, and Condition Factor 32
Maturity Stage and Maturation 33
Spawning Seasons 36

Results 36
The Fishery 36
Fishing Grounds 36
Landings 37
Distribution and Abundance 40
Aspects of Biology 43
Sex Ratio 43
Length-Weight Ralationship and Condition Factor 44
Spawning Seasons 45
Length at Maturity 49

Discussion 52

V THE POPULATION DYNAMICS OF THE SCADS 59

Introduction 59
Materials and Methods 60
Sampling Procedure 60
Length Measurement 61
Estimation of Growth Parameters 62
Modal Progression Analysis 64
ELEFAN Program 64
Estimation of Mortality Rates 65
Total Mortality Rates 65
Natural Mortality Rates 67
Exploitation Rate 68
Recruitment 69

Relative Yield per-Recruit 69

Results 70
Growth Parameters 70
Modal Progression Analysis 70
ELEFAN Program 78
Mortality Rates 80
Total Mortality Rates 80
Natural Mortality Rates 83
Exploitation Rate 84
Recruitment Pattern 85
Relative Yield per-Recruit 87

Discussion 88

VI SUMMARY AND CONCLUSION 94

Summary 94
Conclusion 99

BIBLIOGRAPHY 101
BIOGRAPHICAL SKETCH 112

LIST OF TABLES

Table		Page
1.	Parameters of the Length-Weight Relationship ($W = aL^b$) in *Decapterus spp.* Taken from Different Localities	13
2.	Monthly Catch Composition (%) of *Decapterus spp.* According to the Fishing Zone Taken from the Samples Collected in Cendering Fishing Port 1996-1997	41
3.	The CPUE of *Decapterus spp.* According to the Fishing Grounds off the East Coast of Peninsular Malaysia	42
4.	Sex Ratio of Mature Specimens of *Decapterus spp.* from the East Coast of Peninsular Malaysia	44
5.	Length-Weight Relationships of *Decapterus spp.* from the East Coast of Peninsular Malaysia	45
6.	Monthly Distribution of Maturity Stages (%) for Female *Decapterus macrosoma* from the East Coast of Peninsular Malaysia in 1996-1997	47
7.	Monthly Distribution of Maturity Stages (%) for Female *Decapterus russelli* from the East Coast of Peninsular Malaysia in 1996-1997	48
8.	Maturity Classification by Length Category for *Decapterus macrosoma*	50
9.	Maturity Classification by Length Category for *Decapterus russelli*	51
10.	Length at First Maturity, l*m* (cm), of *Decapterus spp.* Derived Using Spearman-Karber Method	52
11.	Monthly Length-Frequency Distribution, After Being Weighted by CPUE, of *Decapterus macrosoma* from the East Coast of Peninsular Malaysia	71
12.	Monthly Length-Frequency Distribution, After Being Weighted by CPUE, of *Decapterus russelli* from the East Coast of Peninsular Malaysia	72

13. Mean Length of *Decapterus macrosoma* and Its Standard Deviation Based on Mixture Analysis of Length-Frequency Distribution Using Battacharya's Method 73

14. Mean Length of *Decapterus russelli* and Its Standard Deviation Based on Mixture Analysis of Length-Frequency Distribution Using Battacharya's Method 74

15. Input Data for the Gulland and Holt Plot Based on Mixture Analysis of Length-Frequency Distribution Using Bhattacharya's Method 77

16. The Estimated Growth Parameters of the Two Species of Scads (*Decapterus spp.*) Derived from Length-Frequency Distribution 79

17. The Relative Abundance of Successive Length Groups of *D. macrosoma* and *D. russelli* Captured by Purse seine in the East Coast of Peninsular Malaysia in 1996-1997 82

18. The Estimates of Total Mortality Rates for the Two Species of Scads Derived from the Analysis of Catch Curve and Beverton and Holt Model 83

19. The Estimates of Natural Mortality Rates (M) for the Two Species of Scads Derived from Pauly Method 84

20 The Estimates of Exploitation Rates for the Two Species of Scads Based on Growth Parameters Derived from Gulland and Holt Plot and ELEFAN Program with Mortality Rates Derived from Catch Curve and Beverton and Holt Model 85

21. The Estimates of Relative Yield per-Recruit and Biomass per-Recruit of the Two Species of Scads Based on Combination Values of $L\infty$, K, lc, and M Derived from Gulland and Holt Plot and ELEFAN Program 87

LIST OF FIGURES

Figure		Page
1.	Map of Terengganu State Showing Four Main Fish Landing Places	22
2.	Average Monthly Rainfall in the East Coast During 1980-1994	26
3.	Total Marine Fish Landings in the East Coast and Whole of Malaysia, 1988-1994	26
4.	Fishing Grounds of *Decapterus spp.* in the East Coast of Peninsular Malaysia	38
5.	Trends of the Landings of Dominant Pelagic Fishes in the East Coast of Peninsular Malaysia, 1981-1994	39
6.	Trends of the Landings of *Decapterus spp.* and Total Pelagic Fishes in the East Coast of Peninsular Malaysia, 1982-1994	39
7.	Average Landings of *Decapterus spp.* According to the Fishing Gear in the East Coast of Peninsular Malaysia During 1986-1994	40
8.	Monthly Abundance of *Decapterus spp.* Based on the Fish Landed by Purse seiners in Cendering 1996-1997	43
9.	Relationship Between Gonadosomatic Index (GSI) and Maturity Stage of *Decapterus macrosoma*	46
10.	Relationship Between Gonadosomatic Index (GSI) and Maturity Stage of *Decapterus russelli*	46
11.	Monthly Percentage of Ripe (Mature Fish) and Spent Stages of *Decapterus macrosoma* (A) and *D. russelli* (B)	49
12.	Mean Size of *Decapterus macrosoma* During Successive Month Based on the Results of the Bhattacharya Analysis	75
13.	Mean Size of *Decapterus russelli* During Successive Month Based on the Results of the Bhattacharya Analysis	75
14.	Gulland and Holt Plot for *Decapterus macrosoma*	76

15.	Gulland and Holt Plot for *Decapterus russelli*	76
16.	The Growth Curves of *Decapterus macrosoma* (A) and *Decapterus russelli* (B) Superimposed to Structure of Length-Frequency Data Derived from ELEFAN Program	79
17.	Estimation of Total Mortality Rate for *Decapterus Macrosoma* Using Length Converted Catch Curve Based on Growth Parameters Derived from Gulland and Holt Plot (A) and ELEFAN Program (B)	80
18.	Estimation of Total Mortality Rate for *Decapterus russelli* Using Length Converted Catch Curve Based on Growth Parameters Derived from Gulland and Holt Plot (A) and ELEFAN Program (B)	81
19.	Recruitment Pattern of *Decapterus macrosoma*	86
20.	Recruitment Pattern of *Decapterus russelli*	86

LIST OF PLATES

Plate		Page
1.	*Decapterus macrosoma* Bleeker, 1815	11
2.	*Decapterus russelli* Ruppell, 1828	11

Abstract of thesis submitted to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science.

FISHERIES AND POPULATION DYNAMICS OF SCADS, *DECAPTERUS SPP.* (PISCES : CARANGIDAE), IN THE EAST COAST OF PENINSULAR MALAYSIA

By

WIJOPRIONO

September 1997

Chairman : Assoc. Prof. Dr. Hj. Mohd. Zaki Mohd. Said

Faculty : Applied Science and Technology

This study was aimed to investigate some aspects of fisheries and population dynamics of scads, namely *Decapterus macrosoma* (Bleeker) and and *Decapterus russelli* (Ruppell), in the east coast of Peninsular Malaysia.

Monthly sampling in main fish landings in Terengganu State was conducted for a 12 month period. Samples were collected both in landing place and onboard the commercial purse seiners which operated in fishing zones B and C. Secondary data were also collected from LKIM (Lembaga Kemajuan Ikan Malaysia) Terengganu.

Results of this study showed that *D. russelli* was most dominant in scad fishery of the east coast of Peninsular Malaysia. It was widely distributed in both

fishing zones B and C. *D. macrosoma* was mostly caught in fishing zone C, i.e., beyond 12 miles from the shoreline. There were at least four main fishing grounds of *Decapterus spp.* in the fishing zone C of the east coast, spreading from the north to the south. The scads were more abundant in the south fishing grounds than those in the north fishing grounds.

The gonadosomatic index (GSI) of both *D. macrosoma* and *D. russelli* increased with the increasing maturity until stage VI, and then declined in the stage VII of the spent specimens. The spawning of *D. macrosoma* was likely protracted over several months with a peak in October/November, while the spawning of *D. russelli* would likely occur in July/August. First maturity occurred at of 20.18 cm total length in females of *D. macrosoma* and of 20.36 cm in females of *D. russelli*, while for males of *D. macrosoma* and *D. russelli* it occurred at total length of 20.50 cm and 20.66 cm respectively.

Estimates of the growth parameters derived from two different methods were K = 0.94 to 1.00 $year^{-1}$, $L\infty$ = 25.71 to 27.70 cm for *D. macrosoma* and K = 1.08 to 1.10 $year^{-1}$, $L\infty$ – 25.93 to 28.20 cm for *D. russelli*. Estimates of total mortality using two different growth parameters were Z = 3.91 to 4.70 for *D. macrosoma* and Z = 3.75 to 4.47 for *D. russelli*. Based on the values of mortality, the exploitation rate was found in the range of 0.52-0.69 for *D. macrosoma* and of 0.47-0.67 for *D. russelli*.

Taking $E_{0.1}$ as a management criteria for the scad fishery in the east coast of Peninsular Malaysia, relative yield per recruits were estimated to reach optimum

level in the range of 0.85-0.91 for *D. macrosoma* and of 0.76-0.87 for *D. russelli*. These values suggested that the exploitation rates of the two species of scad in the east coast of Peninsular Malaysia are still under optimum level.