

CONTENTS

CHAPTER	PAGE
Abstract	iii
Acknowledgements	iv
List of Tables	v
List of Figures	vi
List of Appendices	viii
List of Abbreviations	ix
Table of Contents	x
1 INTRODUCTION	1
1.1 OVERVIEW	1
1.2 PROBLEM DEFINITION	1
1.3 OBJECTIVES	2
1.4 CONCEPTUAL FRAMEWORK	2
1.5 COLLECTION OF FISHING DATA	8
2 LITERATURE SURVEY	9
2.1 INTRODUCTION	9
2.2 MANAGEMENT PLAN: BASIC CONCEPT	10
2.3 SPATIAL AND TEMPORAL PATTERNS IN BLUE SHARK (PRIONACE GLAUCA) CATCH IN SOUTH AFRICAN LONGLINE FISHERIES	10
2.4 A GENERAL THEORY ON FISH AGGREGATION TO FLOATING OBJECTS: AN ALTERNATIVE TO MEETING POINT HYPOTHESIS	11
2.5 EXCLUSIVE ECONOMIC ZONE	13
2.6 TARGET SPECIES IN RING NET AND GILL NETFISHERY	16
2.7 GEOGRAPHICAL INFORMATION SYSTEMS	19
2.8 GLOBAL POSITIONNING SYSTEM (GPS)	21
2.9 SPATIAL POINT PATTERN ANALYSIS	22
2.10 GEOSTROPHIC CURRENT FLOW IN INDIAN OCEAN	23
3 METHODOLOGY	26
3.1 INTRODUCTION	26
3.2 STUDY AREA	26
3.3 MAP DATA COLLECTION	27
3.4 DATA COLLECTION	29
3.5 SPATIAL POINT PATTERN ANALYSIS	30
3.6 DATA ANALYSIS	34
3.7 ORGANISATION OF THE STUDY	34
4 RESULTS AND DISCUSSION	37
4.1 SPATIAL TREND OF RING NET AND GILL NET FISHING IN 2003	37
4.2 RING NET AND GILL NET FISHING IN SEASON 1	

	(JANUARY, 2013 TO FEBRUARY, 2013)	40
4.3	RING NET AND GILL NET FISHING IN SEASON 2 (MARCH, 2013 TO APRIL, 2013)	43
4.4	RING NET AND GILL NET FISHING IN SEASON 3 (MAY, 2013 TO DECEMBER, 2013)	46
4.5	RING NET AND GILL NET FISHING IN SEASON 4 (JANUARY, 2014 TO FEBRIARY, 2014)	50
4.6	TIME SERIES APPROACH	53
5	CONCLUSIONS AND RECOMMENDATIONS	60
5.1	INTRODUCTION	60
5.2	CONCLUSIONS	60
5.3	RECOMMENDATIONS	61
	REFERENCES	62
	APPENDICES	64
Appendix I	Data Sheet: Catch and Effort Form	65
Appendix II	Data Sheet: Length Frequency Sheet	67
Appendix III	R Programme for Spatial Point Pattern Analysis	68
Appendix IV	Seasonal trends in the density of Skipjack Tuna (<i>Katsuwonus pelamis</i>) CPUE in the RN and RGN fishery (season 1: January, 2013 to February, 2013)	69
Appendix V	Seasonal trends in the density of Skipjack Tuna (<i>Katsuwonus pelamis</i>) CPUE in the RN and RGN fishery (season 2: March, 2013 to April, 2013)	70
Appendix VI	Seasonal trends in the density of Skipjack Tuna (<i>Katsuwonus pelamis</i>) CPUE in the RN and RGN fishery (season 3: May, 2013 to December, 2013)	71
Appendix VII	Seasonal trends in the density of Starry Rainbow runner (<i>Elagatis bipinnulata</i>) CPUE in the RN and RGN fishery	72
Appendix VIII	Seasonal trends in the density of Starry triggerfish (<i>Abalistes Stellatus</i>) CPUE in the RN and RGN fishery	73
Appendix IX	Seasonal trends in the density of Yellowfin tuna (<i>Thunnus albacares</i>) and Bigeye tuna (<i>Thunnus obesus</i>) CPUE in the RN and RGN fishery	74
Appendix X	Fishing Gears In RN, RGN and GL (Nédélec, 1990)	75

LIST OF TABLES

Table	Table	Caption	Page
Table 2.1		Species Identified in RN, GN and LL	18
Table 4.1		Summary of Average Nearest Neighbor (Euclidean) Distance for Season 1 (January, 2013 to February, 2013)	40
Table 4.2		Quadrat Count Table for Season 1 (January, 2013 to February, 2013)	41
Table 4.3		Summary of Average Nearest Neighbor (Euclidean) Distance for Season 2 (March, 2013 to April, 2013)	43
Table 4.4		Quadrat Count Table for Season 2 (March, 2013 to April, 2013)	44
Table 4.5		Summary of Average Nearest Neighbor (Euclidean) Distance for Season 3 (May, 2013 to December, 2013)	45
Table 4.6		Quadrat Count Table for Season 3 (May, 2013 to December, 2013)	47
Table 4.7		Summary of Average Nearest Neighbor (Euclidean) Distance for Season 4 (January, 2014 to February, 2014)	50
Table 4.8		Quadrat Count Table for Season 4 (January, 2014 to February, 2014)	51

LIST OF FIGURES

Figure No	Caption	Page
Figure 1.1	Purse Seine Net (Source: Eurocbc, 2006)	3
Figure 2.1	Marine Life Related to Floating Object	13
Figure 2.2	Exclusive Economic Zone in Sri Lanka	15
Figure 2.3	Skipjack Tuna (<i>Katsuwonus pelamis</i>),	16
Figure 2.4	Yellowfin Tuna (<i>Thunnus albacares</i>)	17
Figure 2.5	Mackerel Scad (<i>Decapterus macarellus</i>)	17
Figure 2.6	Rainbow Runner (<i>Elagatis bipinnulata</i>)	18
Figure 2.7	Arrangement of GPS satellites in space	22
Figure 2.8	Evaluation of OSCAR Currents in the Indian Ocean , Winter (Sikhakolli, 2013)	24
Figure 2.9	Evaluation of OSCAR Currents in the Indian Ocean, Summer (Sikhakolli, 2013)	25
Figure 3.1	The Location of the RN, RGN and GL Fishing Grounds	28
Figure 3.2	Study Organization	36
Figure 4.1	Directional Distribution and Total Production Of RN and RGL	38
Figure 4.2	Seasonal Changes of Fishing Locations in 2013	39
Figure 4.3	Output of Average Nearest Neighbor (Euclidean) Distance for Season 1	40
Figure 4.4	Point Pattern Analysis Plot for Season 1	41
Figure 4.5	Quadrat Count Plot for Season 1	41
Figure 4.6	G-Plot for Season 1	42
Figure 4.7	F-Plot for Season 1	42
Figure 4.8	Output of Average Nearest Neighbor (Euclidean) Distance for Season 2	43
Figure 4.9	Point Pattern Analysis Plot for Season 2	44
Figure 4.10	Quadrat Count Plot for Season 2	44
Figure 4.11	G-Plot for Season 2	45
Figure 4.12	F-Plot for Season 2	45
Figure 4.13	Output of Average Nearest Neighbor (Euclidean) Distance for Season 3	46
Figure 4.14	Point Pattern Analysis Plot for Season 3	47
Figure 4.15	Quadrat Count Plot for Season 3	48
Figure 4.16	G-Plot for Season 3	48
Figure 4.17	F-Plot for Season 3	49
Figure 4.18	Output of Average Nearest Neighbor (Euclidean) Distance for Season 4	50
Figure 4.19	Point Pattern Analysis Plot for Season 4	51
Figure 4.20	Quadrat Count Plot for Season 4	51
Figure 4.21	G-Plot for Season 4	52
Figure 4.22	F-Plot for Season 4	52
Figure 4.23	Time Series Plot for Mackerel Scad (<i>Decapterus macarellus</i>)	53
Figure 4.24	Time Series Plot for Starry triggerfish (<i>Abalistes Stellatus</i>)	53
Figure 4.25	Time Series Plot for Rainbow Runner (<i>Elagatis bipinnulata</i>)	54
Figure 4.26	Time Series Plot for Skipjack Tuna (<i>Katsuwonus pelamis</i>)	54
Figure 4.27	Time Series Plot for Yellowfin Tune (<i>Thunnus albacares</i>)	54

Figure 4.28	Seasonal trends in the density of Mackerel Scad (<i>Decapterus macarellus</i>) CPUE in the RN and RGN fishery (season 1: January, 2013 to February, 2013)	57
Figure 4.29	Seasonal trends in the density of Mackerel Scad (<i>Decapterus macarellus</i>) CPUE in the RN and RGN fishery (season 2: March, 2013 to April, 2013)	58
Figure 4.30	Seasonal trends in the density of Mackerel Scad (<i>Decapterus macarellus</i>) CPUE in the RN and RGN fishery (season 3: May, 2013 to December, 2013)	59

LIST OF APPENDICES

- Appendix I Data Sheet: Catch And Effort Form
- Appendix II Data Sheet: Length Frequency Sheet
- Appendix III R Programme for Spatial Point Pattern Analysis
- Appendix IV Seasonal trends in the density of Skipjack Tuna (*Katsuwonus pelamis*) CPUE in the RN and RGN fishery (season 1: January, 2013 to February, 2013)
- Appendix V Seasonal trends in the density of Skipjack Tuna (*Katsuwonus pelamis*) CPUE in the RN and RGN fishery (season 2: March, 2013 to April, 2013)
- Appendix VI Seasonal trends in the density of Skipjack Tuna (*Katsuwonus pelamis*) CPUE in the RN and RGN fishery (season 3: May, 2013 to December, 2013)
- Appendix VII Seasonal trends in the density of Starry Rainbow runner (*Elagatis bipinnulata*) CPUE in the RN and RGN fishery
- Appendix VIII Seasonal trends in the density of Starry triggerfish (*Abalistes Stellatus*) CPUE in the RN and RGN fishery
- Appendix IX Seasonal trends in the density of Yellowfin tuna (*Thunnus albacares*) and Bigeye tuna (*Thunnus obesus*) CPUE in the RN and RGN fishery

LIST OF ABBREVIATIONS

CBSL	Central Bank of Sri Lanka
CPUE	Catch Per Unit Effort
CRAN	Comprehensive R Archive Network
CSR	Complete Spatial Randomness
EEZ	Exclusive Economic Zone
ESRI	Environmental Systems Research Institute
FAO	Food and Agriculture Organization of the United Nation
FTD	Fishing Technology Division
GDP	Gross Domestic Production
GEBCO	General Bathymetric Chart of the Oceans
GIS	Geographical Information System
GL	Gill Net and Long Line Fishery
GN	Gill Net Fishing
GPS	Global Positioning System
IDAY	Inboard single day Boat
IMUL	Inboard Multi-day Boats
LL	Long Line Fishing
MDFB	Multi-day Fishing Boats
MTRB	Motorized Traditional Boats
NARA	National Aquatic Resource Research and Development Agency
NHO	National Hydrographic Office
NTRB	Non-Motorized Traditional Boats
OFRP	Out-boat engine Fiberglass Reinforced Plastic Boats
OSCAR	Ocean Surface Current Analysis – Real Time
RGN	Ring Net and Gill Net Fishery
RN	Ring Net Fishery
SSH	Sea Surface Height
SST	Sea Surface Temperature
WGS	World geodetic system