

CONTENTS

	Page
Contents.....	viii
List of Tables.....	xiii
List of Figures.....	xv
Chapter	
1. Introduction and Literature Review	
Introduction.....	1
Literature review.....	2
Collagen.....	2
Distribution of collagen in marine animals.....	4
Invertebrate marine animals collagen.....	6
Fish collagen.....	8
Muscle collagen.....	8
Skin collagen.....	9
Bone collagen.....	12
Factors affect collagen functional properties.....	12
Aging and living period.....	12
Processing.....	13
pH and NaCl.....	13
Gelatin.....	13
Functionality of gelatin.....	15
Protein Films.....	16
Collagen and Gelatin films.....	18
Collagen film.....	18
Gelatin films.....	18
Incorporation of antimicrobial and antioxidant in edible film.....	21
Objectives of study.....	22

CONTENTS (Continued)

	Page
2. Isolation and characterization of collagen from bigeye snapper (<i>Priacanthus macracanthus</i>) skin	
Abstract.....	23
Introduction.....	23
Materials and Methods.....	25
Results and Discussion.....	29
Isolation of ASC and PSC from bigeye snapper skin.....	29
SDS-polyacrylamide gel electrophoresis (SDS-PAGE) patterns of ASC and PSC.....	30
Amino acid composition.....	31
Peptide mapping of collagen.....	33
Effect of salt concentration on collagen solubility.....	35
Effect of pHs on collagen solubility.....	36
Thermal stability of collagen.....	37
3. Isolation and characterisation of acid and pepsin-solubilised collagen from the skin of brownstripe red snapper (<i>Lutjanus vitta</i>)	
Abstract.....	39
Introduction.....	39
Materials and Methods.....	41
Results and Discussion.....	45
Isolation of ASC and PSC from brownstripe red snapper skin.....	45
SDS-polyacrylamide gel electrophoresis (SDS-PAGE).....	46
Amino acid composition.....	48
Peptide mapping of collagen.....	49
Effect of pHs on collagen solubility.....	51
Effect of salt concentration on collagen solubility.....	53
Thermal stability of collagen.....	54
Conclusion.....	55

CONTENTS (Continued)

	Page
4. Skin gelatin from bigeye snapper and brownstripe red snapper: Chemical compositions and effect of microbial transglutaminase on gel properties	
Abstract.....	56
Introduction.....	56
Materials and Methods.....	58
Results and Discussion.....	61
Composition of fish skin gelatin.....	61
Effect of MTGase on bloom strength of skin gelatin gels.....	64
Effect of MTGase on SDS-PAGE patterns of gelatin gels.....	66
Microstructure of gelatin gels.....	68
Conclusion.....	69
5. Characterization of edible films from skin gelatin of brownstripe red snapper and bigeye snapper	
Abstract.....	70
Introduction.....	70
Materials and Methods.....	72
Results and Discussion.....	76
Effect of protein concentration on the properties of fish skin gelatin films.....	76
Mechanical properties.....	76
Water vapor permeability.....	77
Light transmission.....	78
Effect of plasticizer levels on the properties of fish skin gelatin films.....	79
Mechanical properties.....	79
Water vapor permeability.....	80
Light transmission.....	81
Film digestibility.....	82
Thermal properties.....	83
Protein patterns.....	84

CONTENTS (Continued)

	Page
Effect of proteinase inhibitors on protein degradation and the properties of fish skin gelatin film.....	85
Protein patterns.....	85
Mechanical properties.....	86
Water vapor permeability.....	87
Conclusion.....	88
6. Effect of plasticizers on the properties of edible films from skin gelatin of bigeye snapper and brownstripe red snapper	
Abstract.....	89
Introduction.....	89
Materials and Methods.....	90
Results and Discussion.....	93
Mechanical properties.....	93
Water Vapor Permeability.....	96
Light transmission.....	97
Color.....	99
Conclusion.....	100
7. Fatty acids and their sucrose esters affect the properties of fish skin gelatin based film	
Abstract.....	101
Introduction.....	101
Materials and Methods.....	103
Results and Discussion.....	106
Mechanical properties.....	106
Water Vapor Permeability.....	109
Light transmission and film transparency.....	110
Color.....	112
Conclusion.....	113

CONTENTS (Continued)

	Page
8. Antioxidative activity and properties of fish skin gelatin films incorporated with BHT and α -tocopherol	
Abstract.....	115
Introduction.....	115
Materials and Methods.....	117
Results and Discussion.....	122
FTIR spectra of fish skin gelatin film incorporated with BHT or α -tocopherol.....	122
Changes in properties of fish skin gelatin films incorporated with BHT or α -tocopherol during storage.....	124
Mechanical properties.....	124
Water Vapor permeability.....	126
Light transmission and film transparency.....	126
Color.....	128
Oxidation of lard during storage as affected by gelatin film incorporated with BHT or α -tocopherol.....	129
Changes in TBARS.....	129
Changes in peroxide values.....	131
Changes in antioxidative activity of fish skin gelatin films incorporated with BHT or α -tocopherol during storage.....	132
Conclusion.....	134
9. Summary and future works.....	135
References.....	137
Vitae.....	153

LIST OF TABLES

Table	Page
1. Types of collagen.....	3
2. Amino acid compositions of collagen from fish and invertebrates.....	5
3. Collagen content of white muscle of fishes.....	9
4. Amino acid compositions of ASC and PSC from bigeye snapper skin (residues per 1000 total amino acid residues).....	32
5. Amino acid composition of ASC and PSC from Brownstripe red snapper skin (residues per 1000 total amino acid residues).....	49
6. Proximate composition of gelatins from bigeye snapper and brownstripe red snapper skins.....	62
7. Amino acid compositions of gelatins from bigeye snapper and browstripe red snapper skin (residues per 1000 total amino acid residues).....	63
8. Mechanical properties, WVP and thickness of fish skin gelatin films as affected by protein concentration.....	77
9. Light transmission (%T) of fish skin gelatin films as affected by protein concentration.....	78
10. Mechanical properties and WVP of fish skin gelatin films as affected by glycerol concentration.....	79
11. Light transmission (%T) of fish skin gelatin films as affected by glycerol concentration.....	82
12. Transition temperature and transition enthalpy of fish skin gelatin films as affected by glycerol concentration.....	83
13. Mechanical and WVP properties of bigeye snapper skin gelatin films prepared from FFS with and without proteinase inhibitors.....	87
14. Mechanical properties and WVP of fish skin gelatin films as affected by plasticizer types and concentrations.....	94
15. Light transmission (%T) and transparency of fish skin gelatin films as affected by plasticizer types and concentrations.....	98
16. Color of fish skin gelatin films as affected by plasticizer types and concentrations.....	99

LIST OF TABLES (Continued)

Table	Page
17. Mechanical properties and WVP of fish skin gelatin films as affected by fatty acid or fatty acid sucrose ester types and concentrations.....	107
18. Light transmission (% T) and transparency of fish skin gelatin films as affected by fatty acid or fatty acid sucrose ester types and concentrations.....	111
19. Color of fish skin gelatin films as affected by fatty acid or fatty acid sucrose ester types and concentrations.....	113
20. Mechanical properties and WVP of bigeye snapper and brownstripe red snapper skin gelatin films incorporated without and with BHT or α -tocopherol during storage.....	125
21. Light transmission (%T) and transparency of bigeye snapper and brownstripe red snapper skin gelatin films incorporated without and with BHT or α -tocopherol during storage.....	128
22. Color of of bigeye snapper and brownstripe red snapper skin gelatin films incorporated without and with BHT or α -tocopherol during storage....	129

LIST OF FIGURES

Figure	Page
1. Schematic representation of the conformation of tropocollagen.....	2
2. Overlap structure of the collagen.....	3
3. Classification of fish based on its collagen content.....	6
4. Structural models of molecular species of subunit composition of Type AR-I collagens.....	7
5. Comparison, by peptide mapping, of lysyl endopeptidase digests from several fish skin collagens.....	10
6. Collagen conversion into gelatin.....	15
7. Protein patterns of ASC and PSC from bigeye snapper skin under reducing and non-reducing conditions.....	31
8. Peptide maps of ASC and PSC from bigeye snapper skin digested by V8 protease and lysyl endopeptidase.....	34
9. Solubility of ASC and PSC from bigeye snapper skin in 0.5 M acetic acid at different NaCl concentrations.....	35
10. Solubility of ASC and PSC from bigeye snapper skin in 0.5 M acetic acid at different pHs.....	36
11. Thermograms of collagen ASC (A) and PSC (B) from bigeye snapper skin rehydrated in 0.05 M acetic acid and deionized water.....	38
12. Protein pattern of ASC and PSC from Brownstripe red snapper skin under reducing and non-reducing conditions.....	47
13. Peptide maps of ASC and PSC from Brownstripe red snapper skin digested by V8 protease and lysyl endopeptidase.....	51
14. Solubility of ASC and PSC from Brownstripe red snapper skin in 0.5 M acetic acid at different pHs.....	52
15. Solubility of ASC and PSC from Brownstripe red snapper skin in 0.5 M acetic acid with different NaCl concentrations.....	53
16. Thermograms of ASC (a) and PSC (b) from Brownstripe red snapper skin rehydrated in 0.05 M acetic acid and deionised water.....	55
17. Bloom strength of gelatin gels from bigeye snapper and browstripe red snapper skins without and with MTGase added at different concentrations.....	65

LIST OF FIGURES (Continued)

Figure	Page
18. Protein pattern of gelatin gel from bigeye snapper and brownstripe red snapper skins added with MTGase at different concentrations.....	67
19. Microstructure of gelatin gels (magnification: 10,000 X).....	68
20. Protein pattern of gelatin films.....	85
21. Protein patterns of FFS of gelatin from bigeye snapper skin.....	86
22. FTIR spectra of bigeye snapper skin gelatin film (A) and brownstripe red snapper skin gelatin film (B) incorporated without and with BHT or α -tocopherol.....	123
23. TBARS of lard covered with bigeye snapper skin gelatin film (A) and brownstripe red snapper skin gelatin film (B) incorporated without and with BHT or α -tocopherol during storage.....	130
24. Peroxide values of lard covered with bigeye snapper skin gelatin film (A) and brownstripe red snapper skin gelatin film (B) incorporated without and with BHT or α -tocopherol during storage.....	132
25. DPPH radical scavenging activity of bigeye snapper skin gelatin film (A) and brownstripe red snapper skin gelatin film (B) incorporated without and with BHT or α -tocopherol during storage.....	134