UNIVERSITI PUTRA MALAYSIA

SELECTIVITY STUDIES ON MALAYSIAN TRAWLS

MOHD. IBRAHIM BIN HAJI MOHAMED

FPSS 1987 2

SELECTIVITY STUDIES ON MALAYSIAN TRAWLS

by

Mohd. Ibrahim Bin Haji Mohamed

A thesis submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Faculty of Fisheries and Marine Science,
Universiti Pertanian Malaysia.

June, 1987

DEDICATION

To my wife Aidah,

&

my son Adil Ridha,

Your sacrifices, undying support, and constant encouragement will forever be remembered.

ACKNOWLEDGEMENT

I am truly indebted to my supervisor Associate Professor Dr. Gunzo Kawamura whose guidance, critical comments, constant encouragement and intellectual stimulation has tremendously assisted me during this period of candidature. Also to my co-supervisor Associate Professor Dr. Abu Khair Mohammad Mohsin, whose patience, encouragement, and critical comments have been a source of inspiration for me during the long hours of preparation, fieldwork, analysis and thesis preparation.

My heartfelt gratitude are also extended to Mohamed Bin Muda, Akesah Bin Ismail, Sujak Bin Samad, Saat Bin Mat and Mohd. Zin Bin Abu Bakar whom at one time or another assisted me during the field work in Terengganu and Selangor and in the ardous task of measuring the fish samples. A special mention is reserved for Mahmud Bin Yusoh whose assistance continued during the data entry and thesis preparation. I am also grateful to Puan Badariah Yusof who assisted me in typing the various tables and illustrations quickly and efficiently.

I am very grateful to the Universiti Pertanian Malaysia for providing the financial assistance necessary to carry out this project. To the many friends and collegues who have been a constant source of encouragement, I extend my sincere thanks. To the fishermen who were kind enough to accomodate me on their fishing trips I am truely grateful.

Finally my eternal gratitude goes to Professor Nelson Marshall of the University of Rhode Island, USA, for his encouragement and trust.

TABLE OF CONTENTS

page

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

NOMENCLATURE

D = maximum body depth

D_c = critical body depth

D_R = depth ratio

L_{25} = 25 percent retention length

L_{50} = 50 percent retention length

L_{75} = 75 percent retention length

L_c = length of first capture

L_∞ = the maximum length of a species

L_o = optimum length of first capture

L/G = length - girth

M' = vertical mesh opening of a net

M_s = mesh size of a net

$M_{ext.}$ = mesh size extension after loading

M_o = optimum mesh size for a fishery

S_C = selection curve

S_f = selection factor

S_R = selection range

K = growth constant

F = rate of fishing mortality

M = rate of mortality

Z = rate of natural mortality

E = experimental L_{50} / Predicted L_{50}

C_L = carapace length

T_L = total length

Abstrak tesis yang dikemukakan kepada Senat Universiti Pertanian Malaysia sebagai memenuhi sebahagian daripada keperluan untuk Ijazah Doktor Falsafah.

SELECTIVITY STUDIES ON MALAYSIAN TRAWLS

oleh

Mohd. Ibrahim Bin Haji Mohamed

Jun, 1987

Penyelia : Profesor Madya Dr. Gunzo Kawamura

Penyelia Bersama : Profesor Madya Dr. Abu Khair Mohammad Mohsin

Fakulti : Perikanan dan Sains Samudera

Suatu kajian yang menggunakan kaedah "Covered Cod-end" dan 70 tundaan pukat tunda ikan dan udang telah dijalankan di Laut China Selatan dan Selat Melaka untuk mengkaji corak pemilihan pukat pukat tunda di Malaysia. Penyiasatan ini adalah bertujuan untuk mengurangkan tekanan yang hebat terhadap sumber-sumber ikan terutamanya terhadap tangkapan anak-anak ikan komersial.

Suatu "model" untuk meramalkan geraf pemilihan spesis ikan dan udang berasaskan ukuran panjang dan lebar spesis tersebut telah dicipta. "Model" ini akan menyenangkan kerja penyiasatan pemilihan pada pukat dengan hanya mendapatkan makluman tersebut dari sampel ikan atau udang dari mana-mana tangkapan.

Hasil penyelidikan ini menunjukkan bahawa saiz mata keroncong 25 mm menangkap 98.20 peratus berbanding dengan saiz

mata keroncong 51 mm yang menghasilkan 56.10 peratus dari ikan-ikan yang memasuki pukat tunda ikan. Dengan pukat tunda udang pula, saiz mata keroncong 25 mm menangkap 92.60 peratus manakala saiz mata keroncong 38 mm menangkap 51.35 peratus dari jumlah ikan yang memasuki pukat tersebut.

Bersamaan ini, ikan baja merupakan 46.40 peratus dari tangkapan pukat tunda ikan dan 68.20 peratus dari tangkapan pukat tunda udang yang menggunakan saiz mata keroncong 25 mm. Ini berbanding dengan 34.60 peratus bagi pukat tunda ikan yang menggunakan saiz mata keroncong 51 mm dan 56.80 peratus untuk pukat tunda udang yang menggunakan saiz mata keroncong 38 mm.

Walaupun kenaikan kelajuan menunda mengurangkan pemilihan dan tambahan masa menunda menambah pemilihan pada pukat saiz mata keroncong yang besar, saiz mata keroncong yang kecil telah menghasilkan keputusan yang berlawanan. Kesan-kesan kelajuan dan masa menunda hanya kecil dan diatasi oleh kesan tangkapan yang besar. Tangkapan besar mengurangkan pemilihan pada semua saiz mata keroncong dan pukat tunda ikan mahupun pukat tunda udang.

Berbeza dari anggapan ramai, saiz mata pukat kecil yang biasa digunakan dalam industri perikanan di Malaysia, mengakibatkan faktor pemilihan yang dependen kepada saiz mata pukat. Berasaskan kepada faktor pemilihan yang didapati, saiz mata pukat yang optimum bagi industri pukat tunda negara adalah 55 mm bagi pukat tunda ikan dan 38 mm untuk pukat tunda udang.

An abstract of the thesis presented to the Senate of Universiti Pertanian Malaysia in partial fulfillment of the requirements for the Degree of Doctor of Philosophy.

SELECTIVITY STUDIES ON MALAYSIAN TRAWLS

by

Mohd. Ibrahim Bin Haji Mohamed

June, 1987

Supervisor : Associate Professor Dr. Gunzo Kawamura

Co-Supervisor : Associate Professor Dr. Abu Khair Mohammad Mohsin

Faculty : Fisheries and Marine Science

A covered cod-end experiment was conducted employing 70 hauls of fish and shrimp trawls in the South China Sea and the Malacca Straits to determine the selectivity pattern of Malaysian trawls. This study was conducted in order to alleviate the intensive fishing effort on the fishery stocks especially towards the juveniles of commercially important species.

A mathematical model was developed to predict the selection curve based on the standard length and maximum body depth of fish and shrimp species retained by the net. Data

collection in a selectivity experiment is now simplified to obtaining the two parameters from fish or shrimp sampled from any catch.

Results of the study revealed that the 25 mm cod-end fish trawl retained 98.2 percent as compared to the 51 mm cod-end which retained 56.1 percent of the catch. With the shrimp trawl, the 25 mm cod-end retained 92.6 percent while the 38 mm cod-end retained 51.35 percent of the catch.

Correspondingly, the trash fish component of the 25 mm mesh size cod-end was high, registering 46.4 percent for the fish trawl and 68.2 percent for the shrimp trawl. This is compared to that of 34.6 percent for the 51 mm cod-end fish trawl and 56.8 percent for the 38 mm cod-end shrimp trawl.

While increased trawling speed decreased the escapement and increased bottom time increased escapement in the larger mesh size cod-ends, similar treatments on the small mesh size cod-ends produced the opposite results. The effect of trawling speed and bottom time on trawl selectivity is small and is overcomed by the effect of catch size. A large catch size decreased escapement in all mesh sizes and trawls.

Contrary to normal assumption, small mesh sizes normally operated in the Malaysian fishery produced selection factors which were mesh size dependent. Based on the new selection factors obtained, the optimum mesh size for the Malaysian trawl fishery was determined to be 55 mm for fish trawl and 38 mm for shrimp trawl.

CHAPTER 1

INTRODUCTION

The Malaysian Fishery

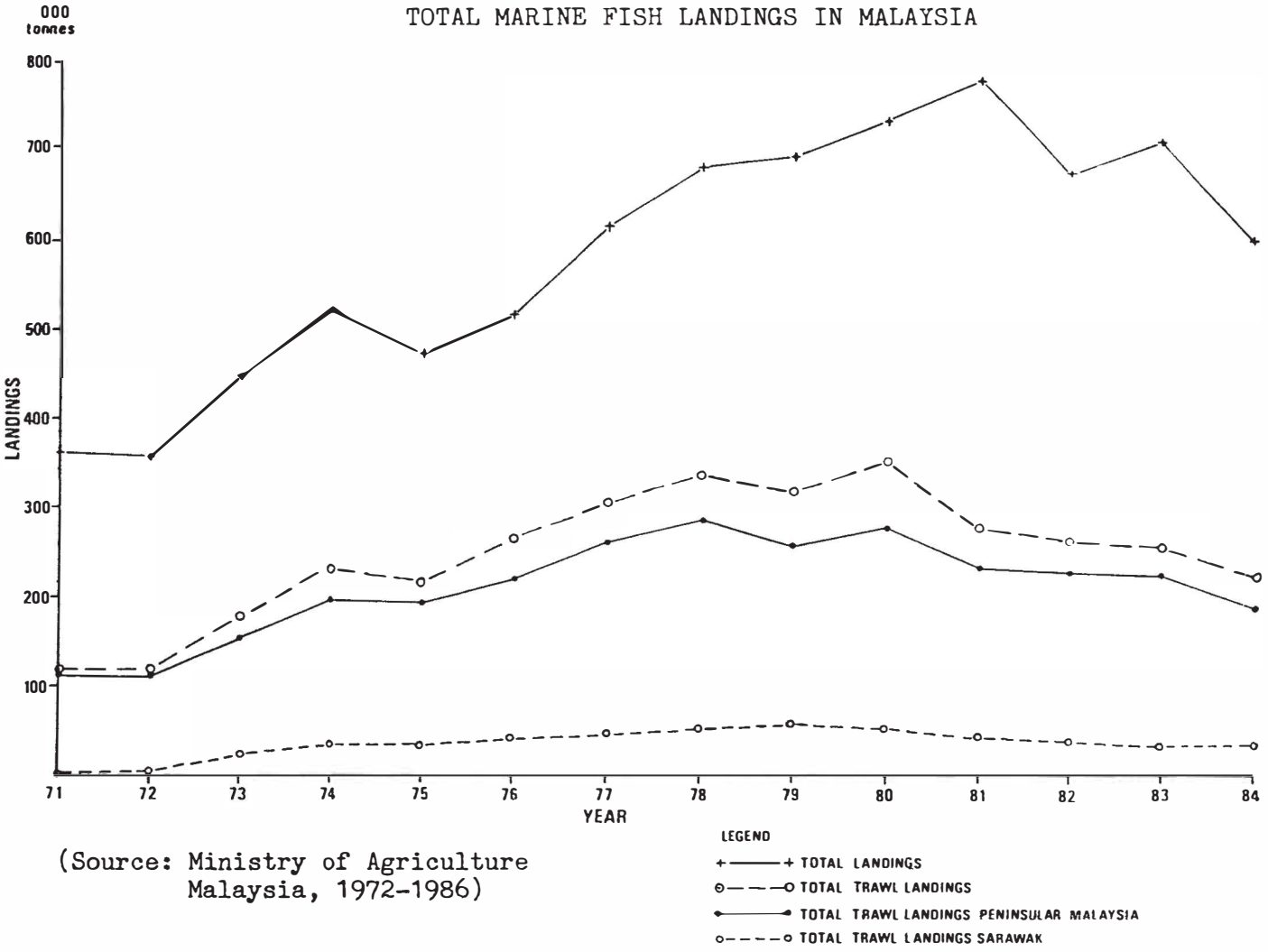
The Malaysian fishing industry recorded a spectacular growth in marine fish landings in the last 20 years. Total landings have increased almost threefold from 243,000 tonnes in 1963 (FAO Yearbook of Fishery Statistics, 1964) to 727,493 tonnes in 1983 (Ministry of Agriculture Malaysia, 1984). The mean growth rate of the fishery over the years from 1963 was approximately 10 percent.

Figure 1.1 illustrates the total marine fish landings in Malaysia from 1971 to 1984. Two distinct peaks in the total catch can be detected. The first is the result of the rapid rise in catch in 1972 and 1973 culminating in the peak in 1974. A further period of rapid rise in catch can be seen in 1976 followed by a more sustained growth culminating in 1981 with a total catch of 757,974.18 tonnes. Since then the total catch has remained at about 700,000 tonnes decreasing to 603,272.96 tonnes in 1984 (Ministry of Agriculture Malaysia, 1986).

The FAO Yearbook of Fishery Statistics 1982, places Malaysia twenty-third among the top 80 fishing nations of the world. Compared to her ASEAN neighbours however, her annual fish landings fell far short of Indonesia with 2,020,000

FIGURE 1.1

TOTAL MARINE FISH LANDINGS IN MALAYSIA



(Source: Ministry of Agriculture Malaysia, 1972-1986)