



**UNIVERSITI PUTRA MALAYSIA**

**MULTIVARIATE ANALYSIS OF PELAGIC FISHES IN THE  
SOUTH CHINA SEA AREA**

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**MULTIVARIATE ANALYSIS OF PELAGIC FISHES IN THE  
SOUTH CHINA SEA AREA**

**By**

**MD. SHAHAB UDDIN**

**Thesis Submitted in Fulfilment of the Requirement for the  
Degree of Doctor of Philosophy in the Faculty of  
Science and Environmental Studies  
Universiti Putra Malaysia**

**September 2001**



**This Thesis is dedicated to my parents**

**and**

**My wife Hasina Akter, son Rafi & daughter Priata**



**Abstract of thesis presented to the Senate of Universiti Putra Malaysia  
in fulfilment of the requirement for the degree of Doctor of Philosophy**

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**Chairman: Prof. Dr. Mohd. Ibrahim Bin Hj. Mohamed**

**Faculty : Science and Environmental Studies**

Pelagic fishes are important fisheries resources in the South China Sea Area. The aim of the study is to determine the dynamics and status of pelagic fishes and develop the fishery management efforts for sustainable development in the region. Three analytical methods, correlation analysis, principal component analysis and cluster analysis were used for this purpose. In this study, 19 species groups were considered and annual catch data were collected from SEAFDEC Fishery Statistical Bulletins from 1976 to 1996. For estimation of MSY (Maximum Sustainable Yield) in the East Coast of Peninsular Malaysia, Schaefer's Surplus Production Model was used based on catch and effort data.

In the case study of estimation of MSY, the estimated MSY was 94,321 mt and  $f_{MSY}$  was 74,011 (days/year) by fishing gear standardization. This study



estimated MSY-like value of the whole South China Sea provisionally based on studies done in the East Coast of Peninsular Malaysia.

The correlation analysis showed the relationship among 21 sub-areas on the basis of catch composition per year. The study indicated that Taiwan, Hong Kong and Singapore did not show significant relationship with other sub-areas. However, West Sumatra, South Java etc showed significant relationship with other sub-areas.

The principal component analysis showed alternation of the major species groups in different sub-areas. The analysis indicated that alternation of major catches were observed at two or four years interval while some species groups were found to be stable over the periods in different sub-areas. Alternation of pelagics by sub-area and by species are very important information as the baseline data for multi-country's fisheries management.

The cluster analysis was used for grouping of sub-areas on annual basis and overall basis. The results of overall basis are summarized in the following two types of grouping. The first type of grouping is as follows: (1) Taiwan, Indonesian part of Malacca Straits, West Coast of Peninsular Malaysia, East Sumatra and Kalimantan; (2) Luzon, Visayas, Mindanao, Sulewesi & Gulf of Thailand; (3) Hong Kong, West Sumatra, North Java, South Java, Bali-Nusa Tenggara, Maluku-Irian Jaya, East Coast of Peninsular Malaysia, Sarawak, Sabah, Indian Ocean and Singapore. The second grouping is that, all sub-areas were grouped into six clusters: (1) Taiwan; (2) Gulf of Thailand; (3) East Coast of Peninsular Malaysia & North Java; (4)

Indonesian part of Malacca Straits, West Coast of Peninsular Malaysia; East Sumatra & Kalimantan; (5) Luzon, Visayas, Mindanao & Sulawesi and (6) Hong Kong, West Sumatra, South Java, Bali-Nusa Tenggara, Maluku-Irian Jaya, Sarawak, Sabah, Indian Ocean & Singapore.

On the pelagic resources or shared stocks, this study emphasized the importance of multi-country's fisheries management and that detailed information is required to achieve the objectives. This study identified the fisheries relationships among the sub-areas, and also clarified the alternation of pelagics in the South China Sea area, based on the multivariate analyses. The important baseline information obtained from the study can be utilised for multi country's pelagic fisheries management in the South China Sea area.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra  
Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**MULTIVARIATE ANALYSIS OF PELAGIC FISHES IN THE  
SOUTH CHINA SEA AREA**

Oleh

**MD.SHAHAB UDDIN**

**September 2001**

**Pengerusi : Prof. Dr. Ibrahim Bin Hj. Mohamed**

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Ikan-ikan pelagik adalah sumber perikanan utama di kawasan Laut China Selatan. Tujuan kajian ini adalah untuk Meneutukan denineih dan headaan ikan pelagik di kawasan tersebut sejak dua dekad yang lalu. Tiga kaedah analisis telah digunakan iaitu, analisis korelasi, analisis ' principal component' dan analisis gabungan . Di dalam kajian ini, 19 kumpulan spesis telah dikaji dan data tangkapan tahunan telah diperolehi daripada Buletin statistik perikanan SEAFDEC dari tahun 1976 hingga 1996. Untuk anggaran pengeluaran Mapan Maksimum atau Maximum Sustainable Yield( MSY) di kawasan pantai timur semenanjung Malaysia, yang merupakan sebahagian daripada kawasan Laut China Selatan, model pengeluaran schaefer telah digunakan berdasarkan tangkapan and data usaha

Dengan menggunakan peralatan tangkapan piawai, anggaran MSY menggunakan model Schaefer adalah 94,321 mt dan fMSY ialah 74,011 (hari/tahun). Berdasarkan

keputusan ini, kajian ini juga menganggarkan nilai MSY bagi keseluruhan kawasan Laut China Selatan.

Analisis korelasi menunjukkan hubungan di kalangan 21 sub-kawasan berasaskan tangkapan komposisi secara tahunan. Kajian ini menunjukkan Taiwan, Hong Kong and Singapura tidak mempamerkan hubungan yang bererti dengan sub-kawasan lain. Tetapi, Sumatra Barat, Java Selatan dan lain-lain menunjukkan hubungan bererti dengan sub-kawasan lain.

Analisis principal component menunjukkan peralihan kumpulan spesis utama di pelbagai sub-kawasan. Analisis ini menunjukkan pengalihan tangkapan utama telah di diperolehi selang dua atau empat tahun sementara beberapa spesis didapati stabil di sub-kawasan yg lain. Matlumat ini sangat penting sebagai maklumat asas bagi pengurusan perikanan pelbagai negara.

Analisis cluster digunakan untuk mengumpulkan sub-kawasan pada tempoh secara tahunan dan secara keseluruhannya. Keputusan menunjukkan bagi kumpulan secara tahunan, mesemua sub-kawasan boleh di bahagikan kepada dua kumpulan iaitu (1) Taiwan, Selat Melaka Indonesia, pantai barat Semenanjung Malaysia, Sumatra Timur dan kalimantan ; (2) Luzon, Visayas, Mindanao, Sulewesi dan Teluk Thailand; (3) Hong Koag, Sumatra Barat, Java utara, Java Selatan, Tenggara Bali-Nusa, Maluku-Irian Jaya, Pantai Timur Semenanjung Malaysia, Sarawak, Sabah, lautan India dan Singapura. Bagi secara keseluruhan, kesemua sub-kawasan dibahagikan kepada enam kumpulan iaitu : (1) Taiwan; (2) Teluk Thailand; (3) Pantai Timur Semenanjung Malaysia dan Java Utara; (4) Selat Melaka Indonesia , Pantai



Barat Semenanjung Malaysia; Sumatra Timur dan Kalimantan; (5) Luzon, Visayas, Mindanao dan Sulawesi dan; (6) Hong Kong, Sumatra Barat, Java Selatan, Tenggara Bali-Nusa, Maluku –Irian Jaya, Sarawak, Sabah, Lautan India dan Singapura.

Bagi sumber pelagik penekanan diberi terhadap kekurangan maklumat asas dalam pengurusan perikanan antara pelbagai negara. Walaubaga imana pun kajian ini telah menerangkan keadaan perikanan dan hubungan di antara sub-kawasan dan juga menerangkan peralihan sepsis pelagik di Laut China Selatan berdasarkan analisis pelbagai pembolehubah. Oleh itu, maklumat asas dalam kajian ini, boleh digunakan oleh pelbagai negara untuk pengurusan perikanan pelagik di Laut China Selatan.

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I certify that an Examination Committee met on 21<sup>st</sup> September 2001 to conduct the final examination of Md. Shahab Uddin on his Doctor of Philosophy thesis entitled "Multivariate Analysis of Pelagic Fishes in the South China Sea Area" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulation 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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## DECLARATION FORM

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degrees at UPM or other institutions.

*S. Shahab Uddin*

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**MD. SHAHAB UDDIN**

Date: **29.10.2001**

## TABLE OF CONTENTS

	<b>Page</b>
<b>DEDICATION</b>	ii
<b>ABSTRACT</b>	iii
<b>ABSTRAK</b>	vi
<b>ACKNOWLEDGEMENTS</b>	ix
<b>APPROVAL SHEETS</b>	xi
<b>DECLARATION FORM</b>	xiii
<b>LIST OF TABLES</b>	xvi
<b>LIST OF FIGURES</b>	xx
<b>LIST OF ABBREVIATIONS</b>	xxviii
<b>CHAPTER</b>	
<b>1</b>	<b>INTRODUCTION</b> 1.1
	1.1 General Introduction 1.1
	1.2 Importance of South China Sea Fisheries 1.3
	1.2.1 Importance of Small Pelagics 1.6
	1.2.2 History of Fisheries Development 1.8
	1.3 Importance of the Study 1.10
	1.4 Objectives of the Study 1.11
<b>2</b>	<b>LITERATURE REVIEW</b> 2.1
	2.1 Pelagic Fish 2.1
	2.2 Fisheries Management 2.8
	2.3 Multivariate Analysis 2.14
	2.3.1 Definition and Concept 2.14
	2.3.2 Principal Component Analysis 2.17
	2.3.3 Cluster Analysis 2.21
	2.4 Stock Assessment 2.23
<b>3</b>	<b>METHODOLOGY</b> 3.1
	3.1 Introduction 3.1
	3.2 Study Area 3.1
	3.3 Estimation of Maximum Sustainable Yield 3.1
	3.4 Correlation Analysis 3.3
	3.5 Multivariate Analysis 3.4
	3.5.1 Principal Component Analysis 3.5
	3.5.2 Cluster Analysis 3.6
	3.6 Selection of Species 3.7
	3.7 Timeframe 3.7
	3.8 Data Sources 3.7
	3.9 Data Analysis 3.8
<b>4</b>	<b>STATUS OF SMALL PELAGICS IN THE SOUTH</b> 4.1



	<b>EAST ASIAN REGION</b>	
	4.1 Introduction	4.1
	4.2 Material and Method	4.1
	4.3 South China Sea Area	4.2
	4.4 Malaysia	4.9
	4.5 Singapore	4.11
	4.6 Hong Kong	4.14
	4.7 Taiwan	4.16
	4.8 Thailand	4.18
	4.9 Philippines	4.21
	4.10 Indonesia	4.24
	4.11 Discussion	4.26
<b>5</b>	<b>HISTORICAL CHANGES OF SMALL PELAGICS IN THE REGION</b>	<b>5.1</b>
	5.1 Introduction	5.1
	5.2 Material and Method	5.1
	5.3 Results	5.2
	5.3.1 Case Study of Estimation of MSY in the waters off East Coast of Peninsular Malaysia	5.2
	5.3.2 Analysis of the Relationships of Catch Composition among the Sub-areas (Correlation)	5.9
	5.3.3 Alternation of the Species by Sub-area based on the Principal Component Analysis	5.32
	5.3.4 Grouping of Sub-area based on the Factor Scores by the Cluster Analysis	5.122
	5.4 Discussion	5.139
<b>6</b>	<b>MANAGEMENT STRATEGY</b>	<b>6.1</b>
<b>7</b>	<b>SUMMARY AND CONCLUSION</b>	<b>7.1</b>
	REFERENCE	R.1
	APPENDICES	A1
	BIODATA OF THE AUTHOR	B.1



## LIST OF TABLES

<b>Table</b>	<b>Page</b>
1.1 Marine Fishery Production in the South China Sea area (mt)	1.5
2.1 Mean annual percentage of pelagic fish in marine fish landings for 1950-1994	2.8
3.1 Species (group) list and Codes of ISSCAAP(FAO) and SEAFDEC	3.8
5.1 Results of calculation of squared correlation coefficient and t-test for linearity between four kinds effort and their CPUE values for purse seine and trawl in the East Coast of Peninsular Malaysia	5.4
5.2 Results of the principal component analysis on the catch quantity of 15 species obtained from Taiwan from 1976 to 1996	5.36
5.3 Factor loading of four extracted components in Taiwan by principal component analysis	5.36
5.4 Results of the principal component analysis on the catch quantity of 9 species obtained from Hong Kong from 1976 to 1996	5.39
5.5 Factor loading of four extracted components in Hong Kong by principal component analysis	5.39
5.6 Results of the principal component analysis on the catch quantity of 17 species obtained from West Sumatra from 1976 to 1997	5.42
5.7 Factor loading of four extracted components in West Sumatra by principal component analysis	5.42
5.8 Results of the principal component analysis on the catch quantity of 17 species obtained from South Java from 1976 to 1997	5.49
5.9 Factor loading of five extracted components in South Java by principal component analysis	5.49



5.10	Results of the principal component analysis on the catch quantity of 17 species obtained from Malacca Straits from 1976 to 1997	5.52
5.11	Factor loading of five extracted components in Malacca Straits by principal component analysis	5.52
5.12	Results of the principal component analysis on the catch quantity of 17 species obtained from East Sumatra from 1976 to 1997	5.55
5.13	Factor loading of four extracted components in East Sumatra by principal component analysis	5.55
5.14	Results of the principal component analysis on the catch quantity of 17 species obtained from North Java from 1976 to 1997	5.63
5.15	Factor loading of four extracted components in North Java by principal component analysis	5.63
5.16	Results of the principal component analysis on the catch quantity of 17 species obtained from Bali.N-Tenggara from 1976 to 1997	5.66
5.17	Factor loading of four extracted components in Bali.N.Tenggara by principal component analysis	5.66
5.18	Results of the principal component analysis on the catch quantity of 17 species obtained from Kalimantan from 1976 to 1997	5.69
5.19	Factor loading of three extracted components in Kalimantan by principal component analysis	5.69
5.20	Results of the principal component analysis on the catch quantity of 17 species obtained from Sulawesi from 1976 to 1997	5.72
5.21	Factor loading of three extracted components in Sulawesi by principal component analysis	5.72
5.22	Results of the principal component analysis on the catch quantity of 17 species obtained from Maluku,Irian Jaya from 1976 to 1997	5.80
5.23	Factor loading of four extracted components in Maluku,Irian	5.80



## Jaya by principal component analysis

5.24	Results of the principal component analysis on the catch quantity of 14 species obtained from West Coast of Malaysia from 1976 to 1998	5.83
5.25	Factor loading of four extracted components in West Coast of Malaysia by principal component analysis	5.83
5.26	Results of the principal component analysis on the catch quantity of 14 species obtained from East Coast of Malaysia from 1976 to 1998	5.86
5.27	Factor loading of four extracted components in East Coast of Malaysia by principal component analysis	5.86
5.28	Results of the principal component analysis on the catch quantity of 17 species obtained from Sarawak from 1976 to 1998	5.89
5.29	Factor loading of Six extracted components in Sarawak by principal component analysis	5.89
5.30	Results of the principal component analysis on the catch quantity of 17 species obtained from Sabah from 1976 to 1998	5.97
5.31	Factor loading of two extracted components in Sabah by principal component analysis	5.97
5.32	Results of the principal component analysis on the catch quantity of 16 species obtained from Luzon from 1976 to 1992	5.100
5.33	Factor loading of five extracted components in Luzon by principal component analysis	5.100
5.34	Results of the principal component analysis on the catch quantity of 16 species obtained from Visayas from 1976 to 1992	5.103
5.35	Factor loading of four extracted components in Visayas by principal component analysis	5.103
5.36	Results of the principal component analysis on the catch quantity of 16 species obtained from Mindanao from 1976 to 1992	5.106
5.37	Factor loading of five extracted components in Mindanao by	5.106



**principal component analysis**

<b>5.38</b>	<b>Results of the principal component analysis on the catch quantity of 13 species obtained from Singapore from 1976 to 1996</b>	<b>5.113</b>
<b>5.39</b>	<b>Factor loading of four extracted components in Singapore by principal component analysis</b>	<b>5.113</b>
<b>5.40</b>	<b>Results of the principal component analysis on the catch quantity of 17 species obtained from Gulf of Thailand from 1976 to 1996</b>	<b>5.116</b>
<b>5.41</b>	<b>Factor loading of five extracted components in Gulf of Thailand by principal component analysis</b>	<b>5.126</b>
<b>5.42</b>	<b>Results of the principal component analysis on the catch quantity of 17 species obtained from Indian Ocean from 1976 to 1996</b>	<b>5.119</b>
<b>5.43</b>	<b>Factor loading of five extracted components in Indian Ocean by principal component analysis</b>	<b>5.119</b>
<b>5.44</b>	<b>Agglomeration schedule of clusters for grouping the sub-areas in 1976, using extracted factor scores</b>	<b>5.125</b>
<b>5.45</b>	<b>Agglomeration schedule of clusters for grouping the sub-areas in 1984, using extracted factor scores</b>	<b>5.128</b>
<b>5.46</b>	<b>Agglomeration schedule of clusters for grouping the sub-areas in 1992, using extracted factor scores</b>	<b>5.132</b>



## LIST OF FIGURES

<b>Figure</b>		<b>Page</b>
1.1	Definition of the sea area employed in this study	1.4
2.1	The main population , reference and control variables in defining biological reference points .	2.12
2.2	Management options for Philippine small pelagic fisheries	2.15
2.3	Six temporal patterns of landings over the period of record (1970-1993) picked out by principal component analysis of the time series of landing for Each species. The species most closely associated with each pattern are listed Beneath the graphic.	2.19
4.1	Catch trend of pelagics in Seven Countries	4.7
4.2	Catch trend of pelagics in South China Sea area	4.8
4.3	Catch trend of pelagics in Malaysia	4.10
4.4	Catch trend of pelagics in Singapore	4.13
4.5	Catch trend of pelagics in Hong Kong	4.15
4.6	Catch trend of pelagics in Taiwan	4.17
4.7	Catch trend of pelagics in Thailand	4.21
4.8	Catch trend of pelagics in Philippines	4.24
4.9	Catch trend of pelagics in Indonesia	4.26
5.1	Relationship between effort (number of days) and CPUE value from 17 pelagics off East Coast of Peninsular Malaysia from 1987 to 1997 by standardized fishing gear	5.6
5.2	Fitted Schaefer's surplus production model from 17 pelagics off East Coast of Peninsular Malaysia from	5.6

1988 to 1997 by standardized fishing gear

5.3	Relationship between effort(number of days) and CPUE value from 17 pelagics off East coast of Peninsular Malaysia from 1987 to 1997 excepted 1993 by purse seine	5.7
5.4	Fitted Schaefer's production model from 17 pelagics off East Coast of Peninsular Malaysia from 1988 to 1997 excepted 1993 by purse seine	5.7
5.5	Relationship between effort (number of days) CPUE value from 17 pelagics off East Coast of Peninsular Malaysia from 1987 to 1997 by trawl	5.8
5.6	Fitted Schaefer's production model from 17 pelagics off East Coast of Peninsular Malaysia from 1987 to 1997 by trawl	5.8
5.7	Magnitude of correlation of Taiwan against each area	5.14
5.8	Magnitude of correlation of Hong Kong against each area	5.14
5.9	Magnitude of correlation of West Sumatra against each area	5.15
5.10	Magnitude of correlation of South Java against each area	5.15
5.11	Magnitude of correlation of Malacca Straits against each area	5.16
5.12	Magnitude of correlation of East Sumatra against each area	5.16
5.13	Magnitude of correlation of North Java against each area	5.17
5.14	Magnitude of correlation of Bali.N.Tenggara against each area	5.17
5.15	Magnitude of correlation of Kalimantan against each area	5.25
5.16	Magnitude of correlation of Sulawesi against each area	5.25

5.17	Magnitude of correlation of Maluku, Irian Jaya against each area	5.26
5.18	Magnitude of correlation of West Coast of Malaysia against each area	5.26
5.19	Magnitude of correlation of East Coast of Malaysia against each area	5.27
5.20	Magnitude of correlation of Sarawak against each area	5.27
5.21	Magnitude of correlation of Sabah against each area	5.28
5.22	Magnitude of correlation of Luzon against each area	5.28
5.23	Magnitude of correlation of Visayas against each area	5.29
5.24	Magnitude of correlation of Mindanao against each area	5.29
5.25	Magnitude of correlation of Singapore against each area	5.30
5.26	Magnitude of correlation of Gulf of Thailand against each area	5.30
5.27	Magnitude of correlation of Indian Ocean against each area	5.31
5.28	Year plots of factor scores of catch quantity of 15 species obtained from Taiwan from 1976 to 1996. The 12 species were reflected in the first and the second components	5.37
5.29	Summarized alternation of species (groups) of major catches in Taiwan based on the principal component analysis	5.38
5.30	Year plots of factor scores of catch quantity of 15 species obtained from Hong kong from 1976 to 1996. The 12 species were reflected in the first and the second components	5.40
5.31	Summarized alternation of species (groups) of major catches in Hong Kong based on the principal component analysis	5.41



5.32	Year plots of factor scores of catch quantity of 15 species obtained from West Sumatra from 1976 to 1997. The 16 species were reflected in the first and the second components	5.43
5.33	Summarized alternation of species (groups) of major catches in West Sumatra based on the principal component analysis	5.44
5.34	Year plots of factor scores of catch quantity of 17 species obtained from South Java from 1976 to 1997. The 11 species were reflected in the first and the second components	5.50
5.35	Summarized alternation of species (groups) of major catches in South Java based on the principal component analysis	5.51
5.36	Year plots of factor scores of catch quantity of 17 species obtained from Malacca Straits from 1976 to 1997. The 14 species were reflected in the first and the second components	5.53
5.37	Summarized alternation of species (groups) of major catches in Malacca Straits based on the principal component analysis	5.54
5.38	Year plots of factor scores of catch quantity of 17 species obtained from East Sumatra from 1976 to 1997. The 16 species were reflected in the first and the second components	5.56
5.39	Summarized alternation of species (groups) of major catches in East Sumatra based on the principal component analysis	5.57
5.40	Year plots of factor scores of catch quantity of 17 species obtained from North Java from 1976 to 1997. The 13 species were reflected in the first and the second components	5.64
5.41	Summarized alternation of species (groups) of major catches in North Java based on the principal component analysis	5.65
5.42	Year plots of factor scores of catch quantity of 17 species obtained from Bali.N.Tenggara from 1976 to 1997. The 15 species were reflected in the first and the second components	5.67





5.43	Summarized alternation of species (groups) of major catches in Bali.N.Tenggara based on the principal component analysis	5.68
5.44	Year plots of factor scores of catch quantity of 17 species obtained from Kalimantan from 1976 to 1997. The 16 species were reflected in the first and the second components	5.70
5.45	Summarized alternation of species (groups) of major catches in Kalimantan based on the principal component analysis	5.71
5.46	Year plots of factor scores of catch quantity of 17 species obtained from Sulawesi from 1976 to 1997. The 16 species were reflected in the first and the second components	5.73
5.47	Summarized alternation of species (groups) of major catches in Sulawesi based on the principal component analysis	5.74
5.48	Year plots of factor scores of catch quantity of 17 species obtained from Maluku,Irian Jaya from 1976 to 1997. The 16 species were reflected in the first and the second components	5.81
5.49	Summarized alternation of species (groups) of major catches in Maluku,Irian Jaya based on the principal component analysis	5.82
5.50	Year plots of factor scores of catch quantity of 14 species obtained from West Coast of Malaysia from 1976 to 1998. The 10 species were reflected in the first and the second components	5.84
5.51	Summarized alternation of species (groups) of major catches in West Coast of Malaysia based on the principal component analysis	5.85
5.52	Year plots of factor scores of catch quantity of 14 species obtained from East Coast of Malaysia from 1976 to 1998. The 11 species were reflected in the first and the second components	5.87
5.53	Summarized alternation of species (groups) of major catches in East Coast of Malaysia based on the	5.88