Atlantic States Marine Fisheries Commission

DRAFT ADDENDUM XXV TO AMENDMENT 3 TO THE AMERICAN LOBSTER FISHERY MANAGEMENT PLAN

RESPONSE TO SOUTHERN NEW ENGLAND STOCK DECLINE

January 2017

This draft document was approved by the American Lobster Management Board to solicit public comment on the issues contained in the document.

Vision: Sustainably Managing Atlantic Coastal Fisheries

Public Comment Process and Proposed Timeline

In May 2016, the American Lobster Management Board (Board) initiated Draft Addendum XXV to address continued stock declines in Southern New England. In August 2016, the Board identified a management goal for the Southern New England stock as well as management targets for development in this addendum. This Draft Addendum presents background on the Atlantic States Marine Fisheries Commission's management of lobster, the addendum process, a statement of the problem, and management measures for public consideration and comment.

The public is encouraged to submit comments regarding the proposed management options in this document at any time during the addendum process. The final date comments will be accepted is **April 7, 2017 at 5:00 p.m**. **EST.** Comments may be submitted by mail, email, or fax. If you have any questions or would like to submit comments, please use the contact information below.

Mail: Megan Ware
Atlantic States Marine Fisheries Commission
1050 N. Highland St. Suite 200A-N
Arlington, VA 22201
Fax: (703) 842-0741

Email: mware@asmfc.org
(Subject line: Lobster Draft Addendum XXV)

August– October 2016	Draft Addendum for Public Comment Developed
October 2016 – February 2017	Preliminary Industry Comment and Subcommittee Review
February 2017	Board Reviews Draft and Makes Any Necessary Changes
February – April 7, 2017	Public Comment Period, LCMTs prepare preliminary proposals
May 2017	Board Review, Selection of Management Measures
Late May/Early June 2017	LCMTs Submit Proposals to Meet Target Increase in Egg Production
August 2017	Board Reviews and Approves LCMT Proposals, Final Approval of Addendum XXV
2018	Implementation of Addendum XXV

Executive Summary

The Southern New England (SNE) lobster stock is at record low abundance and is experiencing recruitment failure. This poor stock condition is the result of environmental factors, such as warming waters, and continued fishing mortality. As an initial management response, the American Lobster Management Board initiated this Draft Addendum to consider increasing egg production in SNE by 20% to 60%. This addendum focuses on increases in egg production so that, if environmental conditions become favorable, the SNE stock can benefit from a strong recruitment year.

To respond to the Board's objective to increase egg production, the Plan Development Team (PDT) evaluated multiple management tools, including: gauge size changes, trap reductions, season closures, trip limits, v-notching, and culls. In their evaluation of these various management tools, the PDT analyzed not only the ability to achieve the specified management targets but also the ability to effectively monitor, administer, and enforce selected management tools. These management tools, if implemented, may have negative economic consequences on the SNE lobster industry.

This Draft Addendum includes seven issues. The first proposes five targets by which to increase egg production, ranging from 0% to 60%. The second issue asks whether the management tools considered for use in the document can be used independently or in conjunction with one another. The third issue addresses the effects of this addendum on the recreational fishery. The fourth issue explores the implementation of season closures and potential impacts to the Jonah crab fishery. The fifth issue examines whether management measures in SNE should be uniform across LCMAs. The sixth issue asks where in LCMA 3 the management measures in this document should apply. The seventh issue asks whether *de minimis* states should be exempt from management action taken as a result of this Draft Addendum.

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1.0 Introduction

The Atlantic States Marine Fisheries Commission (ASMFC) has coordinated the interstate management of American lobster (*Homarus americanus)* from 0-3 miles offshore since 1996. American lobster is currently managed under Amendment 3 and Addenda I-XXIV to the Fishery Management Plan (FMP). Management authority in the Exclusive Economic Zone (EEZ) from 3-200 miles from shore lies with NOAA Fisheries. The management unit includes all coastal migratory stocks between Maine and Virginia. Within the management unit there are two lobster stocks and seven management areas. The SNE stock (subject of this Draft Addendum) includes all, or part of, five of the seven Lobster Conservation Management Areas (LCMAs) (Appendix 1). There are eight states (Massachusetts to Virginia) which regulate American lobster in state waters of the SNE stock, as well as regulate the landings of lobster in state ports.

The Board initiated Draft Addendum XXV to respond to continued stock declines in SNE. The 2015 Benchmark Stock Assessment found abundance, spawning stock biomass (SSB), and recruitment are all at historic low levels in SNE. The stock was deemed depleted as the current reference abundance of 10 million lobsters is well below the management threshold of 24 million lobsters. As a result, the Board directed the PDT to draft an addendum to address the poor condition of the SNE stock by increasing egg production and decreasing fishing mortality.

The principal challenge facing the SNE stock is the increase in natural mortality, primarily due to climate change and predation. Specifically, the 2015 Stock Assessment showed a pronounced warming trend in coastal waters, particularly in New England and Long Island Sound. These warming waters have negatively impacted the stock as they have resulted in reduced spawning and recruitment. Predation from species such as black sea bass has further depleted the stock. Together, these challenges highlight the vital role the environment plays in the health of the American lobster population. Importantly, fishing pressure, while at an all-time low level, continues to be a significant source of mortality and a measurable factor contributing to the overall decline of the SNE stock.

Given these challenges, the Board identified the following goal for this Draft Addendum.

> *"Recognizing the impact of climate change on the stock, the goal of Addendum XXV is to respond to the decline of the SNE stock and its decline in recruitment while preserving a functional portion of the lobster fishery in this area."*

To achieve this goal, the Board tasked the Technical Committee (TC) and the PDT to analyze management tools that would result in increased egg production in the SNE stock. The Board identified four alternative egg production targets for analysis: increasing egg production by 20%; 30%; 40%; and 60%. A 0% increase was also analyzed to provide a baseline, no-action context to assist in decision-making. The Board is pursuing increases in egg production so that, if environmental conditions become favorable in SNE, there will be enough eggs in the water to produce a successful and impactful recruitment event. Given uncertainties surrounding future climate conditions and their impact on the stock, most notably on recruitment, it is unclear whether the SNE stock can be rebuilt to the current reference levels if unfavorable environmental conditions continue.

This Draft Addendum is intended to be an initial response to the most recent stock assessment. The 2015 Stock Assessment clearly stated climate change is impacting the SNE fishery in a profoundly negative way. While the Board recognizes serious and impactful management actions are needed to preserve the SNE stock, it also recognizes questions surrounding the full impacts of climate change still remain. As a result, the Board agreed to take quick and decisive action while preserving a functional portion of the fishery. It is important to note that a functional fishery may not mean the continuation of its current state and size. The Board will continue to monitor the stock and fishery in order to determine the next appropriate course of action. All management tools remain available for future consideration.

2.0. Overview

2.1 Statement of the Problem

The 2015 Benchmark Stock Assessment found the SNE stock to be depleted, with record low abundance and recruitment failure. This poor stock condition can be attributed to many factors including changing environmental conditions and continued fishing mortality. In response, the Board initiated Draft Addendum XXV with the goal of preserving a functional portion of the SNE lobster fishery while addressing the poor stock condition. The measures in this addendum are intended to increase egg production so that, if environmental factors improve, the stock can benefit from a successful recruitment event. This addendum is an initial response to the most recent stock assessment and may be followed by other management measures.

2.2 Resource Issues

Results of the 2015 Benchmark Stock Assessment concluded the SNE stock is depleted and experiencing continued declines (Table 1). The assessment highlighted that abundance, SSB, and recruitment are all at historic low levels for the model time-series (1982-2013). Stock indicators independent of the assessment model corroborate these findings as spawning stock abundance, a measure of the reproductively mature portion of the population, is below the 25th percentile in six of the eight surveys from 2008-2013 (Appendix 2). Furthermore, the distribution of lobsters inshore has contracted as the survey encounter rate is negative in all six inshore indices over the 2008-2013 time period. In contrast to the poor condition of the SNE stock, the assessment concluded that the Gulf of Maine/Georges Bank (GOM/GBK) stock is at record high abundance, with a dramatic increase in abundance since the late 1980's. This dichotomy suggests environmental conditions are changing along the coast and these changes are impacting the condition of the stock.

Table 1. Current (2011-2013) reference estimates for each stock as well as the target and threshold levels for abundance and effective exploitation. The reference abundance is used to determine a depleted status while effective exploitation is used to determine an overfishing status.

		GOM/GBK	SNE
Abundance (millions)	2011-2013 Reference	248	10
	Threshold	66	24
	Target	107	32
Effective Exploitation	2011-2013 Reference	0.48	0.27
	Threshold	0.50	0.41
	Target	0.46	0.37

One of the largest indicators of poor stock condition in SNE has been the marked decline in recruitment, or the number of lobsters surviving to enter the fishery. Indices suggest the stock is in recruitment failure as, since 2011, all larval indices have been below the 25th percentile. Figure 1 depicts larval indices from Long Island Sound from 1983 to 2015, which show a significant decline in the density of larvae since the 1990s. Model-free indicators show similar trends as all four young-of-year indices, which measure the abundance of age 0 lobsters, are below the median (Appendix 2). In 2015, the SNE young-of-year index in Massachusetts was zero (Appendix 2). This is concerning as it means the number of young lobsters which have yet to recruit into the fishery is low and the stock may experience further declines.

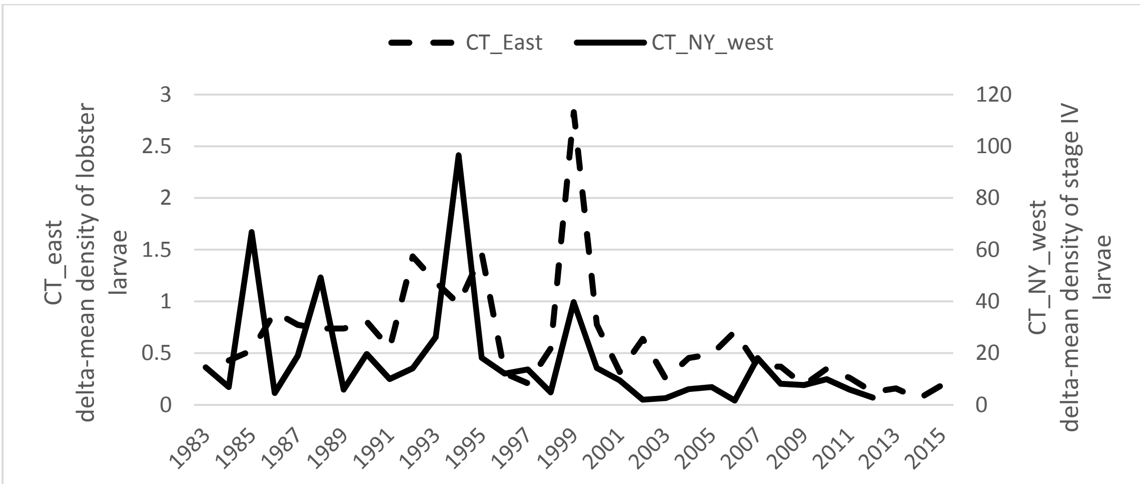

Figure 1: Annual density (delta mean per 1000 m^3) of lobster larvae (all stages) in MPS entrainment samples during their season of occurrence (CT-East) and stage IV larvae captured in surface plankton nets at 8 stations in western Long Island Sound. Source: CT DEEP and Dominion Nuclear Power Station.

Furthermore, analysis by the TC shows SSB and recruitment may be decoupled, meaning there seems to be a lack of cause-effect relationship between SSB and recruitment. Figure 2 shows the relationship between SSB and recruitment from 1979 to 2011. Overall, the plot indicates a positive relationship such that there are more lobsters entering the fishery when the reproductive portion of the population is larger; however, over the last decade, this relationship has decoupled, with recruitment declining and SSB remaining steady. This suggests that recruitment may drop to very low levels well before SSB reaches zero. Low recruitment levels may be the result of reduced mating success, environmentally-mediated changes in survivorship, and/or increased predation. Figure 2 also shows the wide range of recruitment which can be produced from a single level of SSB, even when stock abundance was high in the early 1990s. This is important to note as management action seeking to increase SSB and egg production can result in a wide range of recruitment levels.

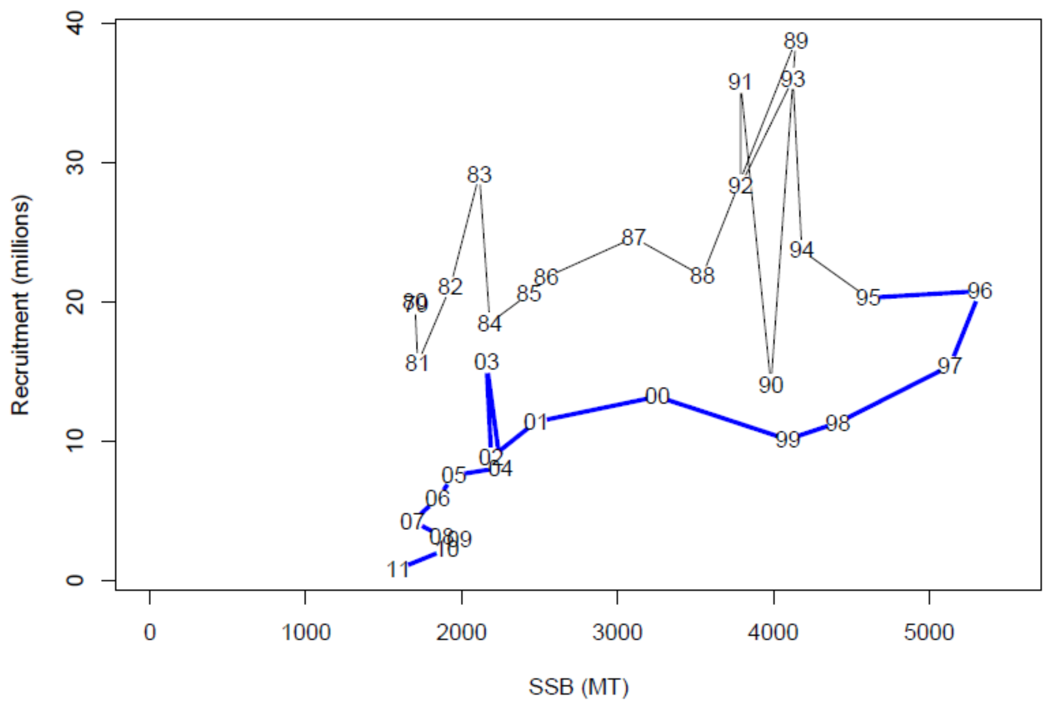

Figure 2: The relationship between model-based spawning stock biomass and recruits from 1979 to 2011. The blue line denotes the trajectory from 1995 – 2011 (recruiting to the model from 1998 to 2014).

There are several contributors to the poor stock condition in SNE, including an increase in natural mortality, primarily as the result of climate change, and continued fishing pressure. Climate change has had a significant impact on the stock as lobster physiology is intricately tied to water temperatures. Not only does water temperature impact when lobster eggs hatch but it also has a direct effect on larval survivorship as waters which are too cold (<10°C) or too warm (>22°C) increase mortality.[1] Adult lobsters also are impacted by warming waters as recent laboratory studies suggest lobsters have a threshold of ~20.5°C, above which lobsters experience significant stress.[2] Ocean temperatures, particularly inshore, have been rising in the past two decades. Data from Buzzards Bay, MA and Long Island Sound show the number of days above 20°C has markedly increased since 1997 (Appendix 3). These warming waters have increased the natural mortality of the stock. Predation also has a significant impact on the species. Lobsters, especially juveniles, are an important source of food for many finfish species including Atlantic cod, spiny dogfish, black sea bass and skate. When populations of these species increase, pressure on the lobster stock increases.

In conjunction with the increase in natural mortality, continued fishing pressure has furthered the decline of the SNE stock. As the stock has decreased to record low abundance, effort and landings in the SNE fishery have likewise declined. This is in response to not only the low abundance but also recently implemented regulations and the higher costs of fuel and bait. Importantly, while the 2015 Stock Assessment did not conclude overfishing is occurring, fishing mortality is still the primary contributor to the stock's mortality. Work by the TC shows that, even when accounting for the recent increases in natural mortality, fishing mortality is removing roughly twice as much SSB from the

[1] MacKenzie, 1988.
[2] Powers et al., 2004.

population than natural mortality annually (Figure 3). This suggests that, in the face of climate change and increases in predation, management action can still have real effects on spawning stock abundance and egg production. Favorable environmental conditions will be needed to translate this increase in egg production into a successful recruitment event. This is highlighted in Figures 2 and 3 as, while the proportion of SSB surviving in SNE has generally increased since 2000, recruitment has significantly declined.

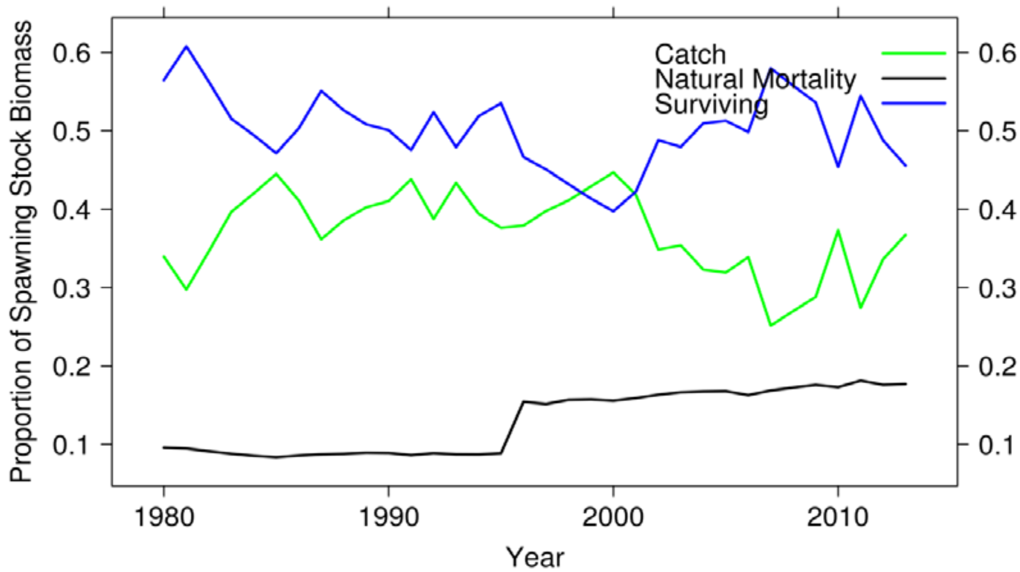

Figure 3: Proportion of SSB surviving or removed by fishing and natural mortality annually (1980-2013).

In an attempt to understand the extent of management action needed to improve stock conditions, the Board directed the TC to model future lobster abundance under various levels of fishing mortality and natural mortality. Results of these stock projections concluded a 75% to 90% reduction in fishing mortality would be needed to stabilize the stock under current natural mortality conditions (Appendix 4); should natural mortality increase, greater reductions in fishing mortality would be needed. The projections also showed that without management action, stock conditions would be expected to deteriorate and reference abundance could decline by 50%. These results highlight the poor condition of the stock and the need for impactful management action.

2.3 Fishery Status

2.3.1 Commercial Fishery

The SNE fishery is carried out by fishermen from Massachusetts, Rhode Island, Connecticut, New York and New Jersey, with smaller contributions from Delaware, Maryland, and Virginia. This fleet is comprised of small vessels (22' to 42'), which make day trips in nearshore waters (less than 12 miles), and larger boats (55' to 75'), which make multi-day trips to the canyons along the continental shelf. The SNE fishery is executed in LCMAs 2, 4, 5, and 6 as well as the western portion of LCMA 3 (Appendix 1).

The SNE fishery has experienced a noticeable contraction in effort and landings over the last decade (Table 2). Landings in the 1980s steadily rose from 4.06 million pounds in 1981 to almost 13 million pounds in 1989. Landings continued to rise in the 1990s, peaking at 21.9 million pounds in 1997. At this time, 41% of landings were from New York, followed by Rhode Island (28%), Connecticut (16%), and Massachusetts (12%). Starting in the early 2000s, landings began to precipitously decline. In 2004, landings (5.28 million pounds) were less than half of what they were four years earlier in 2000 (13.18 million pounds). This trajectory continued such that landings in 2015 were roughly 3.5 million pounds. In 2015, Rhode Island was the largest contributor of landings (55%) followed by Massachusetts (22%). This large decline in harvest is likely the result of a declining stock size, attrition in the fishery, regulatory changes, and substantial increases in the operating costs of the fishery, such as fuel and bait. Interestingly, despite the decrease in overall fishing effort, those who remain in the fishery have experienced increasing catch rates. The TC discussed this trend in their February 2016 presentation to the Board and highlighted that this is due to high attrition in the lobster fleet which has resulted in fewer fishermen concentrating their effort on the remaining aggregations of lobster in SNE.

In conjunction with the decrease in landings, the number of active permit holders has also decreased (Table 3). In 1990, there were 202 active lobster permits in Massachusetts. Only 24 years later, this number decreased by roughly 50% in Massachusetts. Similar trends can be seen in the other states as, from 2007-2014, the number of active permits decreased by 50% in Rhode Island and by 60% in Connecticut.

Data on the number of traps fished in Massachusetts, Rhode Island, Connecticut, and New York also matches the trends seen in landings (Table 4). In 1990, the number of active traps fished in Massachusetts, Connecticut and New York was 291,632 and this quickly rose to 443,833 by 1995. The number of traps fished peaked in 1998, just one year after landings peaked, at 588,422 traps. At this time, 59% of traps were from New York. Since then, the number of active traps has dramatically declined. In 2013, only 151,970 traps were fished in SNE, with New York seeing the largest decline and comprising only 14% of active traps fished. Rhode Island fishermen contributed the largest number of traps fished in 2013 at 42%.

Table 5 shows 2016 trap allocations in LCMAs 2, 3, 4, 5, and 6. The greatest number of traps are allocated in LCMAs 2, 3 and 6; however; a large portion of traps in LCMA 6 are not actively fished. This is corroborated by data showing the harvest of lobster from LCMA 6 has the second lowest landings in the SNE fishery (Table 6). Roughly two-thirds of landings in 2012 came from LCMA 3, followed by LCMA 4 and LCMA 2. The lowest landings are from LCMA 5, which also has the fewest traps allocated to its waters.

Table 2. SNE landings, in pounds, by state from 1981 to 2015.

Year	MA	RI	CT	NY	NJ	DE & South	Total
1981	952,397	750,484	806,892	834,818	593,700	121,100	4,059,391
1982	1,161,836	1,738,274	879,644	1,119,143	846,300	160,200	5,905,398
1983	1,340,411	3,142,252	1,653,467	1,207,442	769,900	143,800	8,257,272
1984	1,494,734	3,416,509	1,796,767	1,308,023	927,700	220,100	9,163,834
1985	1,276,476	3,448,905	1,380,094	1,240,928	1,079,600	201,900	8,627,903
1986	1,300,727	4,155,706	1,254,430	1,416,779	1,123,000	167,700	9,418,343
1987	1,274,272	4,141,975	1,571,896	1,146,613	1,397,100	135,000	9,666,856
1988	1,384,503	3,897,431	1,922,431	1,571,308	1,557,300	89,500	10,422,473
1989	1,485,916	4,927,960	2,076,755	2,344,832	2,059,600	94,000	12,989,062
1990	2,004,577	6,382,563	2,645,547	3,414,911	2,198,867	68,300	16,714,765
1991	2,059,067	5,997,763	2,674,207	3,128,246	1,673,031	54,700	15,587,014
1992	1,792,128	5,502,213	2,533,111	2,651,067	1,213,255	21,000	13,712,774
1993	1,913,042	5,511,204	2,175,963	2,667,107	906,498	24,000	13,197,814
1994	2,227,096	6,080,776	2,147,302	3,954,634	581,396	8,400	14,999,604
1995	2,180,263	5,627,777	2,541,930	6,653,780	606,011	3,355	17,613,116
1996	2,107,994	5,558,208	2,888,056	9,408,519	640,198	29,978	20,632,953
1997	2,554,513	6,085,849	3,467,871	8,878,395	858,426	37,096	21,882,150
1998	2,411,025	5,896,240	3,712,584	7,896,803	721,811	1,306	20,639,769
1999	2,234,115	7,656,157	2,594,841	6,452,472	931,064	6,916	19,875,565
2000	1,536,981	6,484,219	1,386,708	2,883,468	891,183	311	13,182,870
2001	1,501,483	4,179,518	1,322,774	2,052,741	579,753	19	9,636,288
2002	1,541,572	3,600,040	1,062,628	1,440,165	264,425	551	7,909,381
2003	887,888	2,677,133	668,001	945,895	209,956	25,609	5,414,482
2004	819,288	2,254,205	639,341	1,171,210	370,112	30,116	5,284,272
2005	877,397	3,069,430	712,093	1,225,428	369,264	66,164	6,319,776
2006	987,793	2,767,163	789,255	1,301,440	470,877	57,824	6,374,352
2007	867,586	2,323,678	544,542	896,852	680,392	38,811	5,351,861
2008	834,555	2,707,408	416,674	706,843	632,545	55,014	5,353,038
2009	1,040,368	2,335,117	410,060	730,539	179,740	58,527	4,754,351
2010	760,463	2,230,392	432,106	811,809	641,556	50,924	4,927,250
2011	513,222	1,605,269	188,932	343,072	627,077	61,923	3,339,495
2012	665,328	1,845,056	235,386	275,086	919,260	89,507	4,029,624
2013	698,237	1,620,251	132,908	246,754	660,367	96,127	3,454,644
2014	735,400	1,807,430	141,986	222,524	526,367	93,198	3,526,905
2015	769,305	1,966,218	156,708	146,249	445,195	60,790	3,544,464

Table 3. The number of active permits in the SNE stock. An active permit means any commercial vessel that reported landings. MA data includes both active trap and non-trap lobster permits.

	MA	RI	CT	NY	NJ	DE	MD	Total
1990	202							202
1991	190							190
1992	184							184
1993	205							205
1994	236							236
1995	222		365					587
1996	207		322		42		12	583
1997	217		305		42		15	579
1998	225		311		40		12	588
1999	223		299		41		11	574
2000	199		245		53		10	507
2001	191		234		54		10	489
2002	196		210		46		10	462
2003	171		167		34	7	8	387
2004	152		177		35	7	9	380
2005	134		179		27	3	7	350
2006	144		220		27	5	7	403
2007	133	304	195		31	5	8	676
2008	112	288	162		30	5	7	604
2009	110	267	139		33	3	7	559
2010	121	269	129	43	30	3	7	602
2011	116	216	98	41	30	2	5	508
2012	112	195	80	36	29	1	6	459
2013	95	163	59	41	29	1	5	393
2014	96	156	57	47	29	3	6	394

Table 4. Traps fished by state in the SNE stock unit. Traps fished are those traps reported fished by industry members on their state catch reports or on VTRs. (Source: 2015 Stock Assessment)

Year	Massachusetts	Rhode Island	Connecticut	New York	Total
1981	41,395	NA		48,295	89,690
1982	44,123	NA		43,977	88,100
1983	46,303	NA		59,808	106,111
1984	49,072	NA	66,709	77,599	193,380
1985	55,954	NA	65,262	88,332	209,548
1986	59,156	NA	65,826	77,429	202,411
1987	63,518	NA	70,646	76,729	210,893
1988	63,610	NA	79,154	101,790	244,554
1989	62,700	NA	83,915	143,320	289,935
1990	53,768	NA	100,360	137,504	291,632
1991	59,922	NA	101,290	155,276	316,488
1992	58,406	NA	107,668	187,661	353,735
1993	62,615	NA	115,224	237,117	414,956
1994	71,472	NA	110,805	269,419	451,696
1995	71,269	NA	119,983	252,581	443,833
1996	71,830	NA	130,360	314,297	516,487
1997	76,717	NA	133,770	335,860	546,347
1998	83,166	NA	158,527	346,729	588,422
1999	83,394	NA	162,149	332,323	577,865
2000	68,162	NA	122,386	212,767	403,314
2001	65,225	173,133	121,501	191,853	551,712
2002	78,965	152,021	117,731	157,747	506,464
2003	63,444	133,687	85,048	101,207	383,386
2004	55,191	128,081	84,071	102,351	369,694
2005	47,779	117,610	83,946	85,817	335,152
2006	52,990	120,242	90,421	89,301	352,954
2007	49,722	130,556	81,792	92,368	354,438
2008	42,934	104,440	56,355	90,909	294,638
2009	40,237	105,414	63,824	51,173	260,648
2010	48,558	111,509	53,516	70,350	283,933
2011	58,783	78,849	39,518	49,779	226,929
2012	54,102	76,826	29,353	29,678	189,959
2013	49,319	63,089	18,435	21,127	151,970

Table 5: 2016 trap allocations by LCMA in the SNE stock. LCMA 3 includes traps fished in both the SNE stock and the Gulf of Maine/Georges Bank stock. New York has permit holders that have a trap allocation for both LCMA 4 and 6.

	LCMA 2	LCMA 3	LCMA 4	LCMA 5	LCMA 6	LCMA 4/6
MA	33,377	49,040	1,100			
RI	59,789	41,288	2,424			
CT	4,163	652	2,725		139,186	
NY	1,141	2285	10,975	600	110,208	26,840
NJ	940	12,155	6,530	3,154		
DE				4,530		
MD				4,000		
VA				1,200		
TOTAL	99,410	105,420	23,754	13,484	249,394	26,840

Table 6. Estimated SNE lobster landings (in pounds) by LCMA.

Year	LCMA 2	LCMA 3	LCMA 4	LCMA 5	LCMA 6
1982	1,656,479	2,135,954	622,674	99,093	1,359,058
1983	2,958,366	2,258,492	633,254	71,804	2,428,633
1984	2,978,985	2,765,512	795,180	135,652	2,704,070
1985	2,992,330	2,330,628	964,043	170,998	2,273,337
1986	3,081,903	3,009,509	1,084,282	125,969	2,362,128
1987	3,219,900	2,655,725	1,473,841	98,486	2,378,765
1988	3,259,336	2,269,480	1,666,439	85,142	3,195,208
1989	4,175,114	2,845,444	2,232,935	106,126	3,735,250
1990	4,374,062	5,253,653	2,431,198	237,410	4,250,654
1991	4,140,145	4,811,267	2,096,138	115,020	4,393,986
1992	3,795,367	4,023,295	1,448,866	77,854	4,362,551
1993	3,772,494	3,776,113	1,597,447	89,495	3,968,663
1994	5,602,507	3,030,046	554,367	26,013	5,738,398
1995	4,960,453	2,661,176	962,077	45,054	8,564,325
1996	4,880,328	2,610,223	978,376	52,758	11,705,439
1997	5,324,775	3,183,034	1,162,862	36,623	11,650,701
1998	5,273,463	2,724,429	1,534,067	41,963	10,575,143
1999	6,938,658	3,195,423	1,346,509	77,621	8,331,142
2000	5,651,160	2,673,111	1,123,486	53,364	3,802,880
2001	3,862,054	2,053,831	762,408	55,537	3,013,551
2002	3,445,004	1,899,923	442,425	14,838	2,230,869
2003	1,110,534	2,519,713	423,583	17,394	1,448,011
2004	1,184,942	2,014,702	480,203	93,270	1,534,130
2005	1,464,433	1,800,406	457,275	54,181	1,673,396
2006	1,853,505	1,983,721	516,130	59,928	1,840,308
2007	1,430,836	1,494,830	617,978	56,866	1,263,648
2008	1,168,921	1,918,429	440,108	322,916	920,951
2009	1,051,241	2,227,432	488,792	308,212	896,594
2010	1,022,528	2,135,008	522,037	184,409	966,505
2011	730,889	1,954,052	488,977	148,587	306,079
2012	627,051	2,003,412	782,684	154,455	286,215

*To separate landings by LCMA, NMFS statistical areas are placed into a single LCMA.

One of the largest changes over the last decade has been the transition from a primarily inshore to a primarily offshore lobster fishery. In 1982, 64% of landings in SNE were from the inshore portion of the stock. This increased to 87% in 1998 as landings quickly grew in the fishery. However, declines in the stock, particularly inshore, have led the fishery to be primarily executed offshore. Figure 4 shows the landings of lobster inshore and offshore. While the pounds of lobster landed inshore has declined since 1997, offshore landings have experienced less severe declines and have even stabilized over the last decade. In fact, 2011 was the first year in which a greater portion (55%) of lobster were landed offshore than inshore. This shift in the fishery can likely be explained by warming coastal waters which have caused declines in recruitment and prompted migrations of lobsters to cooler waters offshore.

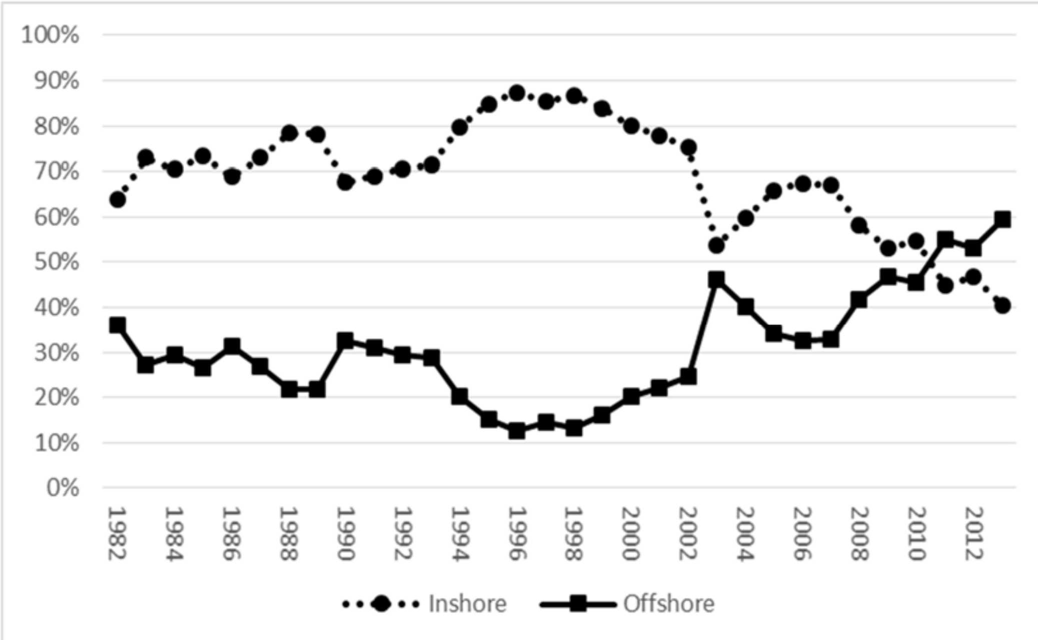

Figure 4: Percentage of landings in SNE occurring in the inshore and offshore fishery. The inshore fishery is defined as landings from statistical areas 538, 539, 611, 612, 613, 614, 621, 625, 631, and 635. The offshore fishery is defined as landings from statistical areas 533, 534, 537, 615, 616, 622, 623, 624, 626, 627, and 632.

The non-trap fishery for lobster is a relatively small percentage of overall landings in SNE. In 2015, a total of 858,736 pounds were landed with non-trap gear. This value is an overestimate as it includes non-trap landings from Massachusetts which spans both the GOM/GBK and SNE stock. 93.6% of non-trap landings come from Massachusetts, followed by Rhode Island (5.8%) and Connecticut (0.4%).

2.3.2. Recreational Fishery

While the lobster fishery is predominately commercial, there is a small recreational fishery which harvests lobsters. This recreational fishery primarily occurs in the summer months and lobster are typically harvested with traps, and in some states, by hand while diving. The states of Massachusetts, Connecticut, and New York currently collect recreational information on lobster landings. In general, recreational landings are only a small percentage of the states' total landings. In Connecticut, recreational landings have declined in conjunction with commercial landings, with the number of personal-use licenses sold in Connecticut dropping from 875 in 2009 to 163 in 2015. Over the last decade, recreational landings in Connecticut have varied between 1% and 4% of annual total harvest. In New York, 2015 recreational harvest was 2,130 pounds, or roughly 1.4% of total state harvest. Recreational harvest in Massachusetts is significantly higher, in pounds, than the other states in SNE with a five year average from 2010-2014 of 224,932 pounds; however, it is important to note that this includes landings from both the GOM/GBK and SNE stocks. Similar to New York, Massachusetts' recreational fishery represents roughly 1% of total state landings.

2.4 Status of Management

Lobster are currently managed under Amendment 3, and its twenty-four addenda. One of the hallmarks of Amendment 3 was the creation of seven LCMAs along the coast. These areas are intended to reflect the regional differences in the fishery and, as a result, are permitted to have disparate management measures. The American Lobster Management Board, the Commission's managing body for the species, is comprised of 10 states (Maine through Virginia) and the Federal Government. While ASMFC is not under the purview of the Magnuson-Stevens Act (MSA), the Federal Government, via NOAA Fisheries, supports the Commission's management of interjurisdictional fisheries. When federal support involves the implementation of management measures offshore (3-200 miles), those regulations must both be compatible with the Commission Plan and consistent with the National Standards outlined in MSA.

To date, the American lobster fishery has primarily been managed through input controls, such as biological measures and trap caps, which limit the amount of effort fishermen put into the fishery. Table 7 describes current management measures for all LCMAs which fall within SNE. All LCMAs have a minimum size of 3 ⅜", with the exception of LCMA 3 which is at 3 $^{17}/_{32}$". All LCMAs also have the same maximum size of 5 ¼", with the exception of LCMA 3 which is at 6 ¾". LCMAs 2, 5, and federal waters of Area 4 require v-notching of egg-bearing females; this is not required in LCMA 6, state waters of LCMA 4, or the SNE portion of LCMA 3. Regardless of their v-notch requirement, all LCMAs do have the same v-notch definition which prohibits retention if the notch is at least a 1/8 inch deep. All LCMAs also have history-based effort control programs with LCMA 2 having the lowest trap cap set at 800 traps.

In response to the findings of the 2009 Stock Assessment, the Board passed several addenda aimed at reducing exploitation (also known as fishing mortality) and scaling the size of the fishery (Table 8). Addendum XVII reduced exploitation by 10%. To comply with Addendum XVII, LCMAs 2, 5, and federal waters of LCMA 4 instituted mandatory v-notching, LCMA 3 increased the minimum gauge size by 1/32", and LCMAs 4, 5, and 6 instituted closed seasons. The Board also approved Addendum XVIII, which implemented a series of trap allocation reductions in LCMAs 2 and 3. The goal of this management action was to scale the size of the SNE fishery to the diminished size of the resource. These are not the first trap reductions taken in the lobster fishery as, previous to Addendum XVIII, LCMA 3 also implemented a 10% (Addendum IV) and 5% (Addendum XI) reduction in trap allocations. After Addendum XVIII, the Board approved Addenda XXI and XXII, which modified the trap transferability rules for LCMAs 2 and 3. The intent of these addenda was to increase the flexibility for fishermen to adjust to management measures aimed at reducing latent effort (traps that are not actively fished) through fishery consolidation. Management measures in these addenda include modifications to the single or individual ownership caps (otherwise known as trap banking) and aggregate ownership caps. These measures have not yet been implemented in federal waters.

Table 7. 2016 LCMA-specific Management Measures.

Mgmt Measure	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	OCC
Min Gauge Size	3 1/4”	3 3/8”	3 17/32 ”	3 3/8”	3 3/8”	3 3/8”	3 3/8”
Vent Rect.	1 15/16 x 5 3/4”	2 x 5 3/4”	2 1/16 x 5 3/4”	2 x 5 3/4”	2 x 5 3/4”	2 x 5 3/4”	2 x 5 3/4”
Vent Cir.	2 7/16”	2 5/8”	2 11/16”	2 5/8”	2 5/8”	2 5/8”	2 5/8”
V-notch requirement	Mandatory for all eggers	Mandatory for all legal size eggers	Mandatory for all eggers above 42°30’	Mandatory for all eggers in federal waters. None in state waters.	Mandatory for all eggers	None	None
V-Notch Definition[1] (possession)	Zero Tolerance	1/8” with or w/out setal hairs[1]	1/8” with or w/out setal hairs[1]	1/8” with or w/out setal hairs[1]	1/8” with or w/out setal hairs	1/8” with or w/out setal hairs[1]	State Permitted fisherman in state waters 1/4” without setal hairs Federal Permit holders 1/8” with or w/out setal hairs[1]
Max. Gauge (male & female)	5”	5 ¼”	6 3/4”	5 ¼”	5 ¼”	5 ¼”	State Waters none Federal Waters 6 3/4”
Season Closure				April 30-May 31	February 1-March 31	Sept 8-Nov 28	February 1-April 30

Table 8: Management action taken by the Board since the 2009 Benchmark Stock Assessment.

Year	Addendum	LCMA Affected	Action Taken	Implementation Date
2012	Addendum XVII	2	Mandatory v-notching	June 1, 2012
		3	Minimum gauge size increased from 3 ½" to 3 17/32"	January 1, 2013
		4	Mandatory v-notching Season closure from April 30 – May 31	July 1, 2012*
		5	Mandatory v-notching Season closure from Feb. 1 – Mar. 31	January 1, 2013
		6	Season closure from Sep 8-Nov 28	January 1, 2013
	Addendum XVIII	2	Trap allocation reduced by 25% on first year, reduced by 5% every year for following five years	2016
		3	Trap allocation reduction annually by 5% for five years	2016
2013	Addendum XIX	3	10% conservation tax assessed on any transfer or full business sale**	2013
	Addendum XX	3	Prohibitive to set lobster traps in Close Area II from Nov 1 – June 15	2013
	Addendum XXI	2	Recipient of a multi-LCMA trap allocation retains multi-LCMA history and declares which area(s) will be fished in a year; Single Ownership Cap/Aggregate Ownership Cap is 1,600 traps for any individual or corporation at a given time; Sunset Provision of two years on Single Ownership Cap	November 1, 2013***
		3	5% reduction for 5 years on active trap cap from 2,000 to 1,548; recipient of a multi-area trap allocation retains the multi-area history and declares which area(s) will be fished each fishing year	November 1, 2013***
	Addendum XXII	3	5% reduction for 5 years on single-ownership and aggregate ownership caps	***
2015	Addendum XXIV	2	Removed 10% conservation tax on full business transfers; traps shall be transferred in increments of 10; dual permit holders are allowed to transfer allocation with dual permit holders from other states	2015

*ASMFC's American Lobster Management Board voted to revise this closure from February 1 – March 31 to April 30- May 31 to maximize the conservation benefit of the closure. NOAA Fisheries implemented this change in Federal waters in November 2015.
**Conservation tax on partial transfers was reduced from 20% and replaced Section 4.1.1 of Addendum XIV
***NOAA Fisheries postponed rule making on Addenda XXI and XXII pending the outcome of SNE management in Addendum XXV.

2.5 Economic Status of Fishery

Total ex-vessel value in 2015 from the SNE lobster stock was just under $18.5 million (Table 9). The largest contributor was Rhode Island with 57% of the total value in SNE. This was followed by Massachusetts (20.9%) and New Jersey (12.2%). While there are a number of participants in the lobster fishery, a large portion of landings are harvested by a small portion of fishermen. In 2015, 57% of fishermen landed less than 10,000 pounds of lobster per year; however, these fishermen were responsible for just 9% of lobster landed in Massachusetts through Virginia. In contrast, just 2% of fishermen landed greater than 100,000 pounds each year but they were responsible for 20% of lobster landed in Massachusetts through Virginia. This suggests a significant portion of landings in the lobster fishery are made by a small number of participants. While the lobster fishery in New England is a distinct fishery with lobster being the primary catch, in the Mid-Atlantic, lobster is often a secondary component of catch in traps. Lobster fishermen in the southern extent of the species' range participate in a multi-species fishery in which harvesters catch lobster, Jonah crab, and black sea bass.

Table 9: 2015 ex-vessel values in the SNE lobster fishery.

	MA	RI	CT	NY	NJ	DE	MD	VA	Total
Ex-Vessel ($)	3,871,993	10,535,726	748,797	820,456	2,248,638	61,400	186,039	24,092	18,497,141
%	20.9%	57.0%	4.0%	4.4%	12.2%	0.3%	1.0%	0.1%	100.0%

*MA and RI values were calculated by multiplying landings from harvester reports by an average price based on dealer information.

In considering the economic status of the lobster fishery, it is also important to consider the Jonah crab fishery, as the two species are managed together and are primarily caught with the same gear. The Jonah crab fishery has experienced immense growth over the last 15 years. In the early 2000's, landings were roughly 2.6 million pounds and the fishery was valued at $1.5 million (ASMFC, 2015b). By 2014, landings increased to over 17 million pounds with a value exceeding $13 million (ASMFC, 2015b). It is believed that this rapid increase in landings is the result of an increase in demand as well as the poor condition of the SNE lobster sock, which has prompted fishermen to supplement their income with Jonah crab.

Table 10 shows 2015 Jonah crab landings and ex-vessel value by state and quarter. Landings primarily came from Massachusetts (~70%) and Rhode Island (~29%) with landings occurring throughout the year. It is important to note that Massachusetts and Rhode Island landings include those from SNE and the GOM/GBK stock, and as a result, may represent an overestimate of Jonah crab landings in SNE.

Table 10: 2015 pounds landed and ex-vessel value for the Jonah crab fishery by state and quarter. Massachusetts and Rhode Island landings include those from SNE and GOM/GBK.

		Quarter 1	Quarter 2	Quarter 3	Quarter 4
Massachusetts	Pounds	2,079,872	2,236,879	1,868,270	2,911,353
	Ex-Vessel	$ 1,582,678	$ 1,690,807	$ 1,406,117	$ 2,214,914
Rhode Island	Pounds	1,022,100	716,318	655,522	1,467,320
	Ex-Vessel	$ 777,179	$ 566,794	$ 508,208	$ 803,182
Connecticut, New York, New Jersey	Pounds	17,298	18,831	13,774	24,156
	Ex-Vessel	$ 5,773	$ 13,237	$ 11,848	$ 15,513
Delaware, Maryland, Virginia	Pounds	16,264	15,511	7,915	3,886
	Ex-Vessel	$ 12,600	$ 25,709	$ 30,856	$ 9,746

2.6 Management Tools Considered

At the August 2016 meeting, the Board provided the Plan Development Team (PDT) with a list of potential management tools to consider in this addendum. They included: gauge size changes, trap reductions, closed seasons, trip limits, v-notching, and culls. The PDT evaluated the effectiveness of these various tools, considering the ability to successfully achieve the management targets for egg production as well as the ability to monitor, administer, and enforce the management tools in the fishery. For this evaluation, the PDT made extensive use of the TC's expertise, including their three memos to the Board in January 2016, April 2016, and July 2016.

2.6.1 Gauge Size Changes

Analysis conducted by the TC suggests that, both inshore and offshore, gauge size changes are an effective management tool to increase egg production and decrease fishing mortality. Changes to the minimum and maximum gauge size are enforceable and provide a direct benefit of keeping lobsters in the water longer. Furthermore, gauge size changes are intricately tied to the biology of lobsters, with clear benefits in terms of egg production and fitness. These impacts can be accurately predicted, adding confidence to the results of management decisions. As a result, gauge size changes are considered for use in this document.

Work presented in the TC's July memo to the Board (see Appendix 5) suggests gauge size changes can be used to achieve up to a 60% increase in egg production. Increases in the minimum size result in larger increases in egg production; however, it is important to note that decreases to the maximum gauge size provide permanent protection to larger lobsters which have likely already survived stressful conditions. Changes to the gauge size may necessitate changes to the vent size as the harvestable window of lobster sizes narrows. This would allow a greater portion of undersized lobsters to exit the trap and reduce stress from handling.

The economic impacts of gauge size changes depend on how the change is implemented, as gradual changes to the gauge size over several years may dampen the reductions in harvest. Short-term impacts of gauge size changes include an immediate decrease in landings as there is a narrower slot from which to harvest lobsters; however, as the population stabilizes, landings settle into a common trajectory.

It is likely that the implementation of gauge size changes, or any of the proposed measures in the addendum, will create increased demand and shipments of lobsters from different LCMAs, particularly those LCMAs in the GOM/GBK which have different gauge sizes. For many states, the minimum and maximum sizes in place are possession limits, meaning harvesters and dealers must abide by their state's regulations. While these strict regulations improve enforcement of gauge sizes, it can complicate interstate commerce as lobsters legally caught in LCMA 1 have a smaller minimum gauge size of 3 ¼". Some states have developed dealer provisions to address this concern. Rhode Island and Connecticut allow dealers to possess smaller lobsters legally harvested in other LCMAs as long as those lobsters are not sold to consumers in their state. Dealers are required to have thorough documentation regarding the origin of lobsters below the state's minimum size and these smaller lobsters must be kept separate from those lobsters legally landed in the state. Massachusetts, because it has lobster landed from four LCMAs, is only able to enforce LCMA-specific gauge sizes at the harvester level but has implemented significant penalties for violations.

2.6.2 Trap Reductions

The relationship between the biology of lobsters and trap reductions is not well understood. One of the major sources of uncertainty is the effect of trap reductions on the exploitation rate. This is because current trap reductions reduce a fisherman's total trap allocation, which includes both actively fished traps and latent effort. As trap allocations are reduced, it is impossible to predict the tipping points between reductions in latent effort and reductions in the number of actively fished traps.

Currently, LCMAs 2 and 3 are going through a series of trap reductions aimed at reducing trap allocations (ASMFC, 2012). Specifically, Addendum XVIII established a 25% reduction in year 1 followed by a series of 5% reductions for 5 years in LCMA 2. In LCMA 3, Addendum XVIII established a series of 5% reductions for 5 years. The intent of these reductions is to scale the size of the SNE fishery to the reduced size of the SNE stock. These trap reductions were initiated in 2016 and, as a result, potential biological impacts of the trap reductions were not included in the 2015 Stock Assessment. It is important to note that these actions reduce a fishermen's total allocation (latent and active effort) and that through the Commission's Trap Transferability Program, fishermen can replace cut traps and immediately build back their number of actively fished traps. Some fishermen may choose to reduce effort or depart the fishery.

In an attempt to understand the impact of trap reductions on the SNE stock, the TC attempted to model the relationship between the number of traps actively fished (as opposed to total trap allocations which include latent effort), the exploitation rate, and associated egg production. Information on the number of actively fished traps was obtained from the 2015 Stock Assessment, which includes data from Massachusetts, Connecticut, Rhode Island and New York (Table 4). Data on the number of actively fished traps in states south of New York are not consistently collected and were not available for use by the TC. The analysis conducted by the TC uses data through quarter four of 2014. This means that in LCMAs 2 and 3, the analysis calculates potential increases in egg production as the result of on-going trap allocation reductions (includes latent and active effort) which began in 2016. The analysis suggests that, based on data from 1999-2013, a 25% reduction in the number of actively fished traps may result in a 14.3% (95% CI: 3.5%-21.2%) reduction in exploitation. This equates to a 13.1% (95% CI: 2.6%-19.7%) increase in egg production.

Though the TC's analysis is based on the best available data, there are several concerns about the ability of trap reductions to achieve the projected increase in egg production. The first is that the above analysis assumes fishermen maintain a constant soak time before and after the reduction of their trap allocation. Some studies show this assumption is not true, and that fishermen reduce their soak times to compensate for fewer traps (i.e. fishermen haul fewer traps more frequently to maintain current exploitation rates)[3]. This results in decreased impacts to catch and much smaller increases in egg production. It is important to note that many of these studies were conducted on the inshore fishery and the ability of offshore fishermen to increase their number of trips and trap hauls is unknown. Secondly, the analysis assumes that historic changes in exploitation are only the result of active trap reductions. This assumption is not true, as previous management measures (gauge size changes, season closures, etc.) and general attrition in the fishery all contribute to the exploitation rate. Again, this results in an overestimate of egg production achieved by trap reductions. Thirdly, the analysis is based on reductions in the number of traps actively fished; however, trap allocation reductions decrease a combination of latent and active traps. This further inflates the expected increase in egg production as trap reductions remove effort that is not currently in the water. Finally, fishermen in LCMAs 2 and 3 can maintain their number of actively fished traps through the Trap Transferability Program, which was created to allow active fishermen to replace cuts in their number of active traps with purchased traps. This again results in an overestimate of egg production benefits. Given these four caveats, the TC's analysis primarily serves as a tool to provide guidance on the upper limit of egg production that may result from trap reductions. It is likely that the increase in egg production resulting from trap reductions would be lower than 13.1%.

While there are several caveats to this management tool, trap reductions are considered for use in this document. Given the tenuous relationship between traps fished and fishing mortality, the economic impacts of trap reductions are not clear. Analysis suggests fishermen may be able to reduce their soak time in order to maintain current harvest levels, thereby minimizing reductions in profit. However, some fishermen may also be encouraged to obtain trap allocations up to the trap cap in order to maintain their current business despite the reductions.

2.6.3 Closed Seasons

Closed seasons are a management tool which can be used to reduce pressure on the lobster stock at vulnerable times. A biological benefit of this tool is that it removes harmful stress sustained by lobsters when they are caught in a trap, hauled to the surface, and handled by fishermen. Analysis by the TC shows seasonal closures can achieve up to a 21.6% increase in egg production, provided fishermen do not drastically alter fishing behavior to compensate for the closure. The largest increases in egg production result from summer closures (July-September) when fishing mortality is highest. Furthermore, a summer closure protects female lobsters which have mated but have yet to extrude their eggs. Importantly, this analysis assumes that fishermen do not adapt to the implementation of a season closure by intensifying their effort during the rest of the year. It also assumes that season

[3] Miller, 1990; Fogarty and Addison, 1997.

closures, on an area-by-area basis, are implemented in a complementary manner as both lobsters and fishermen (i.e. dual permit holders) can move between LCMAs. Otherwise, actual increases in egg production may be lower than those predicted in the analysis.

An important consideration with closed seasons is the potential impact on the Jonah crab fishery. Particularly in SNE, the lobster fishery is evolving into a mixed crustacean fishery in which lobsters and Jonah crab can be caught with the same gear at different times of the year. Season closures would directly impact the Jonah crab fishery if traps must be taken out of the water. Allowing lobster traps to remain in the water during a closed season would greatly reduce the biological benefit of the management tool as lobsters would still be hauled, handled, and thrown overboard. As a result, if season closures are used, the timing should be considered to minimize impacts on the Jonah crab fishery.

Given the potential for season closures to result in biological benefits to the stock, season closures are considered for use in this document. Economic impacts of season closures include reduced profits at certain times of the year; however, studies suggest that gross revenues over the year may increase as the result of season closures. Analysis of the Maine lobster fishery by Chen and Townsend (1993) suggests closures of at least 3-4 months cause landings to be redistributed across seasons, which evens out prices and strengthens market values. SNE markets are more tenuous than those in Maine but may be strengthened by consolidation.

2.6.4 Trip Limits

While trip limits are frequently used as a management tool in other fisheries, to-date they have not been used in the directed lobster fishery. Overall, trip limits are an enforceable management tool which can be used to maintain catch over the harvestable year and potentially reduce exploitation. Trip limits allow both the lobster and Jonah crab fisheries to continue as lobster traps would still be allowed in the water.

There are several concerns about the effectiveness and equity of this management tool. Given the difference in vessel size and capacity between the inshore and offshore fleets, trip limits may disproportionately impact the offshore fleet which frequently takes multi-day trips. As a result, impacted fishermen may respond by increasing the number of trips taken each year to maintain current harvest levels. Trip limits may also encourage fishermen who typically harvest below the limit to increase their catch and maximize their potential harvest. This unintended consequence could result in increased landings, a result contradictory to the stated purpose of this Addendum. Furthermore, trip limits often result in increased discards and stress to the lobsters as they are hauled, handled, and returned to the water. A challenge in implementing trip limits is how states with fishermen harvesting from both the SNE stock and GOM/GBK stock should monitor compliance when only one area may have a trip limit.

Given these concerns, the TC recommended trip limits be considered in conjunction with a quota for the SNE stock. A quota, if properly enforced, can cap landings in a fishery and allow managers to increase or decrease the total catch for the year depending on the current stock status. Implementing a quota in the lobster fishery presents many challenges and questions. The establishment of a quota requires tough discussions on how the total allowable catch will be set and if this will be allocated among jurisdictions, LCMAs, and/or seasons. An effective quota also requires good monitoring and enforcement, both of which need to be carefully considered prior to implementation. A particular challenge in the lobster fishery is how states with fishermen harvesting from both the SNE stock and GOM/GBK stock should monitor landings.

Given the challenges associated with implementing a trip limit and a quota in the SNE lobster fishery, and the stated intent of the Addendum to take quick and decisive action, trip limits and quotas are not considered for use in this document. The Board has not specified quotas as a management tool to consider in this addendum.

2.6.5 V-Notching

V-notching is a tool which has been used in the lobster fishery to protect reproductive females in the population. Currently, LCMAs 2, 5, and federal waters of LCMA 4 require mandatory v-notching; LCMA 6, state waters of LCMA 4, and the SNE portion of LCMA 3 do not. All areas use the same 1/8" definition for possessing a v-notch lobster, a less strict definition than the zero tolerance rule in LCMA 1. As a result, there is some concern that reproductive females who are protected in the Gulf of Maine receive less protection if they migrate south. While v-notching can be a valuable management tool when actively conducted, the value of this tool is predicated on high encounter and harvest rates because egg-bearing lobsters must be encountered by fishermen in order to be v-notched and protected. Given the significant reduction in landings in SNE, v-notching is not expected to produce a large benefit to the stock. Furthermore, the effectiveness of v-notching in SNE has been hindered in the past by issues with non-compliance and incorrect marking. As a result, v-notching is not considered for use in this addendum.

2.6.6 Culls

Lobsters which only have one claw are referred to as culls. Claws can be lost naturally, such as in an interaction with another lobster, or during handling by fishermen. Currently, culls can be legally landed in the lobster fishery. A prohibition on the harvest of culls may reduce fishing mortality; however, it may also encourage better handling practices, reducing the number of culls and the benefit of this management tool on the stock. Furthermore, should culls be prohibited, tolerances would have to be established in case a lobster loses a claw during the steam to port and a clear definition would be needed to address regeneration. Given these limitations, a prohibition on culls is not considered for use in this document.

2.7 Additional Issues Considered

2.7.1 Uniform Regulations

The Lobster FMP and associated addenda attempt to balance the need for regulatory consistency with the desire for area flexibility. Amendment 3 established seven LCMAs by which to manage the fishery. The intent of these LCMAs was to identify the different stock conditions in various parts of the fishery and recognize the different measures needed to successfully manage the species in each area. Amendment 3 also created Lobster Conservation Management Teams (LCMTs) which are intended to inform the Board of conditions in various areas and to advise the Board on LCMA management measures. LCMTs have provided an avenue for industry participation in the management of lobster.

Nevertheless, the Board has recognized the need for a certain amount of standardization in the fishery. For example, all LCMAs have a minimum gauge size of at least 3 ¼ inches, a maximum gauge size, and a prohibition on the harvest of berried lobsters (females bearing eggs). Most recently, the Board expressed the importance of all permitted fishermen having a single uniform trap allocation, and implemented the Trap Tag Database Program to ensure congruence amongst the states and federal government.

Currently, LCMAs use different suites of management measures; however, the Board has expressed some interest in standardizing regulations across LCMAs in SNE. Possible combinations of standardization include creating uniform management measures for the inshore areas (LCMAs 2, 4, 5, and 6) or grouping LCMAs by region. In their April 25th memo to the Board, the TC outlined the costs and benefits of standardizing regulations in SNE. Overall, the report stated that standardizing biological measures would improve enforcement and the stock assessment process but may negatively impact industry by creating clear winners and losers in the fishery. This is especially true in regard to changes to the gauge size, as uniform increases in the minimum size will primarily impact inshore fishermen while uniform decreases in the maximum size will primarily impact offshore fishermen. Uniform regulations, in the context of this addendum, may also create implementation challenges as various LCMAs would have to cooperate to identify a common suite of tools which enable multiple areas to achieve the specified increase in egg production. By contrast, differing Addendum XXV measures, particularly across states and adjacent LCMAs, may complicate needed management and undermine the potential benefits of the proposed measures as lobsters move from area to area.

2.7.2 Stock Boundaries

A complicating factor in the management of lobster is that the boundaries of the LCMAs do not align with the biological boundaries of the stocks (SNE vs. GOM/GBK). This is particularly problematic in LCMA 3 which spans both SNE and GOM/GBK. The intricacy of the stock boundaries is further complicated by the fact that many vessels fishing out of Rhode Island and Massachusetts, which are harvesting lobsters on Georges Bank, must travel through the SNE stock area to reach their port of landing. In addition, these vessels may be permitted to fish in multiple management areas, including areas that span both lobster stocks.

To date, there have been no permit requirements to delineate within which stock an Area 3 fisherman is eligible to fish. Management action taken in response to the 2009 stock assessment was applied throughout LCMA 3, including portions of the GOM/GBK stock. Given that the conservation burden of this addendum applies only to SNE, new conservation rules must either apply to all Area 3 fishermen regardless of location and stock fished (with economic implications on the GOM/GBK fisheries) or new measures will have to be stock specific.

2.7.3 De Minimis

Addendum I to Amendment 3 of the American Lobster FMP allows states which meet specific criteria to apply for *de minimis* status. According to the ASMFC Interstate Fisheries Management Program Charter, *de minimis* is defined as a situation in which, under the existing conditions of the stock and fishery, the conservation and enforcement actions taken by an individual state are expected to contribute insignificantly to a coastwide conservation program. Through Addendum I, states whose commercial landings in the most recent two years do not exceed an average of 40,000 pounds are eligible to apply for *de minimis* status. While *de minimis* states are required to implement the coastwide requirements contained in Section 3.1 of Amendment 3, the Board can determine which other components of the plan a *de minimis* state must adopt. So far, the Board has exempted *de minimis* states from conducting biological sampling of their lobster fishery, as specified in Addendum X.

In 2016, the Board granted *de minimis* status to Delaware, Maryland, and Virginia. Together, these states contribute less than 3% of landings in SNE, and less than 0.1% of landings coastwide. The lobster fishery in these states is, for the most part, a multi-species fishery primarily involving black sea bass. Given the limited participation in the lobster fishery in these states, there is concern that the management measures implemented as a result of Addendum XXV will impose a large and costly administrative burden on the *de minimis* states relative to the size of their lobster fisheries. Since the Board can specify which management measures *de minimis* states must adopt, the Board does have the ability to exempt *de minimis* states from the management measures implemented as a result of Addendum XXV.

3.0 Management Options

The following management issues are intended to increase egg production and decrease fishing mortality in SNE. Management tools which are considered for use in this document include gauge size changes, trap allocation reductions, and season closures. The management options are presented with the intent that each LCMT can choose how they would like to achieve the targeted increase in egg production. During the public comment period, LCMTs are encouraged to submit preliminary proposals on how they would prefer to achieve the various increases in egg production. Approximately one month after the Board chooses an egg production target and selects management alternatives for the issues contained in this addendum, proposals on preferred management measures to achieve the required increase in egg production will be due from the LCMTs. These proposals will be reviewed by the PDT, TC, and Board. If a proposal is not received from a LCMT, states with permitted individuals in that LCMA will work together to choose the management measures that will be implemented to achieve the target increase in egg production. The PDT encourages that states do not implement divergent management measures for a single LCMA; each state should agree on the management measures in a LCMA.

Analysis contained in this document uses data through quarter four of 2014. As a result, 2014 represents current stock status in this addendum and changes in egg production are measured from the 2014 baseline. Table 8 shows the management action implemented by each LCMA before and after 2014. Management actions implemented after 2014 count towards the egg production target chosen by the Board. The value of egg production will depend on the management tool used and the extent of the management action taken, and will be reviewed by the Board. Other management measures which were not implemented as a result of an addendum but which a LCMA believes contributed to a measurable increase in egg production since 2014 may be brought before the Board through the LCMT proposal process.

This document considers potential changes to the minimum and maximum carapace length at which lobsters can be harvested. Carapace length is defined as the straight-line measurement from the rear of the eye socket parallel to the centerline of the carapace to the posterior edge of the carapace. LCMTs would use Table 11 or Appendix 5 to determine the minimum and maximum size limit which would achieve the targeted increase in egg production.

This document also considers trap allocation reductions. LCMTs would use Table 12 to determine the impacts of a 25% trap reduction. Should a LCMA, which is currently going through a series of trap reductions as a part of Addendum XVIII, decide to complete additional trap reductions to achieve the egg production target, these would occur following the final year of trap reductions specified in Addendum XVIII. LCMAs that have previously agreed to reduce traps can accelerate these on-going trap cuts in order to begin implementation of any additional trap reductions and meet the timeline of this addendum. Accelerated trap reductions will not count for a higher level of egg production than those implemented on the scheduled outlined in Addendum XVIII.

This document also considers season closures. LCMTs would use Table 13 to determine the dates of the season closure and the expected increase in egg production.

Issue 1: Target Increase in Egg Production

This issue asks what the target increase in egg production should be in SNE. The Board has stated that the goal of Addendum XXV is to respond to the decline of the SNE stock and its decline in recruitment while preserving a functional portion of the lobster fishery in this area. The Board also identified increases in egg production ranging from 20% to 60%. Option A: 0% Increase in Egg Production is included primarily to add context to the Board's deliberations. Larger increases in egg production have the potential to provide greater benefits to the stock but are also more likely to negatively affect industry.

<u>Option A: 0% Increase in Egg Production (Status Quo)</u>

Under this option there would be no targeted increase in egg production and no changes to management would be made through this addendum. All measures would remain the same as listed in Table 7.

<u>Option B: 20% Increase in Egg Production</u>

Under this option, LCMAs must take management action to increase egg production by 20% from current levels. 2014 represents current stock status in this addendum and changes in egg production are measured from the 2014 baseline.

<u>Option C: 30% Increase in Egg Production</u>

Under this option, LCMAs must take management action to increase egg production by 30% from current levels. 2014 represents current stock status in this addendum and changes in egg production are measured from the 2014 baseline.

<u>Option D: 40% Increase in Egg Production</u>

Under this option, LCMAs must take management action to increase egg production by 40% from current levels. 2014 represents current stock status in this addendum and changes in egg production are measured from the 2014 baseline.

Option E: 60% Increase in Egg Production

Under this option, LCMAs must take management action to increase egg production by 60% from current levels. 2014 represents current stock status in this addendum and changes in egg production are measured from the 2014 baseline.

Issue 2: Management Tools

This issue asks whether management tools can be used independently or must be used in combination with one another. Gauge size changes, trap reductions, and season closures are potential management tools to achieve the targeted increase in egg production. The Board has the greatest confidence in gauge size changes to achieve meaningful biological impacts. There is less confidence in trap reductions and season closures as the effectiveness of both tools is dependent on fishermen maintaining their current fishing behavior.

Option A: Management Tools Can Be Used Independently

Under this option, gauge size changes, trap reductions, and season closures can be used independently, or in conjunction with one another, to achieve the target increase in egg production. For reference, analysis suggests that on their own, gauge size changes can account for up to a 60% increase in egg production, quarterly season closures can account for up to a 21.6% increase in egg production, and a 25% trap reduction in active traps can account for up to a 13.1% increase in egg production.

Option B: Gauge Size Changes and Season Closures Can Be Used Independently

Under this option, gauge size changes and season closures can be used independently, or in conjunction with one another, to achieve the target increase in egg production. Trap reductions cannot be used to achieve the target increase in egg production. For reference, analysis suggests that on their own, gauge size changes can account for up to a 60% increase in egg production and quarterly season closures can account for up to a 21.6% increase in egg production.

Option C: Trap Reductions and Season Closures Must Be Used In Conjunction with Gauge Size Changes

Under this option, gauge size changes can be used as a sole management measure to achieve the targeted increase in egg production; however, trap allocations and season closures must be used in conjunction with gauge size changes. Furthermore, season closures and trap reductions cannot account for more than half of the target increase in egg production. For example, if the target increase in egg production is 40%, trap reductions or season closures cannot account for more than a 20% increase in egg production.

Issue 3: Recreational Fishery

This issue asks whether the recreational fishery must abide by the management measures taken in this addendum. Recreational fishermen are those individuals who do not offer for sale their harvest of lobsters and are identified by their jurisdiction's recreational fishing permit. Historically, the recreational fishery has been subject to gauge size changes and season closures while trap reductions have only impacted the commercial fleet.

Option A: Recreational Fishery Must Abide by Management Action Taken in Addendum
Under this option, recreational fishermen in the lobster fishery must abide by all of the management measures implemented in their LCMA as a result of this addendum. This could include gauge size changes, season closures, and trap reductions.

Option B: Recreational Fishery Must Abide by Gauge Size Changes and Season Closures
Under this option, recreational fishermen in the lobster fishery must abide by any gauge size changes and season closures that are implemented in their LCMA as a result of this addendum. Recreational fishermen would be exempt from trap reductions taken in the LCMA in which they fish.

Option C: Recreational Fishery Must Abide by Gauge Size Changes
Under this option, recreational fishermen in the lobster fishery must abide by any gauge size changes that are implemented as a result of this addendum. Recreational fishermen would be exempt from any trap reductions or season closures implemented in the LCMA in which they fish. Recreational fishermen with a trap allocation would be allowed to keep their pots in the water and land lobster during a season closure that is implemented as a result of this addendum.

Issue 4: Season Closures
This issue asks how seasonal closures, which are established as a result of this Addendum, should be implemented. Season closures implemented in LCMAs 4, 5, and 6 as a result of Addendum XVII currently require lobster traps to be removed from the water and prohibit harvesters from taking, landing, or selling lobster from that LCMA during the closure. Connecticut and New Jersey allows lobster traps to remain in the water only if the license holder has a permit for another species. Since Addendum XVII, a fishery management plan was established for Jonah crab, and the Jonah crab and lobster fisheries are now jointly managed as a mixed-crustacean fishery. As such, the removal of traps during a season closure may negatively impact the Jonah crab fishery. The greatest biological benefit of a season closure is achieved when traps are removed from the water as the hauling and discarding of lobsters can increase stress and predation.

Option A: Lobster Traps Removed from Water
Under this option, lobster traps must be removed from the water during a season closure. No lobsters can be landed by any gear type including non-trap gear (trawls, gill nets, etc.) and trap gears (lobster traps, fish pots, whelk pots, etc.). During a season closure, lobster potters will have a two week period to remove lobster traps from the water and may set baited lobster traps one week prior to the end of the closed season.

Sub-Option A: Most Restrictive Rule Applies: Under this sub-option the most restrictive rule would apply to season closures. For example, if a fisherman is authorized to fish in LCMAs 2 and 3, and LCMA 2 implements a season closure, that fisherman cannot fish in either LCMA 2 or 3 during the closure.

Sub-Option B: Most Restrictive Rule Does Not Apply: Under this sub-option, the most restrictive rule would not apply to season closures. For example, if a fisherman is authorized to fish in LCMAs 2 and 3, and LCMA 2 implements a season closure while LCMA 3 does not, that fisherman could still fish in LCMA 3 while LCMA 2 is closed. The most restrictive rule would apply in the Area 2-3 overlap and the Area 3-5 overlap zones.

Option B: No Possession of Lobsters While Fishing
Under this option, no commercial harvester may possess on board or land lobsters during a season closure. Lobster traps, as well as other gears which harvest lobster, may remain in the water during a season closure and Jonah crab and whelk may be harvested during a season closure.

> Sub-Option A: Most Restrictive Rule Applies: Under this sub-option the most restrictive rule would apply to season closures. For example, if a fisherman is authorized to fish in LCMAs 2 and 3, and LCMA 2 implements a season closure, that fisherman cannot fish in either LCMA 2 or 3 during the closure.
>
> Sub-Option B: Most Restrictive Rule Does Not Apply: Under this sub-option, the most restrictive rule would not apply to season closures. For example, if a fisherman is authorized to fish in LCMAs 2 and 3, and LCMA 2 implements a season closure while LCMA 3 does not, that fisherman could still fish in LCMA 3 while LCMA 2 is closed. The most restrictive rule would apply in the Area 2-3 overlap and the Area 3-5 overlap zones.

Option C: Limit for Non-Trap Bycatch Fisheries
Under this option, a fisherman with a lobster trap allocation may not possess on board or land lobsters during a season closure but lobster traps may remain in the water and Jonah crab and whelk may be harvested. Individuals who are permitted to land lobsters incidentally caught in non-trap gears may continue to land the bycatch allowance established in Amendment 3 of 100 lobsters per day (based on a 24 hour period) up to a maximum of 500 lobster per trip, for trips 5 days or longer. Addendum I categorized the black sea bass pot fishery as a non-trap fishery. As a result, vessels issued an Area 5 trap waiver to fish for black sea bass are allowed to land lobster equivalent to the bycatch allowance established for non-trap gears.

> Sub-Option A: Most Restrictive Rule Applies: Under this sub-option the most restrictive rule would apply to season closures. For example, if a fisherman is authorized to fish in LCMAs 2 and 3, and LCMA 2 implements a season closure, that fisherman cannot fish in either LCMA 2 or 3 during the closure.
>
> Sub-Option B: Most Restrictive Rule Does Not Apply: Under this sub-option, the most restrictive rule would not apply to season closures. For example, if a fisherman is authorized to fish in LCMAs 2 and 3, and LCMA 2 implements a season closure while LCMA 3 does not, that fisherman could still fish in LCMA 3 while LCMA 2 is closed. The most restrictive rule would apply in the Area 2-3 overlap and the Area 3-5 overlap zones.

Issue 5: Uniform Regulations
This issue asks whether management measures should be uniform across LCMAs. See Section 2.7.1 Uniform Regulations for additional information.

Option A: Regulations Are Not Uniform Across LCMAs (Status Quo)
Under this option, regulations would not need to be standardized across management areas. LCMAs would be allowed to develop their own plans for how to achieve the target increase in egg production.

Option B: Regulations Are Uniform Across LCMAs 4 and 5
Under this option, gauge size changes and season closures would be standardized in LCMAs 4 and 5. Existing season closures implemented as a result of Addendum XVII must be reconciled such that they achieve the decrease in fishing mortality specified in Addendum XVII and the increase in egg production specified in Addendum XXV.

Option C: Regulations Are Uniform Across LCMAs 2, 4, 5, and 6
Under this option, gauge size changes and season closures would be standardized in LCMAs 2, 4, 5 and 6. Existing season closures implemented as a result of Addendum XVII must be reconciled such that they achieve the decrease in fishing mortality specified in Addendum XVII and the increase in egg production specified in Addendum XXV.

Issue 6: Implementation of Management Measures in LCMA 3
The following management options are intended to determine where in LCMA 3 the management measures selected in this addendum will apply. See Section 2.7.2 Stock Boundaries for additional information. Due to implications to the Trap Tag Data Base Program, trap reductions must be applied throughout LCMA 3.

Option A: Maintain LCMA 3 as a Single Area (Status Quo)
Under this option, the current boundaries of LCMA 3 would be maintained. Management measures in this document would apply to all LCMA 3 permit holders, including those that fish in the GOM/GBK stock.

Option B: Split LCMA 3 along the 70°W Longitude Line
Under this option, LCMA 3 would be split along the 70°W longitude line to create an eastern section and a western section in LCMA 3 (see Appendix 1). The eastern portion of LCMA 3 would be comprised of areas east of the 70°W longitude line which are currently a part of the GOM/GBK stock. The western portion of LCMA 3 would be comprised of areas west of the 70°W longitude line which are currently a part of the SNE stock.

LCMA 3 permit holders would make a one-time declaration into either the eastern or western portion of LCMA 3 and would only be allowed to fish in their declared portion of LCMA 3. Trap tags would be amended to include “3E” for fishermen exclusively fishing in the eastern portion of the LCMA and “3W” for fishermen exclusively fishing in the western portion of the LCMA. Traps with “3E” trap tags can only be fished in the eastern portion of LCMA 3 while traps with “3W” can only be fished in the western portion of LCMA 3.

LCMA 3 permits and trap allocations may still be transferred as specified in Addendum XXI and the transfer recipient will designate in which section he/she would like to fish. Season closures and gauge size changes that are implemented as a result of this addendum would not apply for fishermen who elect to fish exclusively in the eastern portion of LCMA 3.

<u>Option C: Split LCMA 3 along the 70^{o}W Longitude Line with an Annual Declaration</u>
Under this option, LCMA 3 would be split along the 70^{o}W longitude line to create an eastern section and a western section in LCMA 3 (see Appendix 1). The eastern portion of LCMA 3 would be comprised of areas east of the 70^{o}W longitude line which are currently a part of the GOM/GBK stock. The western portion of LCMA 3 would be comprised of areas west of the 70^{o}W longitude line which are currently a part of the SNE stock.

On an annual basis, current LCMA 3 fishermen could elect to fish exclusively in the eastern portion of LCMA 3. Fishermen who do not choose this option could fish throughout the entire LMCA 3; however, they will be held to the stricter management measures of the two sections, as per the most restrictive rule (ASMFC, 2009). Fishermen can elect to fish exclusively in the eastern portion of LCMA 3 at the start of the fishing year but not during a fishing season. Trap tags would be amended to include "3E" for fishermen exclusively fishing in the eastern portion of the LCMA and traps with "3E" trap tags can only be fished in the eastern portion of LCMA 3. All other LCMA 3 trap tags can be fished in the eastern or western portions of LCMA 3.

LCMA 3 permits and trap allocations may still be transferred as specified in Addendum XXI and the transfer recipient will designate at the start of the fishing year in which section he/she would like to fish. Season closures and gauge size changes adopted in this addendum would not apply for fishermen who elect to fish exclusively in the eastern portion of LCMA 3.

<u>Option D: Split LCMA 3 along the 70^{o}W Longitude Line with an Overlap Area</u>
Under this option, LCMA 3 would be split along the 70^{o}W longitude line to create an eastern section and a western section in LCMA 3 with an overlap area of 30' on either side of the 70^{o}W longitude line. The eastern boundary of the LCMA 3 overlap would be comprised of the area west of the 69^{o} 30' W longitude line. The western boundary of the overlap would be comprised of the area east of 70^{o} 30' W longitude line. Within this overlap area, permit holders who declare fishing activity in either the eastern or western portions of LCMA 3 would be allowed to fish for Lobster or Jonah crab regardless of their LCMA 3 sub-area declaration. The western portion of LCMA 3 would be comprised of areas west of the 70^{o} 30' W longitude line which are currently a part of the SNE stock. The eastern portion of LCMA 3 would be comprised of areas east of the 69^{o} 30' W longitude line which are currently a part of the GOM/GBK stock.

On an annual basis, LCMA 3 fishermen could elect to fish exclusively in the western or eastern portions of LCMA 3, while being allowed to fish annually in the overlap zone without the need to change their area declaration. In the overlap zone, the fishermen would be held to the management measures of the sub-area declared. Fishermen can elect to fish exclusively in either portion of LCMA 3 at the start of the fishing year but not during a fishing season. Trap tags would be amended to include "3E" for fishermen exclusively fishing in the eastern portion of the LCMA and "3W" for fishermen exclusively fishing in the western portion of the LCMA. Traps with "3E" trap tags can only be fished in the eastern portion of LCMA 3 or the overlap area while traps with "3W" can only be fished in the western portion of LCMA 3 or the overlap area.

LCMA 3 permits and trap allocations may still be transferred as specified in Addendum XXI and the transfer recipient will designate at the start of the fishing year in which section he/she would like to fish. Season closures and gauge size changes adopted in this addendum would not apply for fishermen who elect to fish exclusively in the eastern portion of LCMA 3.

Issue 7: Management Action in De Minimis States
This issue asks whether de minimis states can be exempt from implementing the management measures adopted in this Addendum. See Section 2.7.3 De Minimis for additional information.

<u>Option 1: De Minimis States Must Implement Provisions of Addendum XXV (Status Quo)</u>
Under this option, *de minimis* states must implement all management measures adopted as a part of Addendum XXV.

<u>Option 2: De Minimis States Exempt from Provisions of Addendum XXV</u>
Under this option, a *de minimis* state is not required to implement the management measures adopted under Addendum XXV provided the *de minimis* state meets the following conditions:

a) Close the lobster fishery in the *de minimis* state to new entrants. A fisherman can complete a full business sale to another fisherman eligible to land lobsters in the same state.
b) Allow only lobster permit/license holders of the *de minimis* state to land lobsters in that state.
c) Limit landings in the *de minimis* state lobster fishery to the *de minimis* level of no more than 40,000 lbs. annually.

Table 11: Changes in the gauge size inshore (LCMAs 2, 4, 5, and 6) and offshore (LCMA 3) and the corresponding effects in egg production, exploitation, SSB, reference abundance, and catch. Each LCMT may use this table to propose how they will achieve the targeted increase in egg production.

		Min	Max	Harvest Window (mm)	Egg Production	Exploitation	Spawning Stock Biomass	Reference Abundance	Catch
20%	**Inshore**	88mm (3-15/32”)	105mm (4-1/8”)	17 (0.7”)	20%	-18%	20%	9%	-11%
		91mm (3-9/16”)	115mm (4 ½”)	24 (0.9”)	18%	-22%	22%	11%	-14%
		92mm (3-5/8”)	165mm (6 ½”)	73 (2.9”)	20%	-27%	25%	13%	-17%
	Offshore	91mm (3-9/16”)	105mm (4-1/8”)	14 (0.6”)	22%	-21%	22%	9%	-13%
		94mm (3-11/16”)	115mm (4 ½”)	21 (0.8”)	20%	-26%	24%	12%	-17%
		95mm (3 ¾”)	165mm (6 ½”)	70 (2.8”)	21%	-28%	26%	13%	-19%
30%	**Inshore**	94mm (3-11/16”)	115mm (4 ½”)	21 (0.8”)	31%	-36%	38%	19%	-24%
		94mm (3-11/16”)	125mm (4-9/10”)	31 (1.2”)	29%	-35%	36%	18%	-23%
	Offshore	96mm (3-25/32”)	115mm (4 ½”)	19 (0.7”)	29%	-34%	34%	16%	-24%
		97mm (3-4/5”)	165mm (6 ½”)	68 (2.7”)	31%	-38%	38%	18%	-27%
40%	**Inshore**	96mm (3-25/32”)	115mm (4 ½”)	19 (0.7”)	40%	-43%	49%	23%	-30%
		96mm (3-25/32”)	165mm (6 ½”)	69 (2.7”)	37%	-42%	46%	22%	-29%
		97mm (3-4/5”)	165mm (6 ½”)	68 (2.7”)	43%	-46%	53%	25%	-33%
	Offshore	98mm (3-27/32”)	165mm (6 ½”)	67 (2.6”)	39%	-45%	46%	22%	-33%
		99mm (3-7/8”)	165mm (6 ½”)	66 (2.6”)	41%	-47%	49%	23%	-35%
60%	**Inshore**	99 mm (3-7/8”)	115mm (4 ½”)	16 (0.6”)	60%	-56%	71%	32%	-42%
		101mm (3-29/32”)	165mm (6 ½”)	64 (2.5”)	59%	-59%	76%	35%	-45%
	Offshore	102mm (4”)	115mm (4 ½”)	13 (0.5”)	62%	-60%	71%	31%	-47%
		103mm (4-1/16”)	165mm (6 ½”)	62 (2.4”)	63%	-63%	75%	34%	-50%

Table 12: Trap reductions in active SNE traps and the corresponding effects in egg production and exploitation. "All years" include data from 1981-2013 and "recent years" include data from 1999-2013. This split is done to reflect two apparent regimes in the relationship between fishing exploitation and actively fished traps. This table presumes that every trap reduced is active and that latent traps purchased through the Trap Transferability Program do not replace reduced active traps.

Years	Trap Reduction	Egg Production	Exploitation	Spawning Stock Biomass	Catch
All Years (1981-2013)	25%	9.6% (95% CI: 4.5%-13.0%)	-11.6% (95% CI: 6.5% - 16.3%)	14.4%	-6.9%
Recent Years (1999-2013)	25%	13.1% (95% CI: 2.6% - 19.7%)	-14.3% (95% CI: 3.5% - 21.2%)	15.6%	-10.2%

Table 13: Season closures in SNE and the corresponding effects in egg production, exploitation, SSB, and catch. Each LCMT may use this table to propose how they will achieve the targeted increase in egg production. This table assumes that fishermen do not intensify fishing effort during open seasons.

Season Closure	Egg Production	Exploitation	Spawning Stock Biomass	Catch
Winter (Jan-March)	3.0%	-2.1%	2.3%	-0.7%
Spring (April-June)	15.0%	-10.8%	16.0%	-1.7%
Summer (July-Sept)	21.6%	-26.0%	15.5%	-12.3%
Fall (Oct-Dec)	8.1%	-13.6%	8.4%	-4.2%

4.0 Monitoring

Given that Addendum XXV represents an initial response to the results of the 2015 Stock Assessment, monitoring is necessary to determine the need and extent of future management action. The stated goal of this addendum is to increase egg production and reduce fishing mortality. As a result, the exploitation rate of the SNE stock will be monitored. If a reduction in fishing mortality and a corresponding increase in egg production is not observed following the implementation of this addendum, the management tools implemented by this document will be re-evaluated. Furthermore, in order to determine the extent of future management action, model-free abundance indicators for the SNE stock will be updated each year as a part of the annual Fishery Management Plan Review. This includes information on spawning stock abundance, recruit abundance, young-of-year indices, and survey encounter rates.

5.0 Compliance

If the existing lobster management plan is revised by approval of this Draft Addendum, the American Lobster Management Board will designate dates by which states will be required to implement the addendum. A final implementation schedule will be identified based on the target egg production and management tools chosen. In August 2016, the Board initially specified a two year implementation timeline; however, the length of the phase-in period may change with the degree of egg production increase chosen (i.e. a 60% increase in egg production may necessitate a longer implementation period than a 20% increase in egg production). The compliance schedule will take the following format:

XXXXX:	States must submit programs to implement Addendum XXV for approval by the American Lobster Management Board. These programs must reflect the management changes that will occur in each LCMA for which the state has a permitted individual.
XXXXX:	The American Lobster Management Board approves state proposals
XXXXX:	All states must implement Addendum XXV through their approved management programs. States may begin implementing management programs prior to this deadline if approved by the American Lobster Management Board.

6.0 Recommendation for Federal Waters

The SNE lobster resource has been reduced to very low levels. ASMFC believes additional fishery restrictions are necessary to prevent further depletion of the resource.

Management of American lobster in the EEZ is the responsibility of the Secretary of Commerce through the National Marine Fisheries Service (NMFS). ASMFC recommends the federal government promulgate all necessary regulations in Section 3.0 to implement complementary measures to those approved in this addendum.

7.0 References

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Appendix 1: LCMAs, stock boundaries, and NMFS statistical areas.

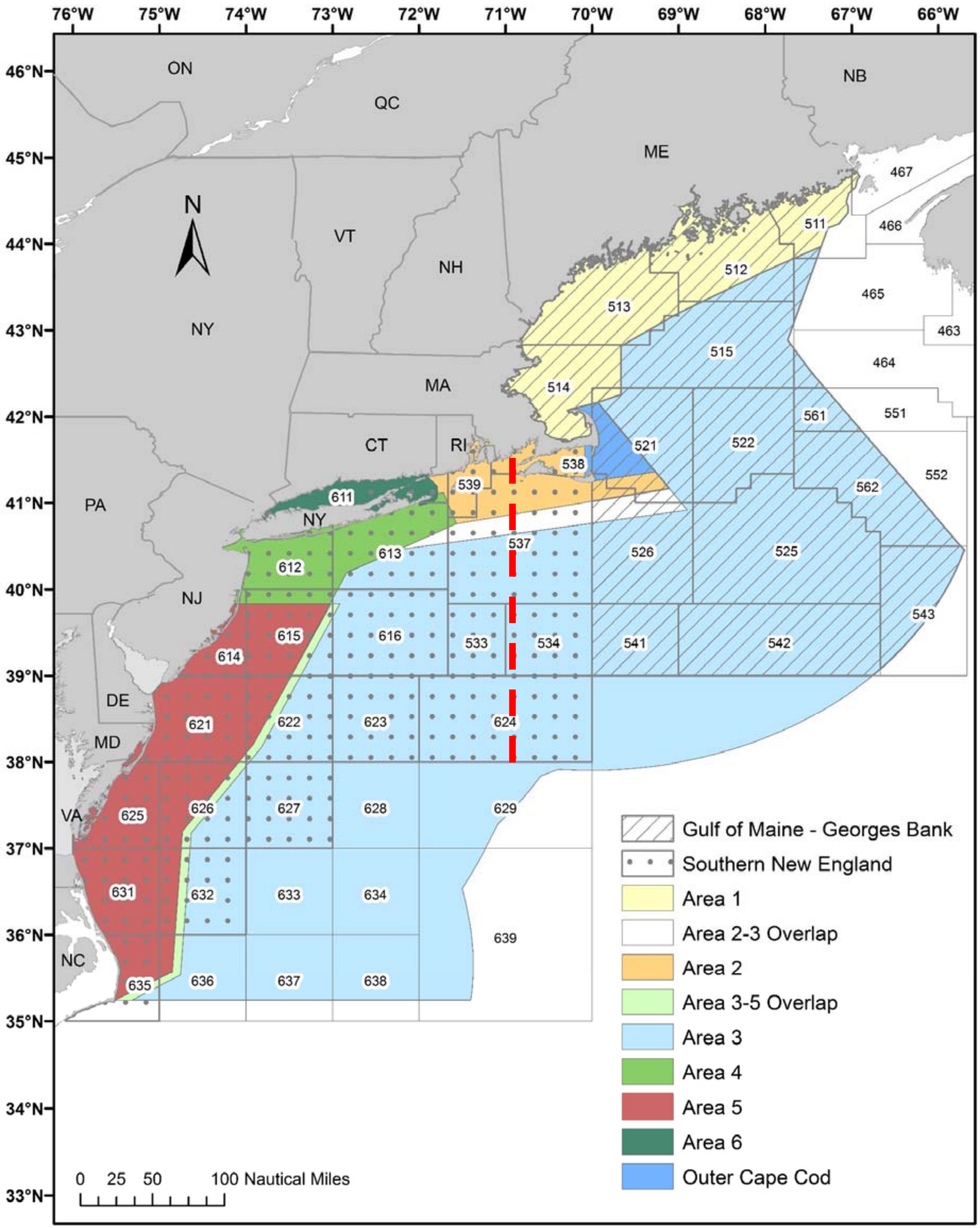

Figure 1. Chart of Lobster stock units (GOM, GMB, and SNE), management conservation areas (1-6 and OCC), and NMFS statistical areas. The red dashed line represents the 70°W longitude line

Appendix 2: Southern New England Model Free Abundance Indicators

SPAWNING STOCK ABUNDANCE Mean weight (g) per tow of mature females								
Survey	NESFC		MA		RI		CT	
	Fall	spring	fall	spring	Fall	spring	Fall	spring
1981	198.93	15.71	9.21	99.78	161.55	111.57		
1982	156.07	118.29	50.04	26.42	53.52	43.52		
1983	120.20	35.51	0.72	59.62	87.86	141.69		
1984	192.38	44.50	4.04	51.67	203.58	259.91	2331.33	
1985	132.96	138.13	1.88	36.90	125.09	60.22	1040.42	1155.01
1986	59.83	61.35	87.60	19.06	128.49	136.78	1548.94	751.75
1987	143.76	67.33	44.51	35.12	475.51	86.13	1869.91	932.49
1988	122.36	121.34	13.16	46.33	662.07	100.75	1081.60	639.82
1989	124.57	44.65	233.88	70.68	363.92	151.06	853.74	1193.87
1990	175.83	75.87	59.02	150.21	230.17	258.72	1818.59	2369.93
1991	160.99	53.14	125.79	236.11	367.25	698.35	2185.29	2692.42
1992	178.88	61.38	179.80	47.84	321.95	117.18	1905.99	3598.02
1993	139.25	71.48	99.33	25.59	1286.74	1595.77	3335.55	2320.25
1994	54.70	36.40	126.00	82.42	359.96	164.37	3402.43	1170.49
1995	145.39	10.18	10.89	92.76	410.53	153.14	2253.58	3302.56
1996	227.08	32.01	59.61	54.16	861.32	353.55	3018.00	3882.27
1997	121.74	137.20	29.11	225.15	654.91	439.93	7173.56	5994.27
1998	161.20	44.97	52.73	138.81	251.53	286.59	2573.44	7738.30
1999	69.56	122.59	24.53	81.12	171.54	324.62	2546.24	8261.90
2000	95.66	60.02	20.08	142.78	268.99	303.32	1744.69	4430.68
2001	95.78	36.43	21.28	16.61	267.62	535.45	1513.56	3363.78
2002	85.56	146.86	0.00	44.75	35.68	572.35	365.12	2044.42
2003	52.83	31.71	0.00	5.97	205.85	110.43	1187.14	698.04
2004	47.10	47.01	37.18	3.58	288.49	591.60	626.96	522.99
2005	110.36	42.31	101.87	23.02	353.53	243.36	473.26	479.71
2006	65.03	90.62	0.00	60.77	465.26	788.63	219.99	465.37
2007	44.60	34.20	41.79	10.32	350.43	206.96	188.98	595.89
2008	25.90	58.14	0.00	19.67	401.73	194.57	248.63	760.88
2009	36.92	24.49	3.95	31.29	184.35	250.00	305.31	371.95
2010	101.74	46.39	130.73	32.09	166.07	177.64	na	361.72
2011	89.95	22.79	36.96	8.55	148.47	152.43	30.24	64.00
2012	205.12	39.64	14.13	9.93	31.16	118.13	6.28	88.85
2013	52.95	42.05	23.96	35.49	2.02	67.76	24.56	39.81
2014	50.93	198.30	0.10	20.95	190.12	24.98	23.00	34.02
2015	na	44.83	54.57	1.72	62.34	15.60	na	23.02
2011 - 2015 ave.	99.74	69.52	25.95	15.33	86.82	75.78	21.02	49.94
25th	93.14	42.48	12.59	36.45	205.28	131.88	1431.95	1162.75
median	128.76	60.69	36.81	52.92	295.47	259.32	1887.95	2369.93
75th	161.04	87.24	90.53	104.27	426.78	375.15	2553.04	3740.14

FULL RECRUIT ABUNDANCE (SURVEY) Abundance of lobsters > 85 mm CL (sexes combined)								
Survey	NEFSC		MA		RI		CT	
	Fall	spring	fall	spring	Fall	spring	Fall	spring
1981	0.24	0.03	0.00	0.02	0.01	0.03		
1982	0.17	0.13	0.07	0.02	0.04	0.03		
1983	0.13	0.03	0.00	0.07	0.13	0.08		
1984	0.24	0.04	0.07	0.03	0.16	0.31	2.67	
1985	0.12	0.07	0.00	0.00	0.10	0.07	0.81	1.06
1986	0.06	0.12	0.05	0.00	0.08	0.11	2.73	0.63
1987	0.19	0.05	0.05	0.05	0.31	0.04	1.62	0.99
1988	0.15	0.04	0.00	0.03	0.83	0.09	1.26	0.82
1989	0.20	0.07	0.20	0.07	0.24	0.05	1.00	1.41
1990	0.19	0.05	0.05	0.05	0.38	0.10	2.39	1.35
1991	0.20	0.04	0.23	0.19	0.44	0.37	1.34	3.26
1992	0.20	0.07	0.22	0.05	0.34	0.10	2.37	1.44
1993	0.14	0.10	0.12	0.02	1.12	1.42	1.55	0.68
1994	0.08	0.03	0.00	0.00	0.55	0.10	3.75	0.50
1995	0.15	0.01	0.01	0.05	0.33	0.07	2.20	1.85
1996	0.22	0.02	0.06	0.08	0.82	0.19	1.97	1.96
1997	0.11	0.19	0.02	0.10	0.98	0.08	4.00	4.44
1998	0.25	0.00	0.04	0.00	0.17	0.17	1.48	4.10
1999	0.08	0.07	0.00	0.16	0.27	0.26	1.70	3.27
2000	0.08	0.08	0.08	0.08	0.30	0.32	0.95	2.44
2001	0.10	0.07	0.02	0.03	0.10	0.32	0.35	2.47
2002	0.08	0.08	0.00	0.08	0.00	0.20	0.03	1.35
2003	0.08	0.05	0.00	0.06	0.29	0.07	0.62	0.35
2004	0.07	0.04	0.04	0.00	0.26	0.41	0.27	0.30
2005	0.12	0.07	0.06	0.00	0.30	0.33	0.21	0.25
2006	0.11	0.06	0.00	0.14	0.24	0.65	0.03	0.20
2007	0.07	0.03	0.05	0.01	0.32	0.15	0.03	0.24
2008	0.07	0.06	0.00	0.02	0.74	0.12	0.19	0.66
2009	0.07	0.03	0.00	0.01	0.17	0.19	0.24	0.32
2010	0.11	0.05	0.15	0.07	0.07	0.12	na	0.26
2011	0.10	0.04	0.07	0.00	0.14	0.16	0.01	0.07
2012	0.19	0.05	0.03	0.02	0.02	0.09	0.03	0.06
2013	0.08	0.09	0.03	0.07	0.00	0.02	0.03	0.07
2014	0.07	0.18	0.00	0.02	0.00	0.00	0.01	0.04
2015	na	0.06	0.05	0.02	na	0.00	na	0.02
2011 - 2015 ave.	0.11	0.08	0.03	0.03	0.04	0.06	0.02	0.05
25th	0.08	0.04	0.00	0.03	0.17	0.07	0.99	0.91
median	0.14	0.06	0.04	0.05	0.31	0.10	1.59	1.41
75th	0.20	0.08	0.07	0.08	0.46	0.28	2.38	2.46

RECRUIT ABUNDANCE (SURVEY) Abundance of lobsters 71 - 80 mm CL (sexes combined)								
Survey	***NEFSC***		***MA***		***RI***		***CT***	
	Fall	***spring***	***fall***	***spring***	***Fall***	***spring***	***Fall***	***spring***
1981	0.40	0.05	0.07	0.65	1.31	0.89		
1982	0.29	0.24	0.04	0.10	0.62	0.26		
1983	0.28	0.14	0.04	0.09	0.43	0.94		
1984	0.19	0.04	0.01	0.42	1.21	1.03	8.62	
1985	0.34	0.78	0.09	0.34	0.97	0.26	5.03	4.73
1986	0.14	0.09	0.20	0.17	1.30	0.75	8.22	3.45
1987	0.20	0.33	0.17	0.27	2.53	0.79	9.46	3.90
1988	0.26	0.09	0.16	0.24	4.14	0.42	4.82	2.16
1989	0.52	0.04	0.43	0.14	3.26	0.93	6.32	5.51
1990	0.36	0.29	0.31	2.29	1.38	2.17	10.31	9.53
1991	0.24	0.18	0.87	1.18	3.05	4.77	14.23	15.39
1992	0.38	0.06	0.57	0.10	1.97	0.67	12.25	16.55
1993	0.17	0.29	0.52	0.25	8.29	7.81	21.46	10.69
1994	0.12	0.10	0.42	0.95	3.64	1.00	18.87	5.90
1995	0.28	0.00	0.03	1.14	4.48	1.36	15.30	16.31
1996	0.77	0.14	0.32	0.40	6.42	1.60	14.91	16.30
1997	0.56	0.62	0.12	1.45	6.10	2.58	40.43	25.49
1998	0.46	0.37	0.11	1.09	3.38	1.63	18.61	37.56
1999	0.20	0.92	0.19	0.75	2.10	1.64	20.22	40.84
2000	0.40	0.30	0.13	0.54	1.83	1.54	12.71	20.72
2001	0.17	0.14	0.03	0.18	2.21	3.03	11.94	19.12
2002	0.17	0.62	0.00	0.34	0.75	2.73	3.52	11.44
2003	0.12	0.21	0.00	0.07	1.00	0.29	5.56	4.58
2004	0.12	0.11	0.00	0.05	1.48	1.86	4.52	2.92
2005	0.08	0.06	0.00	0.08	2.48	1.02	2.14	2.67
2006	0.12	0.14	0.03	0.08	2.26	3.63	1.38	2.12
2007	0.11	0.12	0.00	0.08	2.76	0.73	1.35	2.86
2008	0.12	0.14	0.01	0.16	2.98	0.64	1.43	3.10
2009	0.05	0.05	0.05	0.16	1.36	1.14	1.72	1.55
2010	0.14	0.05	0.18	0.06	1.21	0.44	na	1.41
2011	0.12	0.03	0.00	0.18	1.02	0.42	0.19	0.42
2012	0.16	0.04	0.21	0.07	0.27	0.61	0.14	0.50
2013	0.10	0.02	0.04	0.11	0.02	0.18	0.06	0.23
2014	0.14	0.52	0.00	0.04	0.14	0.02	0.05	0.15
2015	NA	0.01	0.30	0.07	na	0.05	na	0.15
2011 - 2015 ave.	**0.13**	**0.12**	**0.11**	**0.09**	**0.36**	**0.26**	**0.11**	**0.29**
25th	0.17	0.09	0.08	0.23	1.36	0.78	7.74	5.12
median	0.25	0.20	0.17	0.37	2.37	1.45	12.09	11.44
75th	0.38	0.34	0.35	0.99	3.77	2.27	16.13	17.84

YOUNG-OF-YEAR INDICES				
	YOY	**YOY**	**Larvae**	**Postlarvae**
Survey	***MA***	***RI***	***CT / ELIS*** *Summer*	***CT_NY / WLIS*** *Summer*
1981				
1982				
1983				14.48
1984			0.43	6.89
1985			0.53	66.75
1986			0.90	4.58
1987			0.78	18.98
1988			0.74	49.27
1989			0.74	5.88
1990		1.31	0.81	19.66
1991		1.49	0.55	9.97
1992		0.63	1.44	14.12
1993		0.51	1.19	26.23
1994		1.23	0.98	96.52
1995	0.17	0.33	1.46	18.20
1996	0.00	0.15	0.31	12.07
1997	0.08	0.99	0.21	13.69
1998	0.20	0.57	0.55	4.85
1999	0.03	0.92	2.83	39.70
2000	0.33	0.34	0.78	14.28
2001	0.10	0.75	0.32	9.46
2002	0.10	0.25	0.64	1.99
2003	0.03	0.79	0.25	2.60
2004	0.03	0.42	0.45	6.10
2005	0.13	0.53	0.49	6.90
2006	0.17	0.44	0.71	1.70
2007	0.10	0.36	0.37	18.10
2008	0.00	0.14	0.37	8.10
2009	0.03	0.08	0.19	7.62
2010	0.00	0.11	0.35	9.91
2011	0.03	0.00	0.26	5.90
2012	0.00	0.09	0.12	2.77
2013	0.13	0.22	0.16	no data
2014	0.07	0.22	0.06	no data
2015	0.00	0.14	na	no data
2011 - 2015 ave.	**0.05**	**0.13**	**0.15**	**4.34**
25th	0.03	0.39	0.50	6.64
median	0.10	0.69	0.74	13.91
75th	0.17	0.97	0.92	21.30

SURVEY LOBSTER ENCOUNTER RATE								
Proportion of postive tows								
Survey	***NEFSC***		***MA***		***RI***		***CT***	
	Fall	***spring***	***fall***	***spring***	***Fall***	***spring***	***Fall***	***spring***
1981			0.15	0.38	0.54	0.49		
1982	0.34	0.24	0.21	0.28	0.59	0.30		
1983	0.22	0.14	0.16	0.21	0.36	0.45		
1984	0.27	0.09	0.18	0.40	0.45	0.59	0.76	0.72
1985	0.30	0.20	0.22	0.51	0.50	0.31	0.69	0.57
1986	0.25	0.19	0.38	0.39	0.43	0.64	0.61	0.67
1987	0.23	0.13	0.18	0.28	0.47	0.33	0.76	0.63
1988	0.27	0.08	0.21	0.39	0.59	0.49	0.66	0.65
1989	0.37	0.11	0.33	0.50	0.55	0.52	0.63	0.75
1990	0.43	0.14	0.44	0.66	0.54	0.66	0.76	0.73
1991	0.29	0.13	0.39	0.41	0.69	0.77	0.78	0.81
1992	0.31	0.23	0.23	0.51	0.57	0.41	0.69	0.78
1993	0.26	0.09	0.26	0.54	0.73	0.50	0.77	0.74
1994	0.23	0.09	0.20	0.51	0.57	0.56	0.74	0.73
1995	0.33	0.06	0.13	0.44	0.67	0.55	0.68	0.77
1996	0.41	0.08	0.16	0.30	0.76	0.79	0.78	0.68
1997	0.28	0.24	0.21	0.45	0.71	0.75	0.81	0.71
1998	0.30	0.11	0.13	0.54	0.55	0.59	0.71	0.83
1999	0.29	0.18	0.21	0.41	0.59	0.76	0.79	0.78
2000	0.30	0.13	0.15	0.45	0.63	0.68	0.73	0.82
2001	0.24	0.18	0.18	0.28	0.61	0.64	0.58	0.77
2002	0.21	0.19	0.03	0.28	0.45	0.63	0.59	0.73
2003	0.25	0.11	0.03	0.14	0.40	0.53	0.63	0.71
2004	0.20	0.10	0.03	0.28	0.50	0.54	0.66	0.61
2005	0.20	0.08	0.15	0.34	0.45	0.50	0.55	0.63
2006	0.23	0.13	0.03	0.43	0.61	0.81	0.53	0.61
2007	0.19	0.15	0.10	0.34	0.54	0.43	0.53	0.70
2008	0.24	0.11	0.10	0.33	0.52	0.55	0.65	0.63
2009	0.28	0.16	0.05	0.50	0.40	0.57	0.55	0.49
2010	0.30	0.09	0.24	0.23	0.45	0.47	na	0.54
2011	0.32	0.11	0.05	0.18	0.23	0.29	0.28	0.46
2012	0.32	0.12	0.15	0.18	0.16	0.29	0.20	0.44
2013	0.24	0.09	0.08	0.18	0.09	0.20	0.15	0.28
2014	0.24	0.23	0.08	0.13	0.23	0.07	0.10	0.26
2015	na	0.054	0.05	0.10	na	0.12	0.10	0.27
2011 - 2015 ave.	**0.28**	**0.12**	**0.08**	**0.15**	**0.18**	**0.19**	**0.17**	**0.34**

25th	0.25	0.09	0.16	0.37	0.49	0.52	0.65	0.70
median	0.29	0.13	0.20	0.42	0.57	0.59	0.72	0.73
75th	0.31	0.18	0.24	0.51	0.64	0.66	0.76	0.77

Appendix 3. Bottom Water Temperatures

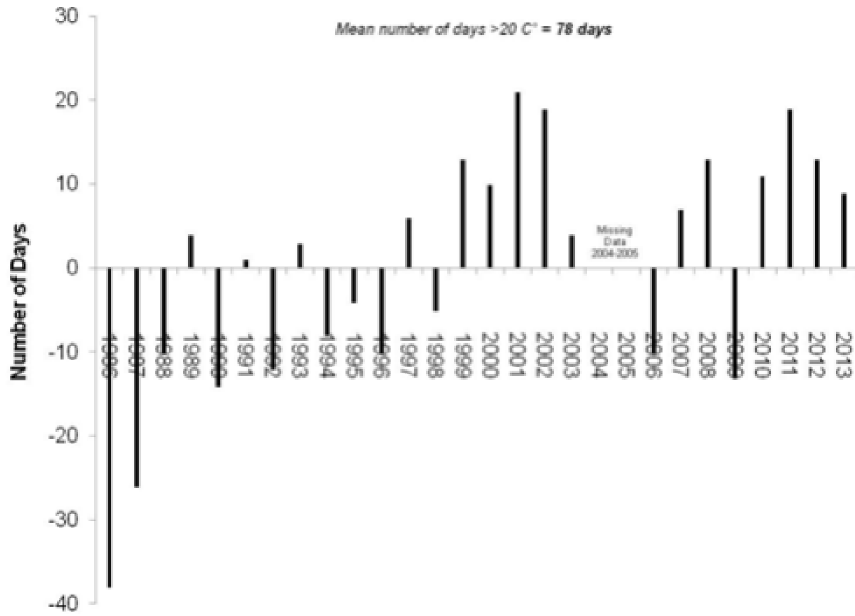

Figure 1: Bottom water (11m) temperature anomalies from the mean number of days >20°C at Cleveland Ledge, Buzzards Bay, MA, 1986-2013. Source: 2015 Benchmark Stock Assessment.

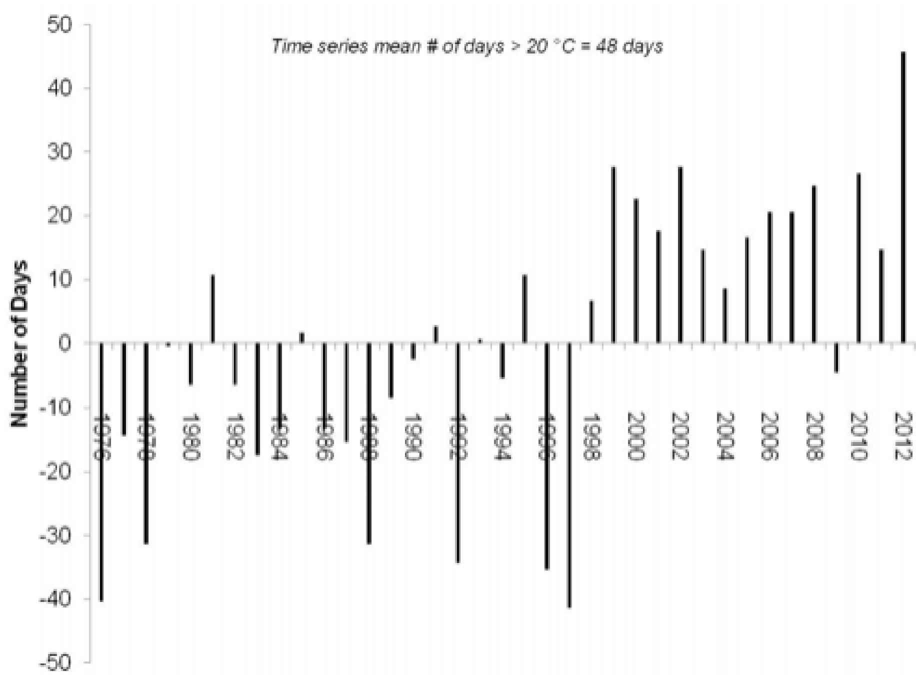

Figure 2: Bottom water (11m) temperature anomalies from the mean number of days >20°C at Dominion Nuclear Power Station, eastern Long Island Sound, CT, 1976-2012.

Appendix 4: Southern New England Stock Projections

The American Lobster Technical Committee (TC) met on December 8th to review projections for the Southern New England (SNE) lobster stock. Below are the series of projections that the TC unanimously recommends for Board consideration. These projections represent two potential scenarios. In the first scenario, recruitment is assumed to be independent of stock biomass and stable at current estimated levels. While this can limit the potential for rebuilding, it is perhaps the more realistic of the two scenarios given that recruitment has been declining for the past couple decades.

In the second scenario, future recruitment is linked to the spawning stock via a Beverton-Holt stock-recruitment relationship. This is perhaps less realistic than the first scenario with regards to stock rebuilding but more realistic for the continued decline of the population because recruitment decreases with further depletion of the spawning stock.

Under the first scenario with fixed recruitment, an 80% to 90% reduction in harvest rate is projected to stabilize the stock at current levels, assuming natural mortality also stabilizes at current levels; even lower harvest rates show some potential for recovery. Under the second scenario with recruitment linked to spawning stock, a 75% reduction in harvest rate would be needed to stabilize the stock under current natural mortality conditions.

The TC ran stock projections to examine population responses under various levels of natural mortality (M) and fishing mortality (F). It is important to note that here F is used to represent the proportion of current catch levels by weight, not a fishery removal rate as is typical. In plots where F was fixed at zero, M varied from 0.15 to 0.5. The effect of varying M on population projections is presented and highlights the sensitivity to the assumed value of M.

The projections are shown in two different units: reference abundance (N) and spawning stock biomass (SSB). Reference abundance is the number of lobsters 78+ mm carapace length on January 1st plus the number that will molt and recruit to the 78+ group during the year. Current reference points are also expressed in N. SSB is the total weight of mature lobsters (both sexes) in the stock. In the projections, SSB shows greater recovery potential than reference abundance because SSB is the product of abundance at-size, the probability of maturity at-size, and weight at-size. As a result, SSB increases more rapidly than N because larger individuals weigh more than smaller lobsters.

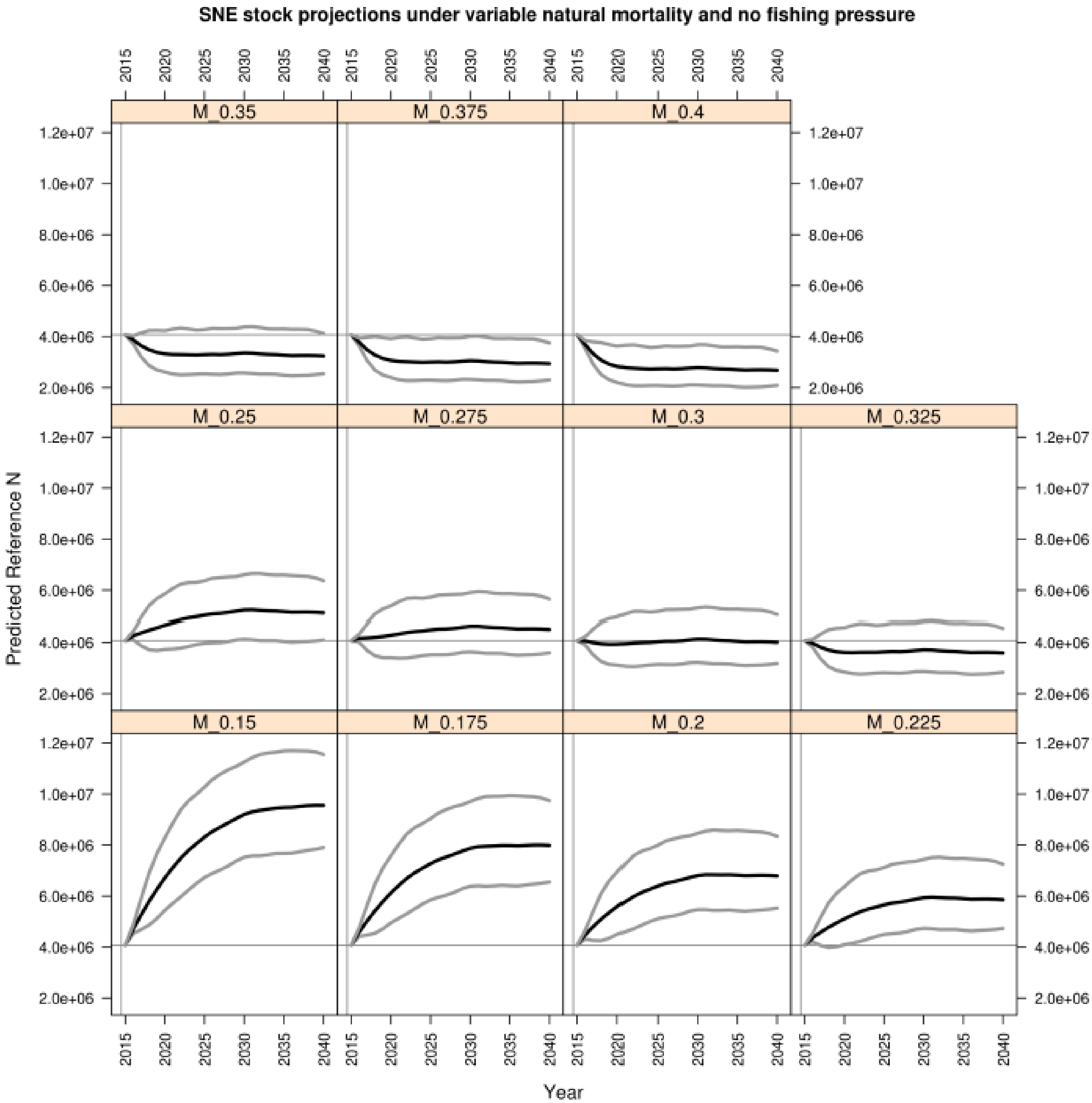

Figure 1: SNE stock projections assuming constant recruitment (similar to levels seen from 2011 to 2014) under various levels of M. F is fixed at zero. The units are reference abundance. Black line is the mean trend +/- 2SD (gray lines).

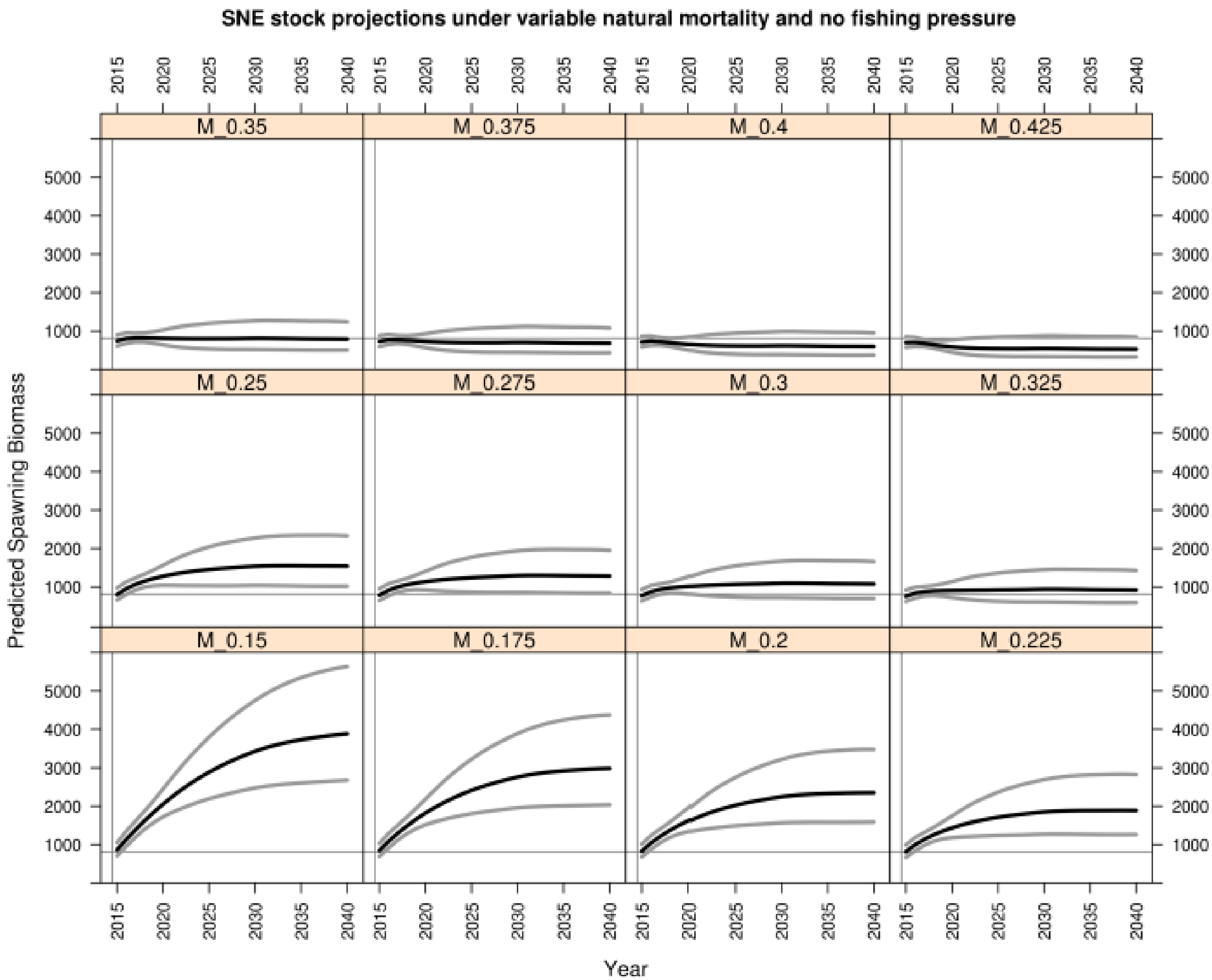

Figure 2: SNE stock projections assuming constant recruitment (similar to levels seen from 2011 to 2014) under various levels of M. F is fixed at zero. The units are SSB. Black line is the mean trend +/- 2SD (gray lines).

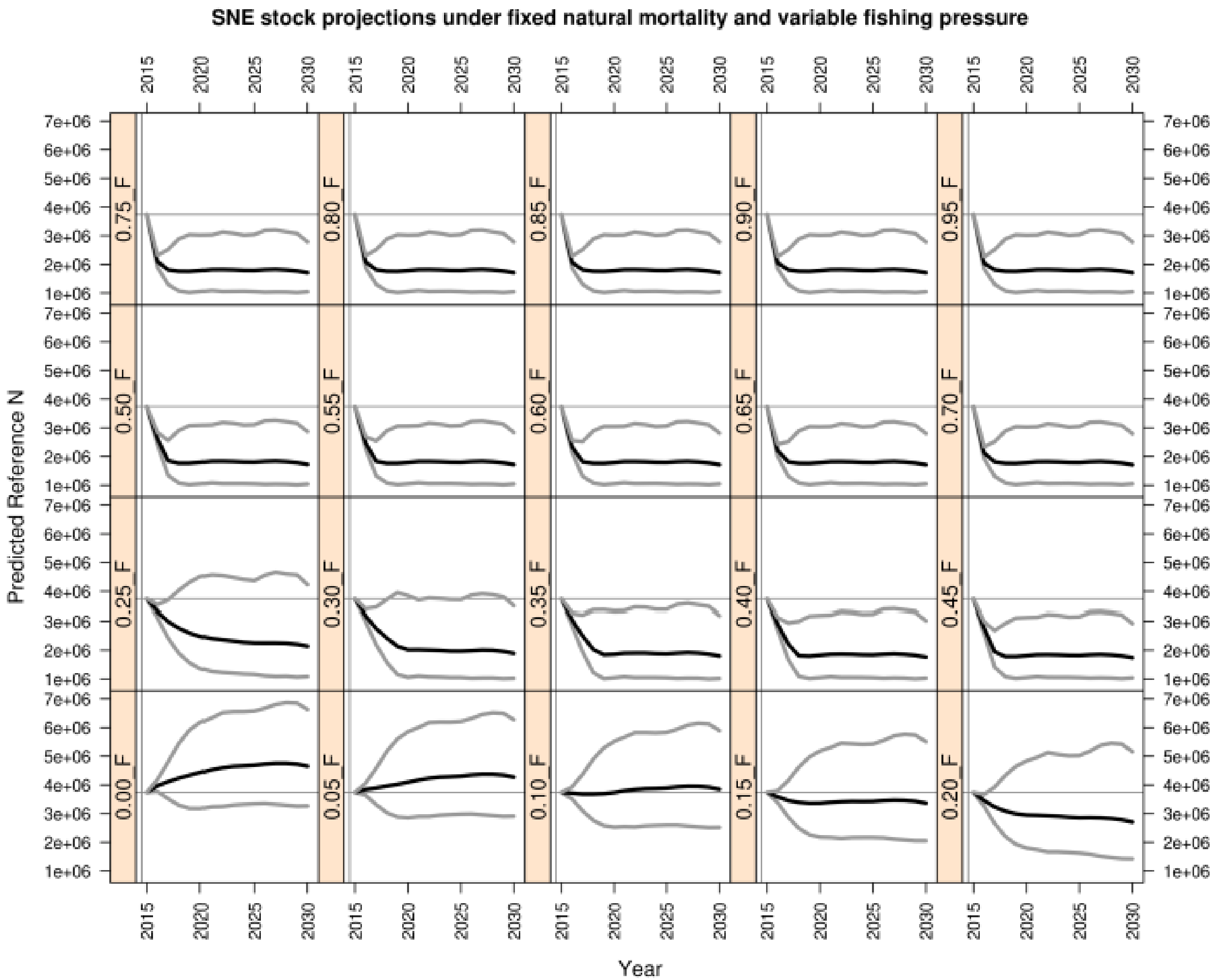

Figure 3: SNE stock projections assuming constant recruitment (similar to levels seen from 2011 to 2014) under various levels of F. M is fixed at 0.285. The units are reference abundance. Black lines is the mean trend 2 +/-2SD (gray lines).

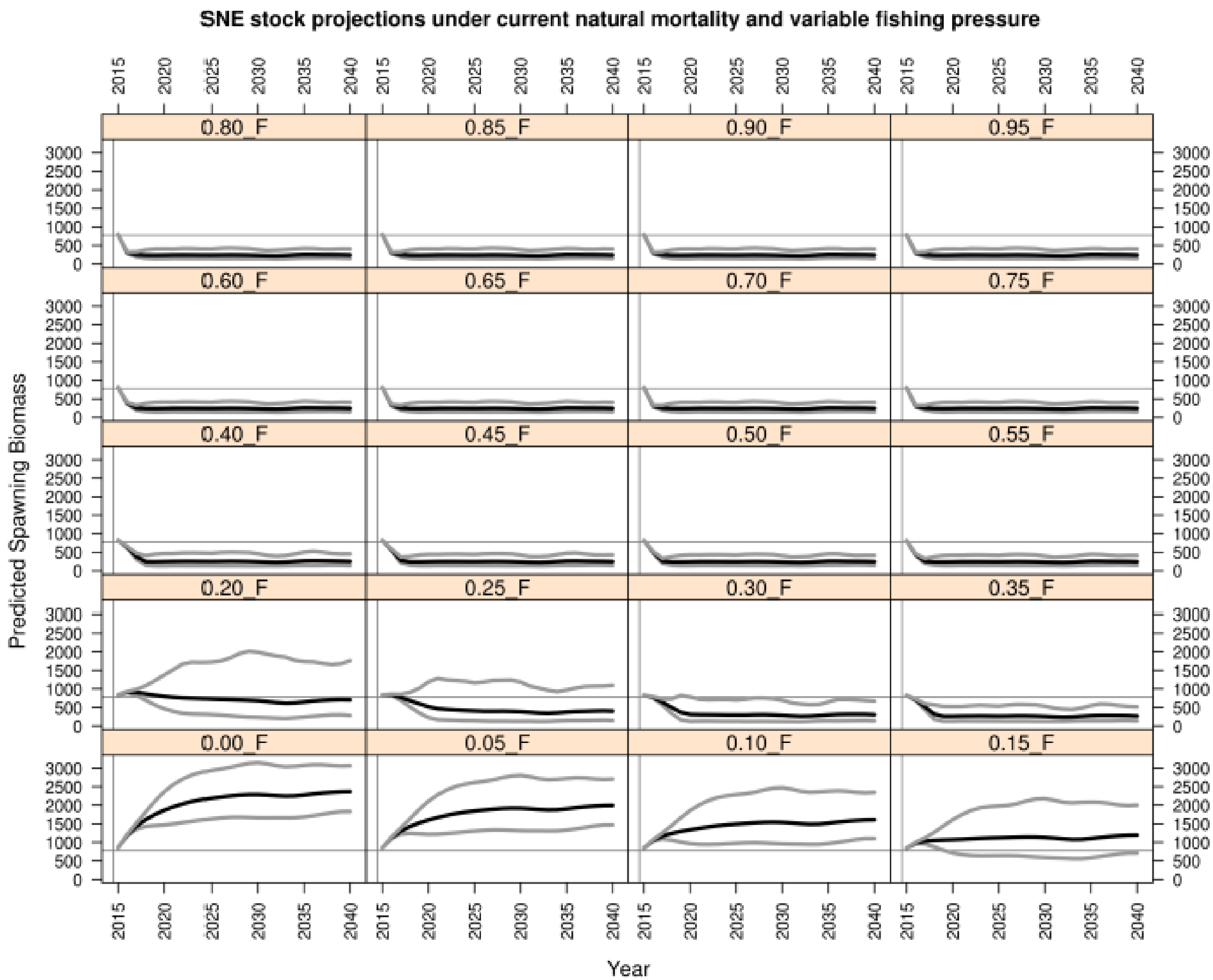

Figure 4: SNE stock projections assuming constant recruitment (similar to levels seen from 2011 to 2014) under various levels of F. M is fixed at 0.285. The units are SSB. Black line is the mean trend +/1 2SD (gray lines).

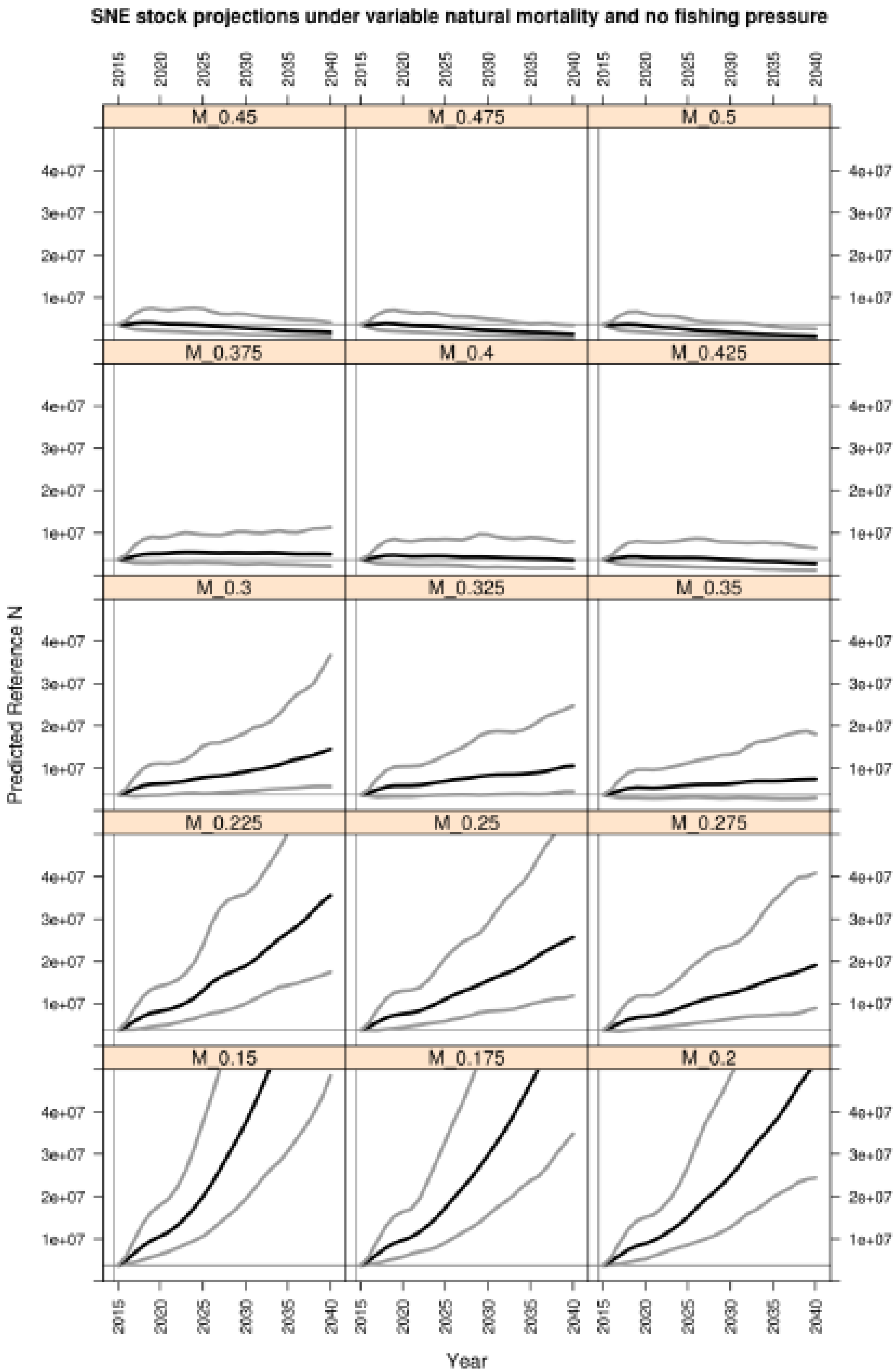

Figure 5. SNE stock projections assuming a Beverton-Holt stock recruit relationship under various levels of M. F is fixed at zero. The units are reference abundance.

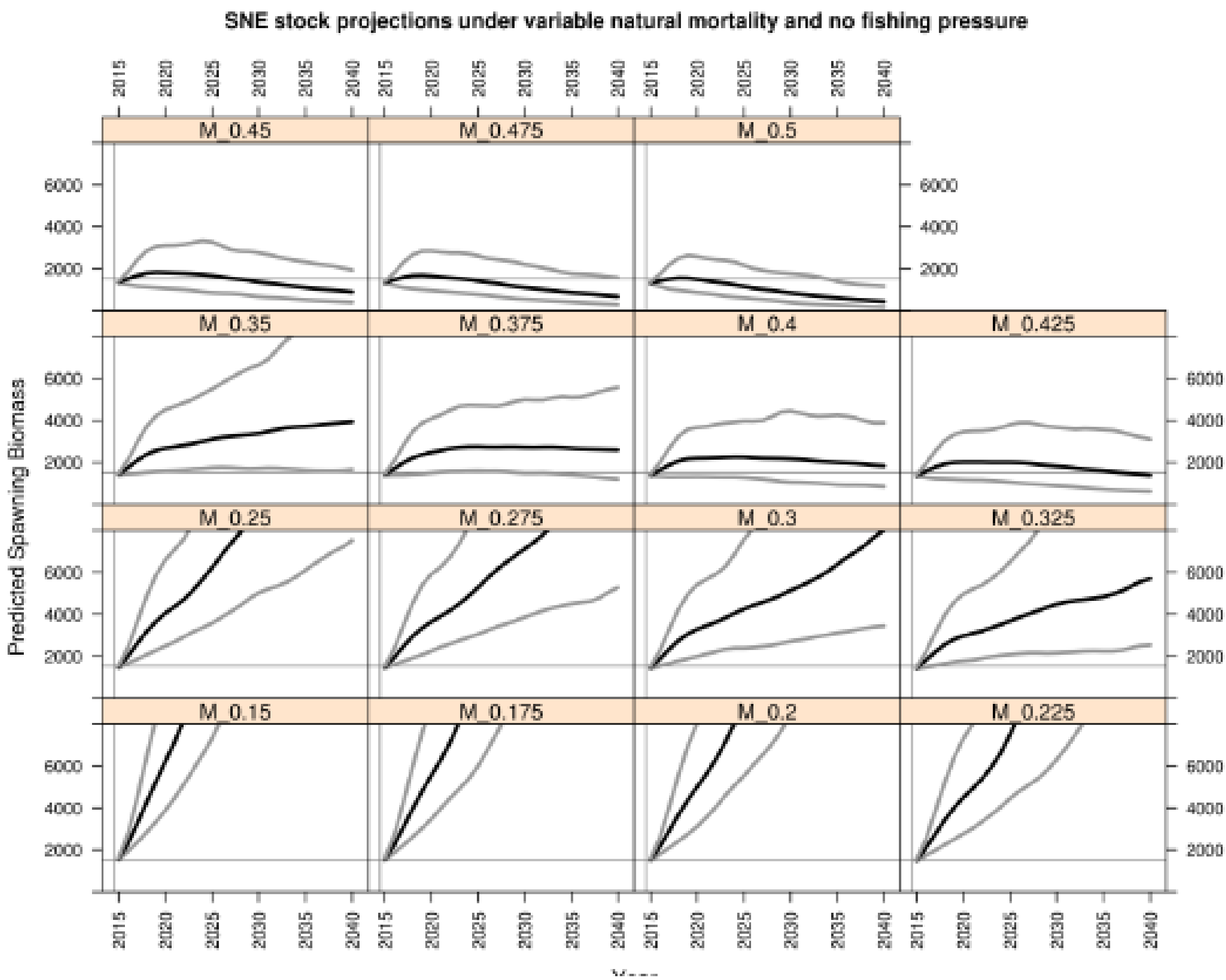

Figure 6: SNE stock projections assuming Beverton-Holt recruitment under various levels of M. F is fixed at zero. The units are SSB.

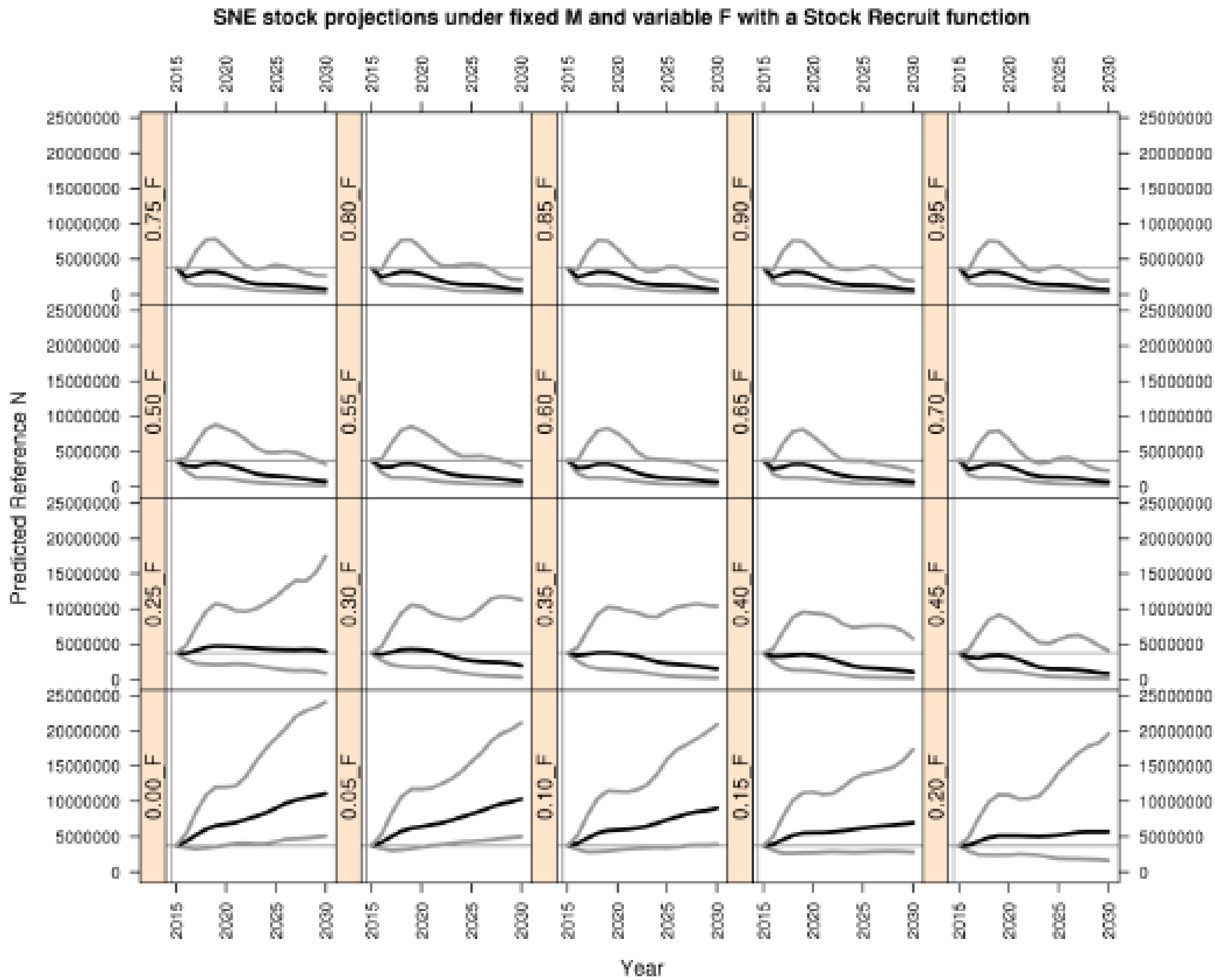

Figure 7: SNE stock projections assuming Beverton-Holt recruitment under various levels of F. M is fixed at 0.285. The units are reference abundance.

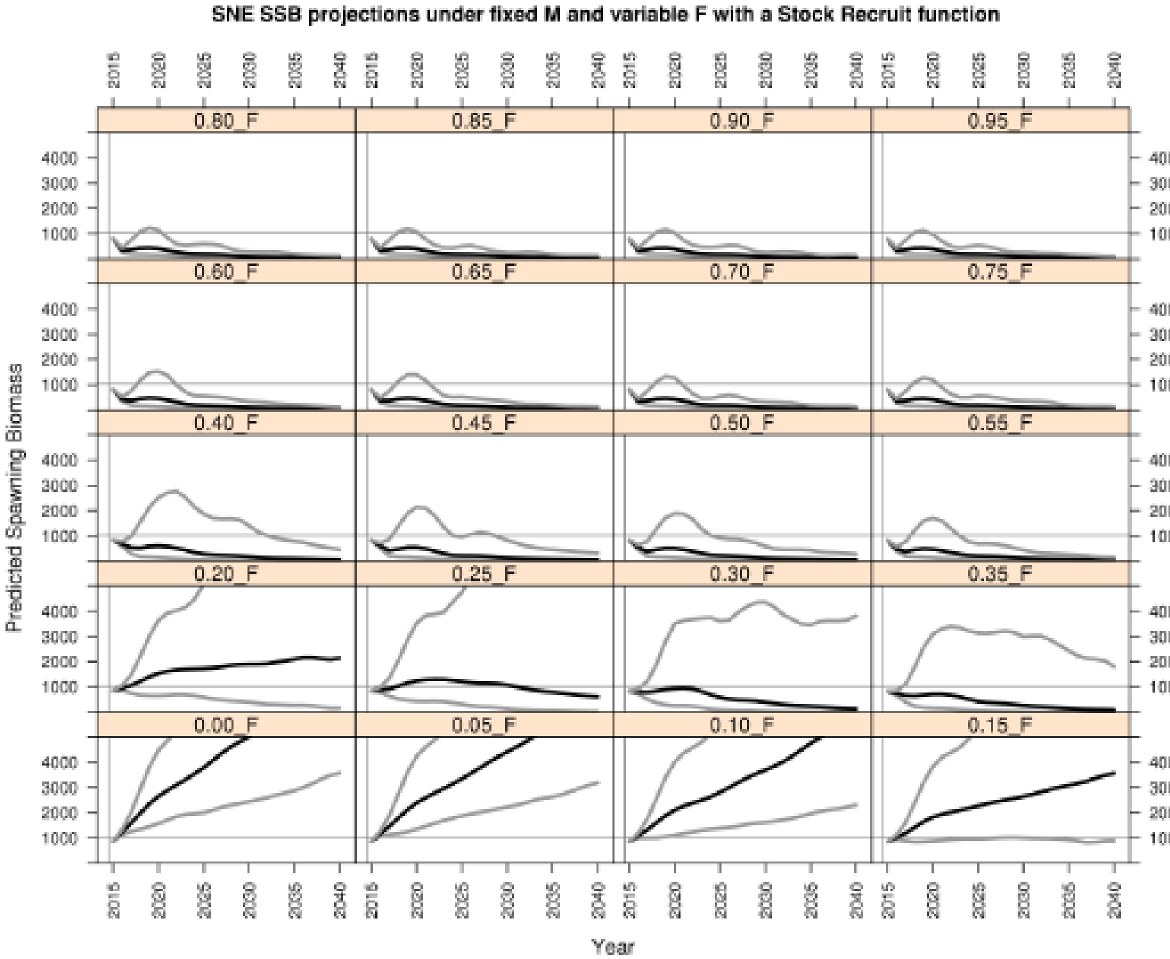

Figure 8: SNE stock projections assuming Beverton-Holt recruitment under various levels of F. M is fixed at 0.285. The units are SSB.

Appendix 5: TC Memo to Board on Gauge Size Changes

MEMORANDUM

TO: American Lobster Management Board

FROM: American Lobster Technical Committee

DATE: July 25, 2016

SUBJECT: Effect of Gauge Changes on Exploitation, SSB, Reference Abundance, and Catch

The following analysis looks at the effect of gauge size changes on egg production, exploitation, spawning stock biomass (SSB), reference abundance, and catch. This work is intended to provide a holistic view of stock and fishery changes that may result from alterations to the minimum and maximum gauge size. Table 1 summarizes scenarios in which a 20% or 60% increase in egg production is achieved, per the motion of the Board at the May 2016 meeting. Tables 2-6 look at all combinations of gauge changes in regards to egg production, exploitation, SSB, reference abundance, and catch.

Table 1. Minimum and maximum size window necessary to achieve a 20% and 60% increase in egg production respectively. Includes % change in exploitation, spawning stock biomass, reference abundance, and catch associated with the size windows presented. *Assumes changes in gauge size from the current 86 mm minimum and 133 mm maximum size inshore, and an 89 mm minimum size and a 171 mm maximum size offshore. English unit conversions are approximate.

	Min	Max	Egg Production	Exploitation	Spawning Stock Biomass	Reference Abundance	Catch
Inshore	88 mm (3 15/32")	105 mm (4 1/8")	20%	-18%	20%	9%	-11%
	91 mm (3 9/16")	115 mm (4 1/2")	18%	-22%	22%	11%	-14%
	92 mm (3 5/8")	165 mm (6 1/2")	20%	-27%	25%	13%	-17%
Offshore	91 mm (3 9/16")	105 mm (4 1/8")	22%	-21%	22%	9%	-13%
	94 mm (3 11/16")	115 mm (4 1/2")	20%	-26%	24%	12%	-17%
	95 mm (3 3/4")	165 mm (6 1/2")	21%	-28%	26%	13%	-19%
Inshore	99 mm (3 7/8")	115 mm (4 1/2")	60%	-56%	71%	32%	-42%
	101 mm (3 29/32")	165 mm (6 1/2")	59%	-59%	76%	35%	-45%
Offshore	102 mm (4")	115 mm (4 1/2")	62%	-60%	71%	31%	-47%
	103 mm (4 1/16")	165 mm (6 1/2")	63%	-63%	75%	34%	-50%

Table 2. Inshore and offshore minimum/maximum gauge change scenarios and corresponding egg production changes from the current gauge sizes. Egg production is expressed as percent increases from the current conditions.

Inshore; Min=86, Max=133

Min Size ↓ / Max size →	105	115	125	135	145	155	165
82	2%	-7%	-8%	-8%	-8%	-8%	-8%
83	3%	-6%	-7%	-7%	-7%	-7%	-7%
84	5%	-4%	-5%	-5%	-5%	-5%	-5%
85	8%	-1%	-3%	-3%	-3%	-3%	-3%
86	12%	1%	0%	0%	0%	0%	0%
87	15%	5%	3%	3%	3%	3%	3%
88	20%	8%	6%	6%	6%	6%	6%
89	23%	11%	9%	9%	9%	9%	9%
90	27%	14%	12%	12%	12%	12%	12%
91	33%	18%	16%	16%	16%	16%	16%
92	39%	22%	20%	20%	20%	20%	20%
93	46%	28%	26%	25%	25%	25%	25%
94	51%	31%	29%	28%	28%	28%	28%
95	NA	35%	32%	32%	32%	32%	32%
96	NA	40%	37%	37%	37%	37%	37%
97	NA	47%	43%	43%	43%	43%	43%
98	NA	56%	51%	51%	51%	51%	51%
99	NA	59%	54%	54%	54%	54%	54%
100	NA	63%	58%	57%	57%	57%	57%
101	NA	69%	63%	62%	62%	62%	62%
102	NA	76%	70%	69%	69%	69%	69%
103	NA	87%	79%	78%	78%	78%	78%
104	NA	91%	82%	81%	81%	81%	81%
105	NA	NA	85%	84%	84%	84%	84%
106	NA	NA	90%	89%	89%	89%	89%
107	NA	NA	97%	96%	95%	95%	95%
108	NA	NA	107%	105%	105%	105%	105%
109	NA	NA	110%	108%	107%	107%	107%
110	NA	NA	113%	111%	110%	110%	110%

Offshore; Min=89, Max=171

Min Size ↓ / Max size →	105	115	125	135	145	155	165
82	-7%	-14%	-15%	-16%	-16%	-16%	-16%
83	-6%	-14%	-15%	-15%	-15%	-15%	-15%
84	-3%	-12%	-13%	-13%	-13%	-13%	-13%
85	0%	-9%	-10%	-11%	-11%	-11%	-11%
86	3%	-7%	-8%	-8%	-8%	-8%	-8%
87	6%	-4%	-5%	-5%	-5%	-5%	-5%
88	10%	-1%	-2%	-2%	-2%	-2%	-2%
89	13%	2%	0%	0%	0%	0%	0%
90	17%	5%	3%	3%	3%	3%	3%
91	22%	8%	6%	6%	6%	6%	6%
92	27%	12%	11%	10%	10%	10%	10%
93	34%	18%	15%	15%	15%	15%	15%
94	39%	20%	18%	18%	18%	18%	18%
95	NA	24%	22%	21%	21%	21%	21%
96	NA	29%	26%	26%	25%	25%	25%
97	NA	35%	32%	31%	31%	31%	31%
98	NA	43%	39%	39%	39%	39%	39%
99	NA	46%	42%	41%	41%	41%	41%
100	NA	50%	45%	45%	45%	45%	45%
101	NA	55%	50%	49%	49%	49%	49%
102	NA	62%	56%	55%	55%	55%	55%
103	NA	72%	64%	64%	63%	63%	63%
104	NA	75%	67%	66%	66%	66%	66%
105	NA	NA	70%	69%	69%	69%	69%
106	NA	NA	75%	74%	73%	73%	73%
107	NA	NA	81%	80%	79%	79%	79%
108	NA	NA	90%	89%	88%	88%	88%
109	NA	NA	92%	91%	90%	90%	90%
110	NA	NA	95%	93%	93%	93%	93%

Table 3. Inshore and offshore minimum/maximum gauge change scenarios and corresponding exploitation changes from the current gauge sizes. Exploitation is expressed as percent increases from the current conditions.

Inshore; Min=86, Max=133

Min Size \ Max size	105	115	125	135	145	155	165
82	7%	14%	14%	14%	14%	14%	14%
83	5%	12%	13%	13%	13%	13%	13%
84	1%	8%	9%	9%	9%	9%	9%
85	-4%	4%	4%	4%	5%	5%	5%
86	-8%	-1%	0%	0%	0%	0%	0%
87	-13%	-6%	-5%	-5%	-5%	-5%	-5%
88	-18%	-11%	-10%	-10%	-10%	-10%	-10%
89	-22%	-14%	-13%	-13%	-13%	-13%	-13%
90	-26%	-18%	-17%	-17%	-17%	-17%	-17%
91	-31%	-22%	-22%	-21%	-21%	-21%	-21%
92	-37%	-28%	-27%	-27%	-27%	-27%	-27%
93	-43%	-33%	-32%	-32%	-32%	-32%	-32%
94	-46%	-36%	-35%	-35%	-35%	-35%	-35%
95	NA	-39%	-38%	-38%	-38%	-38%	-38%
96	NA	-43%	-42%	-42%	-42%	-42%	-42%
97	NA	-48%	-46%	-46%	-46%	-46%	-46%
98	NA	-54%	-53%	-53%	-52%	-52%	-52%
99	NA	-56%	-54%	-54%	-54%	-54%	-54%
100	NA	-58%	-56%	-56%	-56%	-56%	-56%
101	NA	-61%	-59%	-59%	-59%	-59%	-59%
102	NA	-65%	-63%	-63%	-63%	-63%	-63%
103	NA	-71%	-68%	-68%	-68%	-68%	-68%
104	NA	-72%	-69%	-69%	-69%	-69%	-69%
105	NA	NA	-71%	-70%	-70%	-70%	-70%
106	NA	NA	-73%	-72%	-72%	-72%	-72%
107	NA	NA	-75%	-75%	-75%	-75%	-75%
108	NA	NA	-80%	-79%	-79%	-79%	-79%
109	NA	NA	-81%	-80%	-80%	-80%	-80%
110	NA	NA	-81%	-81%	-81%	-81%	-81%

Offshore; Min=89, Max=171

Min Size \ Max size	105	115	125	135	145	155	165
82	23%	31%	32%	32%	32%	32%	32%
83	21%	29%	30%	30%	30%	30%	30%
84	16%	24%	25%	25%	25%	25%	25%
85	11%	20%	20%	21%	21%	21%	21%
86	6%	14%	15%	15%	15%	15%	15%
87	0%	9%	10%	10%	10%	10%	10%
88	-6%	3%	4%	4%	4%	4%	4%
89	-10%	-1%	0%	0%	0%	0%	0%
90	-15%	-5%	-4%	-4%	-4%	-4%	-4%
91	-21%	-11%	-10%	-9%	-9%	-9%	-9%
92	-27%	-16%	-15%	-15%	-15%	-15%	-15%
93	-34%	-23%	-22%	-22%	-22%	-22%	-22%
94	-38%	-26%	-25%	-25%	-25%	-25%	-25%
95	NA	-30%	-28%	-28%	-28%	-28%	-28%
96	NA	-34%	-33%	-33%	-33%	-33%	-33%
97	NA	-40%	-38%	-38%	-38%	-38%	-38%
98	NA	-47%	-45%	-45%	-45%	-45%	-45%
99	NA	-49%	-47%	-47%	-47%	-47%	-47%
100	NA	-52%	-50%	-50%	-49%	-49%	-49%
101	NA	-55%	-53%	-53%	-53%	-53%	-53%
102	NA	-60%	-57%	-57%	-57%	-57%	-57%
103	NA	-66%	-63%	-63%	-63%	-63%	-63%
104	NA	-68%	-64%	-64%	-64%	-64%	-64%
105	NA	NA	-66%	-66%	-66%	-66%	-66%
106	NA	NA	-68%	-68%	-68%	-68%	-68%
107	NA	NA	-72%	-71%	-71%	-71%	-71%
108	NA	NA	-77%	-76%	-76%	-76%	-76%
109	NA	NA	-78%	-77%	-77%	-77%	-77%
110	NA	NA	-79%	-78%	-78%	-78%	-78%

Table 4. Inshore and offshore minimum/maximum gauge change scenarios and corresponding spawning stock biomass (SSB) changes from the current gauge sizes. SSB is expressed as percent increases from the current conditions.

Inshore; Min=86, Max=133

Min Size \ Max size	105	115	125	135	145	155	165
82	-1%	-9%	-10%	-10%	-10%	-10%	-10%
83	0%	-8%	-9%	-9%	-9%	-9%	-9%
84	4%	-5%	-6%	-6%	-6%	-6%	-6%
85	7%	-2%	-3%	-3%	-3%	-3%	-3%
86	11%	1%	0%	0%	0%	0%	0%
87	16%	5%	4%	4%	4%	4%	4%
88	20%	9%	8%	8%	8%	8%	8%
89	25%	13%	11%	11%	11%	11%	11%
90	30%	17%	15%	15%	15%	15%	15%
91	36%	22%	20%	20%	20%	20%	20%
92	43%	27%	26%	25%	25%	25%	25%
93	51%	34%	32%	32%	32%	32%	32%
94	57%	38%	36%	36%	36%	35%	35%
95	NA	43%	40%	40%	40%	40%	40%
96	NA	49%	46%	46%	46%	46%	46%
97	NA	57%	54%	53%	53%	53%	53%
98	NA	67%	63%	63%	63%	63%	63%
99	NA	71%	67%	66%	66%	66%	66%
100	NA	76%	71%	71%	71%	71%	71%
101	NA	82%	77%	76%	76%	76%	76%
102	NA	90%	84%	84%	84%	84%	84%
103	NA	102%	95%	94%	94%	94%	94%
104	NA	106%	98%	97%	97%	97%	97%
105	NA	NA	102%	101%	101%	101%	101%
106	NA	NA	107%	106%	106%	106%	106%
107	NA	NA	115%	113%	113%	113%	113%
108	NA	NA	125%	124%	124%	124%	124%
109	NA	NA	128%	126%	126%	126%	126%
110	NA	NA	131%	129%	129%	129%	129%

Offshore; Min=89, Max=171

Min Size \ Max size	105	115	125	135	145	155	165
82	-11%	-18%	-19%	-19%	-19%	-19%	-19%
83	-10%	-17%	-18%	-18%	-18%	-18%	-18%
84	-7%	-15%	-16%	-16%	-16%	-16%	-16%
85	-4%	-12%	-13%	-13%	-13%	-13%	-13%
86	0%	-9%	-10%	-10%	-10%	-10%	-10%
87	4%	-6%	-7%	-7%	-7%	-7%	-7%
88	8%	-2%	-3%	-3%	-3%	-3%	-3%
89	12%	1%	0%	0%	0%	0%	0%
90	17%	5%	4%	4%	4%	4%	4%
91	22%	9%	8%	8%	8%	8%	8%
92	29%	15%	13%	13%	13%	13%	13%
93	36%	21%	19%	19%	19%	19%	19%
94	41%	24%	22%	22%	22%	22%	22%
95	NA	28%	26%	26%	26%	26%	26%
96	NA	34%	31%	31%	31%	31%	31%
97	NA	41%	38%	38%	38%	38%	38%
98	NA	50%	47%	46%	46%	46%	46%
99	NA	54%	50%	50%	49%	49%	49%
100	NA	58%	54%	53%	53%	53%	53%
101	NA	64%	59%	59%	59%	59%	59%
102	NA	71%	66%	65%	65%	65%	65%
103	NA	82%	75%	75%	75%	75%	75%
104	NA	85%	78%	77%	77%	77%	77%
105	NA	NA	82%	81%	81%	81%	81%
106	NA	NA	87%	86%	85%	85%	85%
107	NA	NA	93%	92%	92%	92%	92%
108	NA	NA	103%	101%	101%	101%	101%
109	NA	NA	105%	103%	103%	103%	103%
110	NA	NA	108%	106%	106%	106%	106%

Table 5. Inshore and offshore minimum/maximum gauge change scenarios and corresponding reference abundance changes from the current gauge sizes. Reference abundance is expressed as percent increases from the current conditions.

Inshore; Min=86, Max=133

Max size →

Min Size ↓	105	115	125	135	145	155	165
82	-3%	-6%	-6%	-6%	-6%	-6%	-6%
83	-2%	-5%	-5%	-5%	-5%	-5%	-5%
84	0%	-3%	-4%	-4%	-4%	-4%	-4%
85	2%	-2%	-2%	-2%	-2%	-2%	-2%
86	4%	0%	0%	0%	0%	0%	0%
87	6%	3%	2%	2%	2%	2%	2%
88	9%	5%	5%	5%	5%	5%	5%
89	11%	7%	6%	6%	6%	6%	6%
90	13%	9%	8%	8%	8%	8%	8%
91	16%	11%	10%	10%	10%	10%	10%
92	19%	14%	13%	13%	13%	13%	13%
93	23%	17%	16%	16%	16%	16%	16%
94	25%	19%	18%	18%	18%	18%	18%
95	NA	21%	20%	20%	20%	20%	20%
96	NA	23%	22%	22%	22%	22%	22%
97	NA	26%	25%	25%	25%	25%	25%
98	NA	31%	30%	30%	30%	30%	30%
99	NA	32%	31%	31%	31%	31%	31%
100	NA	34%	33%	33%	33%	33%	33%
101	NA	36%	35%	35%	35%	35%	35%
102	NA	40%	38%	38%	38%	38%	38%
103	NA	45%	42%	42%	42%	42%	42%
104	NA	46%	43%	43%	43%	43%	43%
105	NA	NA	45%	44%	44%	44%	44%
106	NA	NA	46%	46%	46%	46%	46%
107	NA	NA	49%	49%	49%	49%	49%
108	NA	NA	53%	53%	53%	53%	53%
109	NA	NA	54%	54%	54%	54%	54%
110	NA	NA	55%	55%	55%	55%	55%

Offshore; Min=89, Max=171

Max size →

Min Size ↓	105	115	125	135	145	155	165
82	-8%	-11%	-11%	-11%	-11%	-11%	-11%
83	-8%	-10%	-11%	-11%	-11%	-11%	-11%
84	-6%	-9%	-9%	-9%	-9%	-9%	-9%
85	-4%	-7%	-8%	-8%	-8%	-8%	-8%
86	-2%	-5%	-6%	-6%	-6%	-6%	-6%
87	0%	-3%	-4%	-4%	-4%	-4%	-4%
88	2%	-1%	-1%	-2%	-2%	-2%	-2%
89	4%	0%	0%	0%	0%	0%	0%
90	6%	2%	2%	2%	2%	2%	2%
91	9%	4%	4%	4%	4%	4%	4%
92	12%	7%	7%	7%	6%	6%	6%
93	16%	10%	10%	10%	10%	10%	10%
94	18%	12%	11%	11%	11%	11%	11%
95	NA	14%	13%	13%	13%	13%	13%
96	NA	16%	15%	15%	15%	15%	15%
97	NA	19%	18%	18%	18%	18%	18%
98	NA	23%	22%	22%	22%	22%	22%
99	NA	25%	23%	23%	23%	23%	23%
100	NA	26%	25%	25%	25%	25%	25%
101	NA	28%	27%	27%	27%	27%	27%
102	NA	31%	30%	30%	30%	30%	30%
103	NA	36%	34%	34%	34%	34%	34%
104	NA	37%	35%	35%	35%	35%	35%
105	NA	NA	36%	36%	36%	36%	36%
106	NA	NA	38%	38%	38%	38%	38%
107	NA	NA	40%	40%	40%	40%	40%
108	NA	NA	44%	44%	44%	44%	44%
109	NA	NA	45%	45%	45%	45%	45%
110	NA	NA	46%	46%	46%	46%	46%

Table 6. Inshore and offshore minimum/maximum gauge change scenarios and corresponding catch changes from the current gauge sizes. Catch is expressed as percent increases from the current conditions.

Inshore; Min=86, Max=133

Min Size \ Max size	105	115	125	135	145	155	165
82	4%	7%	8%	8%	8%	8%	8%
83	3%	6%	7%	7%	7%	7%	7%
84	0%	4%	5%	5%	5%	5%	5%
85	-2%	2%	2%	2%	2%	2%	2%
86	-5%	0%	0%	0%	0%	0%	0%
87	-8%	-3%	-3%	-3%	-3%	-3%	-3%
88	-11%	-6%	-6%	-6%	-6%	-6%	-6%
89	-14%	-9%	-8%	-8%	-8%	-8%	-8%
90	-17%	-11%	-10%	-10%	-10%	-10%	-10%
91	-20%	-14%	-13%	-13%	-13%	-13%	-13%
92	-25%	-18%	-17%	-17%	-17%	-17%	-17%
93	-30%	-22%	-21%	-21%	-21%	-21%	-21%
94	-33%	-24%	-23%	-23%	-23%	-23%	-23%
95	NA	-27%	-26%	-26%	-26%	-26%	-26%
96	NA	-30%	-29%	-29%	-29%	-29%	-29%
97	NA	-34%	-33%	-33%	-33%	-33%	-33%
98	NA	-40%	-39%	-38%	-38%	-38%	-38%
99	NA	-42%	-40%	-40%	-40%	-40%	-40%
100	NA	-44%	-42%	-42%	-42%	-42%	-42%
101	NA	-47%	-45%	-45%	-45%	-45%	-45%
102	NA	-51%	-49%	-49%	-49%	-49%	-49%
103	NA	-58%	-55%	-54%	-54%	-54%	-54%
104	NA	-59%	-56%	-56%	-56%	-56%	-56%
105	NA	NA	-58%	-57%	-57%	-57%	-57%
106	NA	NA	-60%	-60%	-60%	-59%	-59%
107	NA	NA	-63%	-63%	-63%	-63%	-63%
108	NA	NA	-69%	-68%	-68%	-68%	-68%
109	NA	NA	-70%	-69%	-69%	-69%	-69%
110	NA	NA	-71%	-71%	-71%	-71%	-71%

Offshore; Min=89, Max=171

Min Size \ Max size	105	115	125	135	145	155	165
82	13%	17%	17%	17%	17%	17%	17%
83	12%	16%	16%	16%	16%	16%	16%
84	9%	13%	14%	14%	14%	14%	14%
85	6%	11%	11%	11%	11%	11%	11%
86	3%	8%	9%	9%	9%	9%	9%
87	0%	5%	6%	6%	6%	6%	6%
88	-4%	2%	2%	2%	2%	2%	2%
89	-6%	-1%	0%	0%	0%	0%	0%
90	-10%	-3%	-3%	-3%	-3%	-3%	-3%
91	-13%	-7%	-6%	-6%	-6%	-6%	-6%
92	-18%	-11%	-10%	-10%	-10%	-10%	-10%
93	-24%	-15%	-14%	-14%	-14%	-14%	-14%
94	-27%	-17%	-17%	-16%	-16%	-16%	-16%
95	NA	-20%	-19%	-19%	-19%	-19%	-19%
96	NA	-24%	-23%	-22%	-22%	-22%	-22%
97	NA	-28%	-27%	-27%	-27%	-27%	-27%
98	NA	-35%	-33%	-33%	-33%	-33%	-33%
99	NA	-37%	-35%	-35%	-35%	-35%	-35%
100	NA	-39%	-37%	-37%	-37%	-37%	-37%
101	NA	-42%	-40%	-40%	-40%	-40%	-40%
102	NA	-47%	-44%	-44%	-44%	-44%	-44%
103	NA	-54%	-51%	-50%	-50%	-50%	-50%
104	NA	-56%	-52%	-52%	-52%	-52%	-52%
105	NA	NA	-54%	-54%	-53%	-53%	-53%
106	NA	NA	-56%	-56%	-56%	-56%	-56%
107	NA	NA	-60%	-60%	-60%	-60%	-60%
108	NA	NA	-66%	-66%	-66%	-66%	-66%
109	NA	NA	-67%	-67%	-67%	-67%	-67%
110	NA	NA	-69%	-68%	-68%	-68%	-68%