

**FINAL  
ATLANTIC HERRING FISHERY MANAGEMENT PLAN**

**Incorporating the**

**ENVIRONMENTAL IMPACT STATEMENT**

**and**

**REGULATORY IMPACT REVIEW**

**(Including the Regulatory Flexibility Analysis**

Volume I



prepared by the

New England Fishery Management Council  
5 Broadway, Saugus, MA 01906-1036  
Tel (781) 231-0422 Fax (617)565-8937

in consultation with the

Atlantic States Marine Fisheries Commission  
Mid-Atlantic Fishery Management Council  
National Marine Fisheries Service

Draft EIS submitted by NEFMC: June 2, 1998  
Final document submitted by NEFMC: March 8, 1999



## 1.0 Executive Summary

The New England Fishery Management Council (Council, NEFMC) proposes management measures for the Atlantic Herring (*Clupea harengus harengus*) Fishery Management Plan (FMP). These measures are prepared under the authority of the Magnuson-Stevens Fishery Conservation and Management Act. They have been closely coordinated with the Atlantic States Marine Fishery Commission (the Commission, or ASMFC), which is developing complementary measures to manage herring within state waters, and the Mid-Atlantic Fishery Management Council (MAFMC).

The Atlantic herring management unit is defined as all Atlantic sea herring within the U.S. territorial sea and Exclusive Economic Zone (EEZ). The herring resource is in an under-exploited state. Estimates of current stock size are based on the most recent fully-reviewed assessment (NEFSC 1998a) which estimated the 1997 biomass at 2.9 million metric tons (mt) and the spawning stock biomass at 1.8 million mt. The maximum sustainable yield (MSY) for the Atlantic herring coastal stock complex is estimated as 317,000 mt (including Canadian Georges Bank and New Brunswick fixed gear harvest). There is considerable uncertainty, however, about current stock size which could be overestimated. These estimates of a large exploitable biomass have increased commercial interest in developing this fishery, but there are concerns that specific spawning components (notably the Gulf of Maine component) may be unable to sustain current or increased fishing pressure.

The maximum fishing mortality established by this FMP is  $F_{\text{Threshold}}=0.30$ . The minimum biomass level is established as 1/2 the biomass at MSY, or approximately 500,000 mt. This FMP establishes a target fishing mortality of 0.28 when total biomass is larger than biomass at MSY. When biomass is less than the biomass at MSY, the target fishing mortality will be determined based on a five year rebuilding schedule.

The primary management measures recommended include: (1) the adoption of a Total Allowable Catch (TAC) for the herring fishery and distribution of the TAC across time and area (2) closure of the directed herring fishery in an area when the TAC is reached (3) effort controls to limit catches as a TAC is approached (4) the permitting of all participating vessels, operators, dealers, and processors (5) mandatory data reporting for all licensed vessels, dealers, and processors (6) restrictions on size of vessels allowed in the fishery (8) spawning area closures (9) restrictions on joint venture processing activities, (10) adoption of an overfishing definition, and (11) designation of essential fish habitat.

The FMP will allow for the development of a sustainable fishery that targets the entire herring resource. Overfishing will be prevented through the use of effective management controls as the fishery develops. An annual scientific review of the resource will allow for adjustments to the fishery as a result of fluctuations in stock size.

## 1.1 Table of Contents

### Volume I

<b>1.0 EXECUTIVE SUMMARY .....</b>	<b>III</b>
1.1 TABLE OF CONTENTS .....	IV
1.2 LIST OF TABLES .....	XI
1.3 LIST OF FIGURES .....	XI
<b>2.0 HISTORY AND PURPOSE OF THE FMP .....</b>	<b>1</b>
2.1 HISTORY OF PRIOR MANAGEMENT ACTIONS .....	1
2.2 PURPOSE AND NEED FOR ACTION .....	9
2.3 GOALS AND OBJECTIVES .....	10
2.4 MANAGEMENT UNIT .....	11
2.5 STATUS OF THE STOCKS .....	12
2.6 OVERFISHING DEFINITION .....	12
<b>3.0 PROPOSED MANAGEMENT ACTION.....</b>	<b>21</b>
3.1 HABITAT PROTECTION AND PRESERVATION.....	21
3.2 SPECIFICATIONS.....	21
3.2.1 IWP/JVP Specifications.....	24
3.2.2 Initial Plan Specifications.....	25
3.3 GENERAL ADMINISTRATIVE PROVISIONS .....	29
3.3.1 Permits.....	29
3.3.2 Observers/Sea Samplers .....	31
3.3.3 Reporting and Record Keeping Requirements.....	32
3.3.3.1 Domestic Fishermen and Foreign Processing Vessels.....	32
3.3.3.2 Dealer Reports.....	33
3.3.3.3 Processor Reports .....	33
3.3.4 FMP Monitoring .....	33
3.3.5 Framework Adjustment Measures.....	35
3.3.6 Management Measures That Can Be Adjusted Through Framework Action .....	37
3.3.6.1 Management Area Boundaries or Additional Management Areas .....	37
3.3.6.2 Size, Timing, or Location of a New or Existing Spawning Area Closure.....	37
3.3.6.3 Closed Areas Other Than a Spawning Closure .....	38
3.3.6.4 Restrictions in the Amount of Fishing Time .....	38
3.3.6.5 Days at Sea System.....	38
3.3.6.6 Adjustments to Specifications .....	38
3.3.6.7 Adjustments to the Amount of Canadian Catch Deducted When Determining Specifications .....	38
3.3.6.8 Distribution of the TAC.....	39
3.3.6.9 Gear Restrictions .....	39
3.3.6.10 Vessel Size/Horsepower Restrictions .....	39
3.3.6.11 Closed Seasons.....	39
3.3.6.12 Minimum Fish Size .....	40
3.3.6.13 Trip Limits .....	40
3.3.6.14 Seasonal, Area, or Industry Sector Quotas.....	40
3.3.6.15 Measures to Protect Essential Fish Habitat .....	40
3.3.6.16 Measures to Facilitate Aquaculture.....	41
3.3.6.17 Changes to the Overfishing Definitions.....	41
3.3.6.18 Vessel Monitoring System (VMS) .....	41
3.3.6.19 Use Restrictions .....	42
3.3.6.20 Quota Monitoring Tools.....	42

Table of Contents (cont.)

3.3.6.21	Permit and Vessel Upgrading Restrictions .....	42
3.3.6.22	Implementation of Measures to Reduce Gear Conflicts.....	42
3.3.6.23	Limited Entry or Controlled Access System .....	43
3.3.6.24	Other Management Measures Currently Included in the FMP .....	44
3.4	MANAGEMENT AREAS.....	44
3.5	SPAWNING AREA CLOSURES .....	46
3.5.1	Management Area 1 .....	46
3.5.2	Management Areas 2 and 3 .....	49
3.6	CATCH CONTROLS .....	49
3.6.1	Total Allowable Catch (TAC).....	49
3.6.2	TAC Limitation.....	50
3.6.3	TAC Distribution .....	50
3.6.3.1	Initial TAC Distribution.....	53
3.6.4	Effort Control – Mandatory Days Out of the Fishery.....	54
3.6.5	Transfers at Sea.....	55
3.6.6	Vessel Size Limits .....	56
3.7	ROE FISHERY .....	56
3.8	MEASURES TO REDUCE/MONITOR BYCATCH .....	57
3.9	JOINT VENTURE RESTRICTIONS .....	59
3.9.1	Permits.....	59
3.9.2	Management Area Restrictions.....	59
3.9.3	Observer and Data Reporting Requirements .....	59
3.9.4	Other Limitations, Conditions, or Requirements.....	59
3.10	VESSEL MONITORING SYSTEM (VMS).....	60
3.11	RECREATIONAL FISHERY .....	60
3.12	ASMFC MANAGEMENT MEASURES.....	60
3.12.1	Spawning Area Restrictions.....	61
3.12.2	Permits.....	61
3.12.3	Directed Mealing.....	61
3.12.4	Fixed Gear Fishery .....	61
3.12.5	Vessel Size Limits.....	61
3.12.6	Internal Waters Processing (IWP) Restrictions .....	61
3.13	MANAGEMENT AND RESEARCH NEEDS .....	62
<b>4.0</b>	<b>DESCRIPTION OF THE FISHERY.....</b>	<b>63</b>
4.1	DESCRIPTION OF THE RESOURCE.....	63
4.2	DESCRIPTION OF THE HABITAT .....	63
4.3	DESCRIPTION OF THE FISHERY .....	63
4.4	SOCIAL/CULTURAL FRAMEWORK.....	63
4.5	EXISTING MANAGEMENT FRAMEWORK .....	63
4.5.1	Applicable Federal Laws and Regulations.....	63
4.5.2	Other Applicable Laws .....	63
4.5.3	Other Fishery Management Plans .....	64
4.5.4	Management Institutions .....	65
4.5.5	Treaties or International Agreements.....	66
4.5.6	Federal laws, Regulations, and Policies .....	66
4.5.7	State Laws, Regulations, and Policies .....	66
4.5.8	Local and Other Applicable Laws, Regulations, and Policies .....	68

Table of Contents (cont.)

<b>5.0 COMPLIANCE WITH NATIONAL STANDARDS .....</b>	<b>69</b>
5.1 NATIONAL STANDARD 1 – OPTIMUM YIELD .....	69
5.2 NATIONAL STANDARD 2 – SCIENTIFIC INFORMATION .....	69
5.3 NATIONAL STANDARD 3 – MANAGEMENT UNITS.....	70
5.4 NATIONAL STANDARD 4 – ALLOCATIONS .....	71
5.5 NATIONAL STANDARD 5 – EFFICIENCY .....	73
5.6 NATIONAL STANDARD 6 – VARIATIONS AND CONTINGENCIES.....	74
5.7 NATIONAL STANDARD 7 – COSTS AND BENEFITS.....	75
5.8 NATIONAL STANDARD 8 – COMMUNITIES .....	75
5.9 NATIONAL STANDARD 9 – BYCATCH .....	77
5.10 NATIONAL STANDARD 10 – SAFETY OF LIFE AT SEA.....	77
<b>6.0 FISHERY IMPACT STATEMENT .....</b>	<b>79</b>
6.1 PERMIT STATUS .....	79
6.2 AMERICAN LOBSTER FISHERY .....	82
6.3 NORTHEAST MULTISPECIES FISHERY .....	82
6.4 SEA SCALLOP FISHERY .....	83
6.5 SQUID, MACKEREL, BUTTERFISH FISHERY .....	83
6.6 WHITING.....	84
6.7 MONKFISH.....	85
6.8 SPINY DOGFISH.....	85
6.9 CONCLUSIONS .....	86
<b>7.0 RELATIONSHIP WITH OTHER APPLICABLE LAWS.....</b>	<b>90</b>
7.1 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) .....	90
E.1.0 ENVIRONMENTAL IMPACT STATEMENT COVER SHEET .....	92
E.2.0 TABLE OF CONTENTS .....	92
E.3.0 SUMMARY .....	92
E.3.1 Background.....	92
E.3.2 Major Conclusions .....	93
E.3.3 Areas of Controversy .....	93
E.3.4 Issues to be Resolved .....	94
E.4.0 PURPOSE AND NEED FOR ACTION.....	95
E.5.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION .....	95
E.5.1 Description of the Proposed Action.....	95
E.5.2 Alternatives to the Proposed Action.....	95
E.5.2.1 No Action Alternative (status quo).....	95
E.5.2.2 Limited Entry/Controlled Access .....	96
E.5.2.2.1 Discussion.....	96
E.5.2.2.2 Gulf of Maine Controlled Access Area Options.....	97
E.5.2.2.3 Limits on Catches and Effort.....	98
E.5.2.2.3.1 Options for Qualifying for Participation in Area 1 or 1A .....	98
E.5.2.2.4 Options for Qualifying Outside Area 1 or 1A .....	100
E.5.2.2.5 Transferability: Conservation Permits and Associated DAS.....	101
E.5.2.2.6 Fishery Development Permits .....	101
E.5.2.2.7 Other Guidance in Permit Structure .....	103
E.5.2.3 Alternatives Outside the Council's Authority.....	103

## Table of Contents (cont.)

E.6.0	AFFECTED ENVIRONMENT .....	103
E.6.1	Data Considerations .....	103
E.6.1.1	Stock Assessment Workshops .....	104
E.6.1.2	NRC Review of Northeast Fishery Stock Assessments .....	106
E.6.1.3	NMFS Strategic Plan for Research.....	107
E.6.1.4	Atlantic Coastal Cooperative Statistics Program.....	107
E.6.1.5	Transboundary Resources Assessment Committee.....	108
E.6.1.6	Herring Fishery Data Limitations.....	110
E.6.2	Physical Environment.....	111
E.6.2.1	Gulf of Maine.....	112
E.6.2.2	Georges Bank.....	113
E.6.2.3	Middle Atlantic Region (Cape Cod to Cape Hatteras) .....	113
E.6.3	Biological Environment.....	114
E.6.3.1	Species Life History.....	114
E.6.3.1.1	General .....	114
E.6.3.1.2	Age and Growth .....	115
E.6.3.1.3	Spawning/Reproduction/Early Life History .....	116
E.6.3.1.4	Distribution .....	119
E.6.3.1.5	Foods/Feeding .....	121
E.6.3.1.6	Predator/Prey Relationships.....	121
E.6.3.1.7	Parasites/Disease.....	124
E.6.3.1.8	Stock Structure and Migration .....	125
E.6.3.1.9	Abundance and Present Condition.....	126
E.6.3.2	Other Stocks.....	134
E.6.3.3	Endangered Species and Marine Mammals .....	138
E.6.3.3.1	Endangered and Protected Species .....	138
E.6.3.3.2	Other Biota.....	139
E.6.3.4	Stellwagen Bank Marine Sanctuary.....	140
E.6.4	Human environment.....	140
E.6.4.1	History of exploitation .....	140
E.6.4.2	The Commercial and Recreational Herring Fishery .....	143
E.6.4.2.1	The Recreational Herring Fishery .....	143
E.6.4.2.2	The Commercial Herring Fisheries .....	144
E.6.4.2.2.1	Directed Fishery.....	144
E.6.4.2.3	Vessels and Domestic Harvesting Capacity .....	163
E.6.4.2.4	Ports.....	172
E.6.4.2.5	Other fisheries.....	174
E.6.4.2.6	Bycatch .....	177
E.6.4.3	Herring Processing Sector.....	182
E.6.4.3.1	Domestic Processors .....	182
E.6.4.3.1.1	Estimate of DAP .....	190
E.6.4.3.2	Internal Waters Processing (IWP) .....	191
E.6.4.3.3	International Trade .....	194
E.6.4.3.3.1	Two-Way Trade in Round Herring with Canada .....	195
E.6.4.3.3.2	International Markets for Various Product Types .....	199
E.6.4.4	Social and Cultural Aspects .....	214
E.6.5	Impacts of Human Activity (Fishing) on the Environment.....	217
E.6.5.1	Impacts of Human Activity Other Than Fishing on the Environment.....	217
E.7.0	ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION .....	217
E.7.1	Summary of Consequences .....	217
E.7.2	Biological Impacts of the Alternatives .....	218
E.7.2.1	Overfishing Definition.....	218
E.7.2.2	Specifications .....	219
E.7.2.3	Management Areas.....	221

## Table of Contents (cont.)

E.7.2.4	Spawning Area Closures.....	222
E.7.2.5	Catch Controls.....	229
E.7.2.5.1	Total Allowable Catch.....	229
E.7.2.5.2	TAC Distribution.....	235
E.7.2.5.2.1	Initial TAC Distribution .....	236
E.7.2.5.3	Mandatory Days Out of the Fishery.....	237
E.7.2.5.4	Vessel Size Limits.....	238
E.7.2.6	Use Restrictions .....	240
E.7.2.6.1	Other Roe Fishery Alternatives.....	241
E.7.2.7	General Administrative Provisions.....	241
E.7.2.8	Vessel Monitoring System (VMS).....	242
E.7.2.9	Measures to Reduce/Monitor Bycatch.....	242
E.7.2.10	Biological Impacts of Alternatives Not Selected.....	243
E.7.2.10.1	No Action.....	243
E.7.2.10.2	Controlled Access.....	244
E.7.2.10.3	Other Management Alternatives .....	244
E.7.2.11	Impacts of the Proposed Action on Protected Species .....	245
E.7.2.11.1	Impacts of the Management Measures.....	245
E.7.2.11.1.1	Background on Recent Management Actions Affecting Protected Species .....	245
E.7.2.11.1.2	Specifications.....	246
E.7.2.11.1.3	General Administrative Provisions .....	247
E.7.2.11.1.4	Management Areas.....	248
E.7.2.11.1.5	Spawning Closures.....	248
E.7.2.11.1.6	TACs and Effort Controls.....	249
E.7.2.11.1.7	Transfers at Sea .....	249
E.7.2.11.1.8	Vessel Size Limits.....	250
E.7.2.11.1.9	Roe Fishery.....	250
E.7.2.11.1.10	Measures to Reduce and Monitor Bycatch and VMS .....	250
E.7.2.11.1.11	Joint Venture Restrictions .....	250
E.7.2.11.1.12	Impacts of the Alternatives, Including No Action.....	251
E.7.2.11.2	Impacts of the Herring Fishery.....	251
E.7.2.11.3	Ecological Relationships.....	253
E.7.2.11.4	Sea Turtles .....	254
E.7.2.11.5	Shortnose Sturgeon.....	254
E.7.2.11.6	Seabirds .....	254
E.7.2.11.7	Right Whale Critical Habitat Designation .....	254
E.7.2.12	Impacts on Habitat and Other Biota .....	255
E.7.2.13	Impacts on Stellwagen Bank National Marine Sanctuary.....	255
E.7.3	Economic Impacts of the Alternatives.....	255
E.7.3.1	Specifications.....	256
E.7.3.2	Management Areas.....	256
E.7.3.3	Spawning Area Closures.....	257
E.7.3.3.1	Other Spawning Area Closure Alternatives .....	260
E.7.3.4	Catch Controls.....	261
E.7.3.4.1	TAC Distribution.....	262
E.7.3.4.2	Mandatory Days Out of the Fishery.....	263
E.7.3.4.3	Overall Impact of Catch Controls .....	265
E.7.3.4.4	Vessel Size Limits.....	270
E.7.3.5	Roe Fishery .....	273
E.7.3.6	Joint Venture/Internal Waters Processing Restrictions.....	273
E.7.3.7	Vessel Monitoring Systems.....	274
E.7.3.7.1	Vessel Costs.....	274
E.7.3.7.2	NMFS Costs.....	276
E.7.3.8	General Administrative Measures.....	280
E.7.3.9	Other Costs .....	280



E.7.3.9.1	Costs to Processors .....	280
<b>Table of Contents (cont.)</b>		
E.7.3.10	Enforcement Costs.....	280
E.7.3.11	Alternatives Not Selected .....	282
E.7.3.11.1	No Action .....	282
E.7.3.11.2	Limited Entry/Controlled Access .....	282
E.7.3.11.2.1	Controlled Access Qualification Criteria.....	283
E.7.4	Social Impacts of the Alternatives.....	286
E.7.4.1	Spawning Area Closures.....	287
E.7.4.2	Catch Controls.....	287
E.7.4.2.1	Total Allowable Catch .....	287
E.7.4.2.2	Vessel Size Limits.....	289
E.7.4.2.2.1	Harvesting.....	289
E.7.4.2.2.2	Processing.....	289
E.7.4.3	Roe Fishery .....	290
E.7.4.4	Safety Considerations .....	291
E.7.4.5	Alternatives Not Selected .....	300
E.7.4.5.1	No Action (status quo).....	300
E.7.4.5.2	Controlled Access.....	300
E.7.4.5.3	Miscellaneous Management Alternatives .....	301
E.7.5	Cumulative Impacts of the Proposed Action.....	301
E.7.5.1	Canadian Herring Fisheries .....	301
E.7.5.2	ASMFC Amendment One to the Atlantic Herring FMP.....	303
E.7.5.3	Other Northeast Region Fisheries .....	303
E.8.0	RATIONALE FOR THE PROPOSED ALTERNATIVE.....	304
E.9.0	LIST OF PREPARERS.....	306
E.10.0	EIS CIRCULATION LIST .....	306
E.11.0	PUBLIC COMMENTS.....	307
7.2	REGULATORY IMPACT REVIEW .....	308
7.2.1	Introduction.....	308
7.2.2	Problem Statement .....	308
7.2.3	Management Objectives.....	308
7.2.4	Management Alternatives.....	308
7.2.5	Analysis of Management Alternatives .....	308
7.2.6	Summary of Regulatory Impacts.....	309
7.2.7	Determination of Significant Regulatory Action .....	311
7.3	INITIAL REGULATORY FLEXIBILITY ANALYSIS.....	312
7.3.1	Introduction.....	312
7.3.2	Problem Statement .....	312
7.3.3	Objectives.....	312
7.3.4	Determination of Significant Economic Impact .....	312
7.3.4.1	Impacts on Vessel Gross Revenues .....	315
7.3.5	Indirectly Affected Industries.....	320
7.3.6	Compliance Costs.....	321
7.3.7	Mitigating Factors.....	321
7.3.8	Identification of Overlapping Regulations.....	323
7.3.9	Conclusion .....	323
7.4	ENDANGERED SPECIES ACT (ESA) .....	323
7.5	MARINE MAMMAL PROTECTION ACT (MMPA).....	323
7.6	COASTAL ZONE MANAGEMENT ACT (CZMA).....	323
7.6.1	States Contacted and Council Determination of Consistency with State Programs .....	323
7.6.1.1	State contacts.....	324
7.6.2	CZMA Letters .....	325

7.6.3 State Concurrences .....	325
Table of Contents (cont.)	
7.7 PAPERWORK REDUCTION ACT (PRA).....	352
<b>8.0 REFERENCES.....</b>	<b>354</b>
8.1 PUBLIC MEETINGS/SUMMARY OF PROCEEDINGS .....	354
8.2 BIBLIOGRAPHY .....	358
8.3 GLOSSARY.....	372
<b>9.0 DRAFT REGULATORY TEXT .....</b>	<b>376</b>

**Volume II**

- APPENDIX I - A Social Impact Assessment of the New England Herring Fishery (Dyer and Poggie 1998)
- APPENDIX II – NEFSC summary of bycatch information in the herring fishery
- APPENDIX III – Using Observers to Monitor Status of Atlantic Herring Spawning Stocks and Groundfish Bycatch in the Gulf of Maine (Stevenson and Scully 1999)
- APPENDIX IV – Essential Fish Habitat Source Document - Atlantic Herring
- APPENDIX V – Draft Regulatory Text
- APPENDIX VI – Paperwork Reduction Act Supporting Statements

**Volume III**

- APPENDIX VII – Public Hearing Comments (responses to comments are in Section 8 of Volume I)
- APPENDIX VIII – Written Comments (responses to comments are in Section 8 of Volume I)

## 1.2 List of Tables

Table 1 - Summary of overfishing reference points for Atlantic herring.....	16
Table 2 – Estimates of $B_{MSY}$ , $F_{MSY}$ , $K$ and $r$ for the Atlantic herring coastal stock complex derived from VPA estimates of biomass ( $10^3$ mt) and surplus production model estimates of biomass relative to $B_{MSY}$ for the years 1973 – 1990. ....	17
Table 3- Initial recommended Atlantic herring specifications.....	26
Table 4 - Distribution of spawning components by season.....	52
Table 5 – Initial TAC distribution.....	54
Table 6 – Northeast Region fishing permits held by vessels that targeted herring during 1996 – 1997...	81
Table E.7 – Projections for the coastal stock complex of Atlantic herring (landings and SSB estimates in thousands of metric tons) .....	129
Table E.8 – Important species landed or raised in the northeast.....	135
Table E.9 - Total Gulf of Maine (GOM), Southern New England (SNE), Middle Atlantic (MAT) and New Brunswick, Canada (NB) herring catch, 1960-1996 (metric tons).....	152
Table E.10 - U. S. commercial herring landings and value.....	153
Table E.11- Herring landings by distance offshore .....	153
Table E.12 - Domestic herring landings by state.....	154
Table E.13 - Landings by major gear type (metric tons), 1986-1997.....	155
Table E.14 – Summary of 1997 landings.....	157
Table E.15- Annual landings distribution (percent each month), Management Area 1.....	158
Table E.16 - Annual landings distribution (percent each month), Management Area 2.....	159
Table E.17 - Overview of vessels that landed herring, 1996.....	163
Table E.18 - Dependency on herring revenue by gear type, dependence class 1 (75 to 100 percent of revenue), 1997 .....	166
Table E.19 - Dependency on herring revenue by gear type, dependence class 2 (50 to 75 percent of revenue), 1997 .....	167
Table E.20 - Dependency on herring revenue by gear type, dependence class 3 (25 to 50 percent of revenue), 1997 .....	167
Table E. 21 - Dependency on herring revenue by gear type, dependence class 4 (0-25 percent of revenue), 1997.....	168
Table E.22 - Annualized catch of additional northeast vessels .....	169
Table E.23 - Herring landings by major port, 1995 - 1997.....	173
Table E.24 - Herring landings as a percent of total landings and as a percent of total value of all landings in a port, 1995-1997.....	174
Table E.25 - Herring bycatch ratios in the shrimp fishery.....	175
Table E.26. - Summary of trips landing herring and mackerel, 1996.....	176
Table E.27 - Summary of trips landing herring and mackerel, 1997.....	176
Table E.28 - Catch of other species for mid-water trawl gear targeting herring in 1995 (pounds) .....	179
Table E.29 - Bycatch species (pounds) observed during observer trips funded by Maine DMR, 1997...	180
Table E.30 - Observed herring catches (pounds), retained and discarded, on trips with herring discards, 1997 – 1998.....	181
Table E.31 – Maine canned herring products and packing plants .....	186
Table E.32 – Atlantic herring exports to Canada .....	189
Table E.33 – Herring used by Maine sardine canneries.....	189
Table E.34 – Summary of recent herring processing estimates.....	190
Table E.35 - Internal waters and joint venture processing allocations (mt) by state and fishing year, 1989 - 1996.....	193
Table E.36 - Internal Waters Processing (IWP) landings (mt) by state, 1985-1996 .....	193
Table E.37 - World nominal catches of herring, 1986-1996.....	201
Table E.38 - Top 10 non-USA herring importing countries (from all sources), 1996, based on value...	202
Table E.39 – U.S. herring imports, by product 1980-1988.....	203

List of Tables (cont.)

Table E.40 - U. S. herring imports, by product, 1989-1997.....	204
Table E.41 - U. S. herring imports, top 10 countries by value.....	205
Table E.42 - U. S. herring exports, by product, 1981-1988.....	206
Table E.43 - U. S. herring export products, 1989-1997.....	207
Table E.44 - U. S. herring exports, top 10 countries, by value.....	208
Table E.45 - U.S. Exports of herring by product form and country for 1996 and 1997.....	209
Table E.46 - Imports of Herring to Northeast U.S. Customs Districts and the Entire U.S. from Canada.....	211
Table E.47 - Northeast U.S. Atlantic herring exports to Canada.....	212
Table E.48 - Canned sardine exports, 1986-1997.....	213
Table E.49 - U. S. Imports of canned sardines, 1986-1997.....	213
Table E.50 - Selected demographic characteristics of Maine communities with sardine canneries.....	215
Table E.51 - Estimated herring catch from bottom trawls, gear code 50.....	233
Table E.52 - Estimated herring catch from sink gillnets, gear code 100.....	233
Table E.53 - Estimated herring catches in the northern shrimp fishery 1989-1996.....	234
Table E.54 - 1996/1997 Reported landings of "incidental catch" herring, Management Area 1.....	234
Table E.55 - Initial TAC distribution.....	236
Table E.56 - Catches in Maine Spawning Closure Areas 1A, 1B, 1C (metric tons).....	257
Table E.57 - 1997 landings from areas of the proposed spawning closures.....	259
Table E.58 - Potential changes in revenue under various TAC options, Management Area 1A.....	263
Table E.59 - Estimated fleet VMS costs based on Boatracs system.....	276
Table E.60 - VMS costs to the government.....	279
Table E.61 - Description of vessels qualifying under option 1 by principal herring gear.....	284
Table E.62 - Description of vessels qualifying under option 2 by principal herring gear.....	284
Table E.63 - Non-qualifying vessel characteristics by ton class, option 2.....	285
Table E.64 - Additional qualifying vessel characteristics by ton class, option 3.....	285
Table E.65 - Qualifying vessel characteristics, by ton class, option 4.....	286
Table 66 - The number of vessels and their activity by database (1997).....	317
Table 67 - 1997 herring vessel revenues.....	318
Table 68 - The numbers and the activity of vessels with directed herring fishing by annual herring revenue.....	319
Table 69 - Impacts of the Management Area 1A TAC on the revenues of herring vessels.....	320
Table 70 - Summary of response burden and costs for requirements subject to the PRA.....	353

### 1.3 List of Figures

Figure 1 – Recommended herring overfishing definition reference points.....	18
Figure 2 – Rebuilding trajectories for Atlantic herring .....	19
Figure 3 – Overfishing threshold and target fishing mortality.....	20
Figure 4 - Herring management areas .....	46
Figure 5 - Herring Management Area 1 spawning closures.....	48
Figure E.6 - Map of the northeastern U.S. and eastern Canada showing distribution and spawning locations of major Atlantic herring stocks .....	119
Figure E.7 - U. S. Atlantic herring coastal stock complex biomass .....	130
Figure E.8 – NMFS spring (above) and fall (below) bottom trawl surveys.....	131
Figure E.9 - NMFS spring bottom trawl survey .....	132
Figure E.10 - NMFS larval herring abundance indices .....	133
Figure E.11 - Herring landings by major gear type, 1984 – 1997 .....	156
Figure E.12 – 1997 (Jan-Apr) Atlantic herring catch by statistical area .....	160
Figure E.13 – 1997 (May-Aug) Atlantic herring catch by statistical area.....	161
Figure E.14 – 1997 (Sep-Dec) Atlantic herring catch by statistical area.....	162
Figure E.15- Potential harvest of vessels that landed herring in 1996 .....	171
Figure E.16 – Comparison of New England lobster and herring landings, 1994-1997 .....	188
Figure E.17 - Biomass predictions based on different annual harvests .....	221
Figure E.18 – Essential fish habitat designations for Atlantic herring eggs.....	226
Figure E.19 – Essential fish habitat designations for Atlantic herring larvae .....	226
Figure E.20 – Distribution of ICNAF gonadal stage 5 herring from commercial catch samples .....	227
Figure E.21 – Distribution of ICNAF gonadal stage 6 herring from commercial catch samples .....	228
Figure E.22 - Management measures modeled on 1996 catch .....	268
Figure E.23 - Management measures modeled on 1997 catch .....	269
Figure E.24 - Air temperatures off Portland, MA .....	296
Figure E.25 - Wind speeds off Portland, ME .....	296
Figure E.26 - Wave heights off Portland, ME.....	297
Figure E.27 – Air temperatures off Buzzard's Bay, MA .....	297
Figure E.28 – Wind speeds off Buzzard's Bay.....	298
Figure E.29 – Wave heights off Buzzard's Bay .....	298
Figure E.30 – Average wind speeds on Georges Bank .....	299
Figure E.31 – Wave heights on Georges Bank.....	299

