

# CONTENTS

	Page
Declaration	ii
Abstract	iii
Acknowledgement	vi
Contents	vii
List of Tables	x
List of Figures	xii
List of Plates	xv
List of Appendices	xvi
1. INTRODUCTION	1
1.1. Marine fisheries in Sri Lanka	1
1.2. Beach seine fishery in Sri Lanka	3
1.3. Catch and species composition of beach seine fishery	8
1.4. Contributions to the country's economy	9
1.5. Beach seine fishery management in Sri Lanka	10
1.6. Objectives of the study	11
2. MATERIALS AND METHODS	12
3. BEACH SEINE CRAFT	17
3.1. Introduction	17
3.2. Materials and methods	18
3.3. Results	18
3.3.1. Fishing crafts used in the beach seine fishery	18
3.3.1.1. Beach seine paru	18
3.3.1.2. Beach seine paru with out-trigger	19
3.3.1.3. Beach seine paru with square type dugout	19
3.3.1.4. FRP paru	19
3.3.1.5. Wooden vallam	20
3.3.1.6. FRP vallam	20
3.3.1.7. Beach seine canoe	20
3.3.1.8. Catamaran	21
3.3.1.9. Log rafts (Teppam and Kattumaran)	21
3.3.1.10. FRP boats	21
3.4. Discussion	26

<b>4. BEACH SEINE GEAR</b>	<b>28</b>
4.1. Introduction	28
4.2. Materials and Methods	28
4.3. Results	28
4.3.1. General structure of the beach seine	28
4.3.1.1. Structure of the cod end	31
4.3.1.2. Structure of the body	31
4.3.1.3. “Siringu” or “nool katti”	34
4.3.1.4. “Lanu thiringu”	34
4.3.1.5. Coir wings and ropes	35
4.3.2. Variation of the types of beach seines	35
4.3.2.1. “Kachchi dela”	36
4.3.2.2. Commonly used beach seine	36
4.3.2.3. “Nool dela”	38
4.3.2.4. “Adassi dela”	38
4.3.2.5. “Kota dela”	38
4.3.2.6. “Siri dela” (Mini beach seine)	39
4.3.2.7. Nylon beach seine	39
4.3.2.8. “Pita dela” (Outer net)	40
4.3.3. Colour of the beach seine	44
4.3.4. Value of the beach seines	44
4.4. Discussion	45
<b>5. METHODS OF OPERATION AND STRATEGIES USED IN THE BEACH SEINE FISHERY</b>	<b>48</b>
5.1. Introduction	48
5.2. Materials and Methods	49
5.3. Results	50
5.3.1. Beach seine operating systems	52
5.3.2. Methods used in setting of beach seines	53
5.3.3. Migrating pattern of beach seine fishermen	56
5.3.1.1. Local migrants	56
5.3.2.2. Migrants to east coast	56
5.4. Discussion	57

6. BEACH SEINE FISHERY - CATCH, EFFORT, PRODUCTION AND ECONOMICS	59
6.1. Introduction	59
6.2 Materials and methods	59
6.2.1. Study period and sampling sites	59
6.2.2. Collection of data	60
6.2.3. Estimation of the fishing effort	60
6.2.4. Estimation of catch per unit effort (CPUE) and catch per unit area (CPUA)	61
6.2.5. Estimation of production	63
6.2.6. Species composition	63
6.2.7. Bio-economic information	64
6.3. Results	65
6.4. Discussion	85
7. IMPACT OF THE BEACH SEINE FISHERY ON SMALL MESHED GILLNET FISHERY AND SOME POPULATION DYNAMICS OF <i>Amblygaster sirm</i> IN SOUTHERN COASTAL WATERS OF SRI LANKA	93
7.1. Introduction	93
7.2. Materials and Methods	94
7.2.1. Data correction	96
7.2.2. Estimation of population parameters	97
7.2.3. Virtual Population Analysis (VPA)	98
7.2.4. Bio-economic prediction	100
7.3. Results	102
7.4. Discussion	118
8. GENERAL DISCUSSION	124
8.1. Recommendations	131
Appendices	132
References	142

## LIST OF TABLES

	Page
Table 3.1. Specifications of the beach seine crafts observed from northwestern to southern area from 1992 to 1997	23
Table 3.2. Specifications of the beach seine crafts observed from northwestern to southern area from 1992 to 1997	24
Table 3.3. Specifications of the beach seine crafts observed from northwestern to southern area from 1992 to 1997	25
Table 4.1. Specifications of the different parts of a beach seine	29
Table 4.2. Specific information on different types of beach seines observed in northwestern to southern regions of Sri Lanka from 1992 to-1997	42
Table 4.3. Specific information on different types of beach seines observed in northwestern to southern regions of Sri Lanka from 1992 to-1997	43
Table 6.1. Beach seine effort in the northwestern region of Sri Lanka from 1992 to 1994	68
Table 6.2. CPUE of the beach seine fishery in the northwestern region of Sri Lanka from 1992 to 1994	69
Table 6.3. Beach seine effort in the southern region of Sri Lanka from 1995 to 1997	70
Table 6.4. CPUE of the beach seine fishery in the southern region of Sri Lanka from 1995 to 1997	71
Table 6.5. CPUE in catch per man-hour of the beach seine fishery in Northwestern southern regions of Sri Lanka	73
Table 6.6. CPUE in catch per m <sup>2</sup> of the beach seine fishery in northwestern and southern regions of Sri Lanka	73
Table 6.7. Fish production of the beach seine fishery in the northwestern region from 1992 to 1994	76

Table 6.8.	Fish production of the beach seine fishery in the southern region of Sri Lanka from 1995 to 1997	77
Table 6.9.	Catch rate and percentage contribution of dominant species of the beach seine catches in northwestern and southern regions of Sri Lanka from 1992 to 1997	79
Table 6.10	Monthly income and expenditure of beach seine fishermen in the northwestern and southern regions of Sri Lanka from 1992 to 1994	84
Table 7.1.	Probability of capture of <i>A. sirm</i> by beach seines and gillnets in the southern region from 1995 to 1996	102
Table 7.2.	Results of the Jones' length based cohort analysis of <i>A. sirm</i> caught by beach seines in the southern coast from 1995 to 1996	110
Table 7.3.	Results of the Jones' length based cohort analysis of <i>A. sirm</i> caught by gillnets in the southern coast from 1995 to 1996	110
Table 7.4.	Results of the Jones' length based cohort analysis of <i>A. sirm</i> caught by both beach seine and gillnets in the southern coast from 1995 to 1996	110
Table 7.5.	Effect of changing the beach seine fishery without considering the gillnets. Assessment was carried out using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	116
Table 7.6.	Effect of changing the gillnet fishery without considering the gillnets. Assessment was carried out using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	116
Table 7.7..	Effect of changing the beach seine fishery while the gillnet effort is kept at constant level Assessment was carried out using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	117
Table 7.8.	Effect of changing the gillnet fishery while the beach seine effort is kept at constant level Assessment was carried out using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	117
Table 7.9.	Effect of changing both beach seine and gillnet fisheries. Assessment was carried out using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	117

## LIST OF FIGURES

	Page
Figure 2.1. Map showing the major beach seine landing sites visited in the study area	14
Figure 2.2. Map of the northwestern study area indicating beach seine landing sites and sampling sites	15
Figure 2.3. Map of the southern study area indicating beach seine landing sites and sampling sites	16
Figure 3.1. Schematic cross sectional diagrams of three craft types used in the beach seine fishery	22
Figure 3.2. Different types of crafts used in the beach seine fishery in Sri Lanka	23
Figure 3.3. Different types of crafts used in the beach seine fishery in Sri Lanka	24
Figure 3.4. Different types of crafts used in the beach seine fishery in Sri Lanka	25
Figure 4.1. Schematic drawing of a beach seine	30
Figure 4.2. Different types of cod ends used in the beach seines observed from northwestern to southern regions of Sri Lanka from 1992 to 1997	32
Figure 4.3. Different body types of beach seines observed from northwestern to southern regions from 1992 to 1997	33
Figure 4.4. Diagram showing the development of beach seine in Sri Lanka from 1865 to 1997	47
Figure 5.1. Existing methods of beach seine operations	54
Figure 5.2. Beach seine setting methods depending on the water current	55
Figure 6.1. Schematic drawing of the swept area covered by a beach seine	62

Figure 6.2.	Monthly variation in the fishing effort and catch per unit effort of the beach seine fishery in the northwestern region of Sri Lanka from 1992 to 1994	67
Figure 6.3.	Monthly variation in the fishing effort and catch per unit effort of the beach seine fishery in the southern region of Sri Lanka from 1995 to 1997	67
Figure 6.4.	Monthly variation in the estimated total production of the beach seine fishery in the northwestern region of Sri Lanka from 1992 to 1994	75
Figure 6.5.	Monthly variation in the estimated total production of the beach seine fishery in the southern region of Sri Lanka from 1995 to 1997	75
Figure 6.6.	Monthly variation of the species composition in the catches of three sampling sites at northwestern region of Sri Lanka from 1992 to 1994	80
Figure 6.7.	Monthly variation of the species composition in the catches of three sampling sites at southern region of Sri Lanka from 1995 to 1997	81
Figure 7.1.	Steps followed to estimate the growth parameters and mortality values	95
Figure 7.2.	Steps followed in the Jones' length based cohort analysis	99
Figure 7.3.	Steps followed in the Thompson and Bell prediction model	101
Figure 7.4.	Gear selection ogive for <i>A. sirm</i> caught by beach seines in the southern coast from 1995 to 1997	104
Figure 7.5.	Gear selection ogive for <i>A. sirm</i> caught by gillnets in the southern coast from 1995 to 1997	104
Figure 7.6.	Biased and unbiased samples of <i>A. sirm</i> caught by beach seine in the southern coast from 1995 to 1997	105

Figure 7.7.	Biased and unbiased samples of <i>A. sirm</i> caught by gillnet in the southern coast from 1995 to 1997	105
Figure 7.8.	Monthly length frequency distribution of <i>A. sirm</i> in the southern coast from 1995 to 1997 with the estimated growth curves	106
Figure 7.9.	Recruitment pattern of <i>A. sirm</i> in the southern coast from 1995 to 1996	108
Figure 7.10.	Virtual population analysis using Jones' length based cohort analysis for <i>A. sirm</i> in the southern coast from 1995 to 1996	109
Figure 7.11.	Assessment of the effect of changing the beach seine fishery without considering the gillnet fishery, using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	113
Figure 7.12.	Assessment of the effect of changing the gillnet fishery without considering the beach seine fishery, using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	113
Figure 7.13.	Assessment of the effect of changing the beach seine fishery while the gillnet effort is kept at a constant level, using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	114
Figure 7.14.	Assessment of the effect of changing the gillnet fishery while the beach seine effort is kept at a constant level, using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	114
Figure 7.15.	Assessment of the effect of changing both fisheries using <i>A. sirm</i> stocks in the southern coast of Sri Lanka from 1995 to 1996	115



## LIST OF PLATES

		Page
Plate 4.1	Schooling of fish shoals during the Kachchidela operation	37
Plate 4.2	Stretched body and wing parts of a beach seine	37
Plate 5.1	Fishermen engaged in a beach seine operation at Sinnapadu	51

## LIST OF APPENDICES

	Page
Appendix 6.1. Beach seine centers and number of beach seines in the northwestern region of Sri Lanka from 1992 to 1994	132
Appendix 6.2. Beach seine centers and number of beach seines in the southern region of Sri Lanka from 1995 to 1997	133
Appendix 6.3. Beach seine catch rates recorded from the northwestern region from 1992 to 1994	134
Appendix 6.4. Beach seine catch rates recorded from the southern region from 1995 to 1997	135
Appendix 6.5. Fin fish and crustacean species found in the beach seine catches in the northwestern and the southern coast from 1992 to 1997	136
Appendix 7.1. Raised length frequency values of <i>A. sirm</i> caught by beach seines in the southern region from July 1995 to May 1997	138
Appendix 7.2. Raised length frequency values of <i>A. sirm</i> caught by gillnets in the southern region from July 1995 to May 1997	139
Appendix 7.3. Equations used to estimate the gear selection ogive	140
Appendix 7.4. Equations used in the Jones length based cohort analysis	141