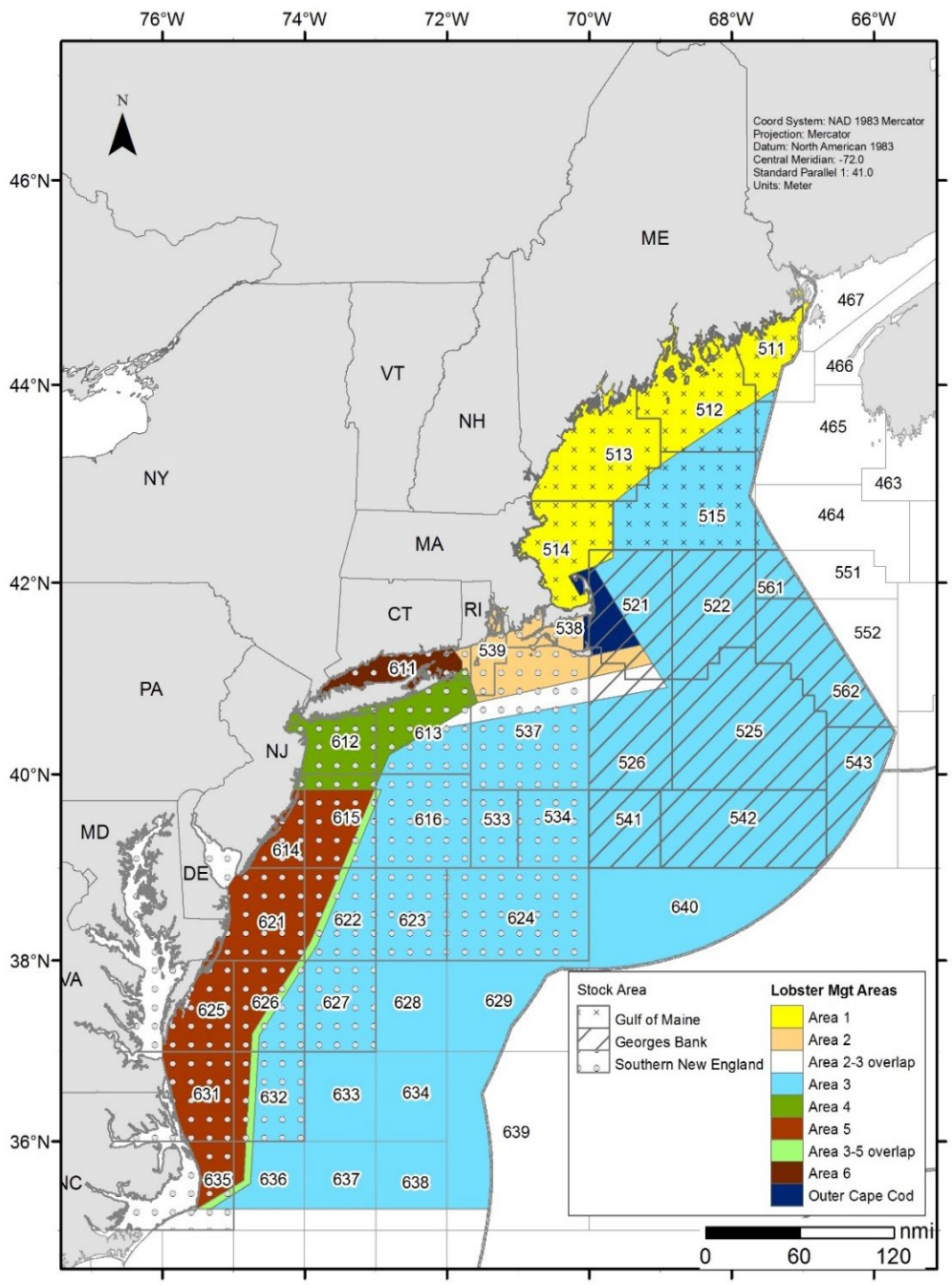
American Lobster Assessment

Lobster Board Presentation

October 19, 2020



Management Unit

- ME - VA

- 2 Stock Units
  - GOM & GBK combined

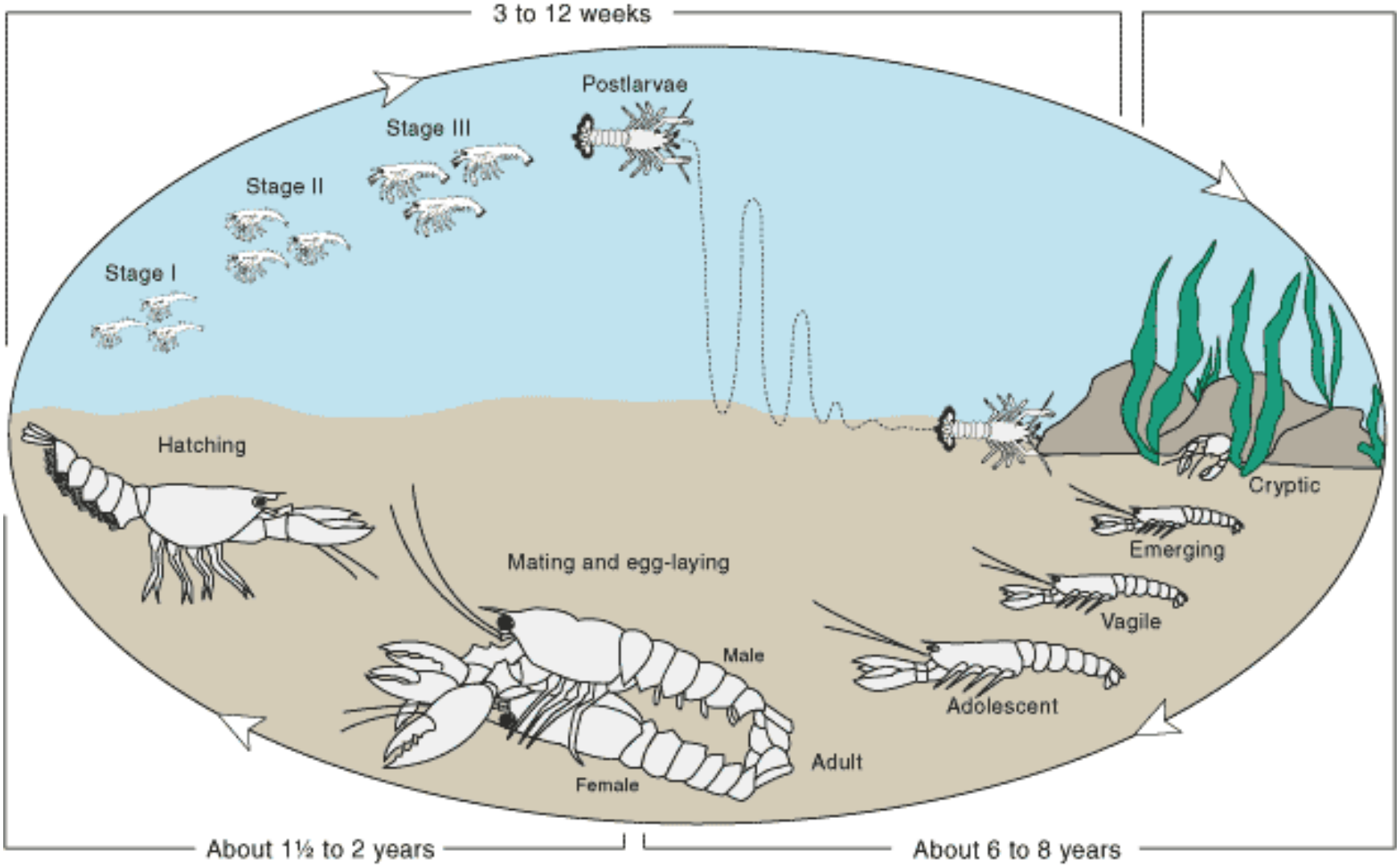
- 7 Management Areas

Management History

- Since 1997 a total of 25 Addendum to Amendment III have been passed

Management 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. No v-notching 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]	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 1/4"	6 3/4"	5 1/4"	5 1/4"	5 1/4"	State Waters none Federal Waters 6 3/4"
Season Closure				April 30-May 31[2]	February 1-March 31[3]	Sept 8-Nov 28[4]	February 1-April 30

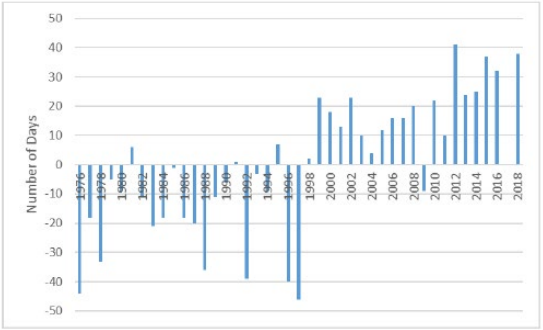
Life History



Source: St. Lawrence Global Observatory – SLGO, http://slgo.ca/, 2011

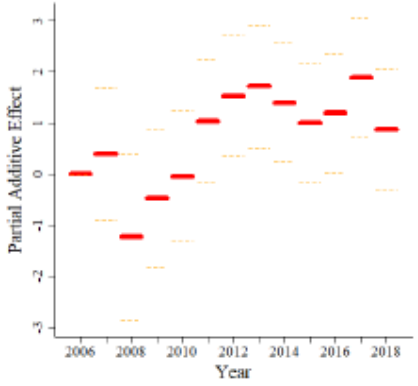
Temperature

- **Key environmental driver**
  - Temperatures in NW Atlantic are increasing and are predicted to continue to increase
- **12-18 ^{o} C – "Optimal Range"**
  - Increasing in GOM, GBK, offshore SNE
- **20 ^{o} C – "Stress Threshold"**
  - Increasing inshore SNE



SNE days $\geq$ 20 ^{o}C

- Impacts timing of life history annual cycles and life stage
  - Maturity and growth
    - Decrease size at maturity GOM/GBK
    - Increase size at maturity SNE – shift offshore
  - Implications of climate change on the lobster population and our model assumptions
- Drives behavior through metabolism and activity levels
  - Effects on survey catchability
- Affects recruitment
  - winter threshold <5^{o} C necessary for egg development
  - Hatching and larva development require >10-12^{o} C threshold
  - Temperature impacts rate of development
- At higher levels, increases stress and disease
  - SNE increase M



GOM SD

Information used to Assess Stocks

- Empirical Data
  - Fishery Dependent
  - Fishery Independent
  - Biological
  - Environmental
- Model Free Indicators
  - Mortality Indicators
  - Abundance Indicators
  - Fishery Performance Indicators
  - ❖ Stress Indicators
- Model Results
  - Reference abundance estimates
  - Reference exploitation estimates
  - Reference Points

University of Maine Assessment Model

Inputs

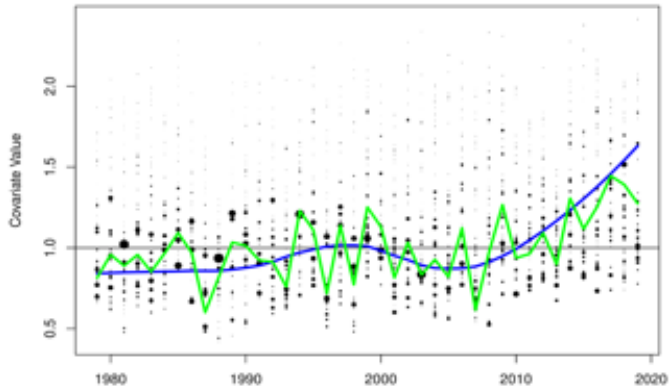
- Life history characteristics (growth, M, maturity (SSB))
- Commercial Catch
  - weight
  - Length
  - sex ratio
- Bottom trawl and ventless trap
  - survey trends
  - Length
- Legal size specs
- Gear retention info
- Discard ovigerous/v-notched
  - Sea samples, AOLA and CFRF
- Recruitment covariates
- Survey catchability covariates

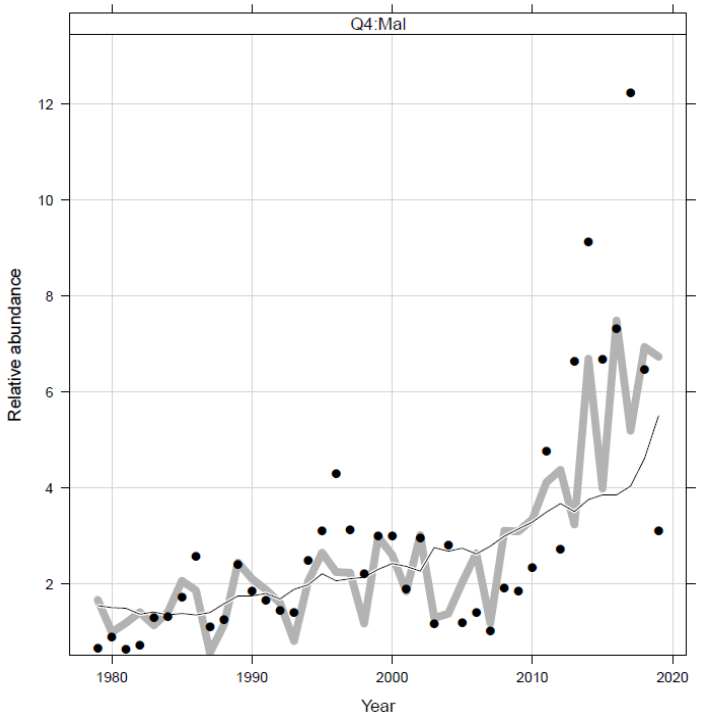
Outputs

- Goodness of fit diagnostics
- Recruitment to model 53+ mm CL each year
- Abundance and spawning biomass
- Population size composition
- reference abundance and effective exploitation
- Per recruit reference points
  - Not estimated for this assessment

Survey Catchability Covariates

- Multiple surveys indicating changing catchabilities.
- 2015 – nonlinear catchability
- 2020 - further modification
- Environmental covariate often locally weighted by co-located lobster density to capture mean environmental condition experienced by lobster.

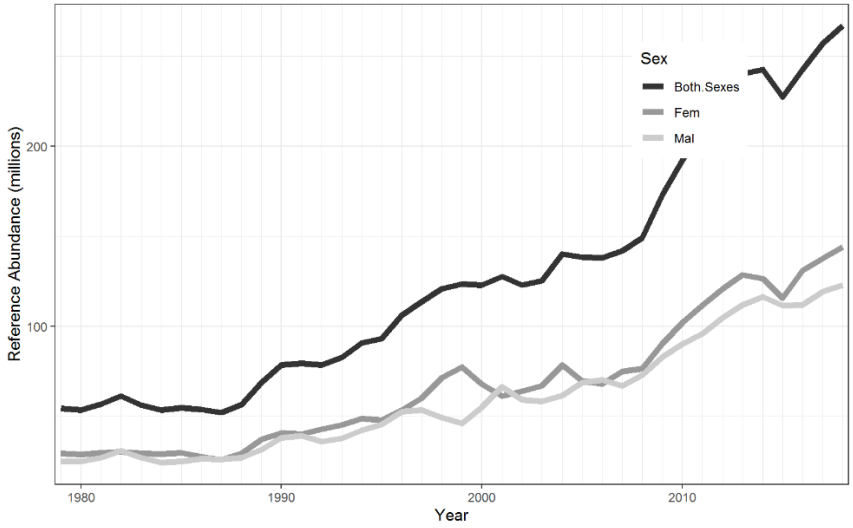


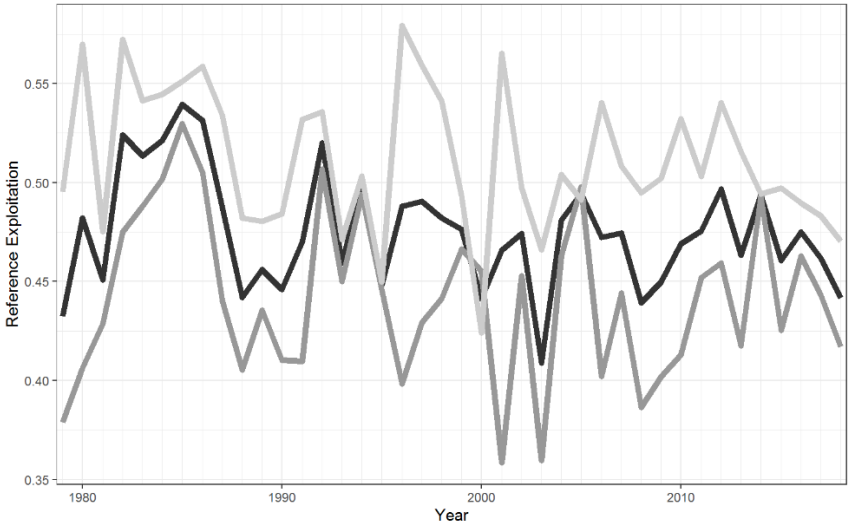


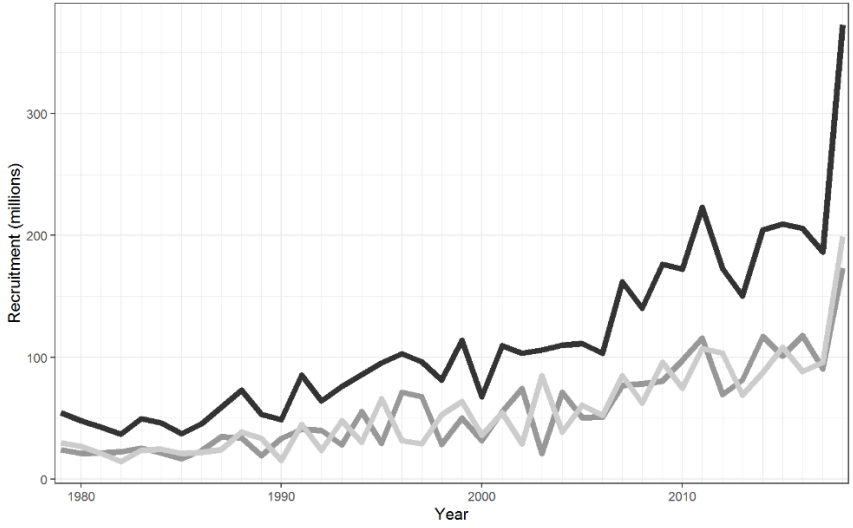
Model Uncertainty

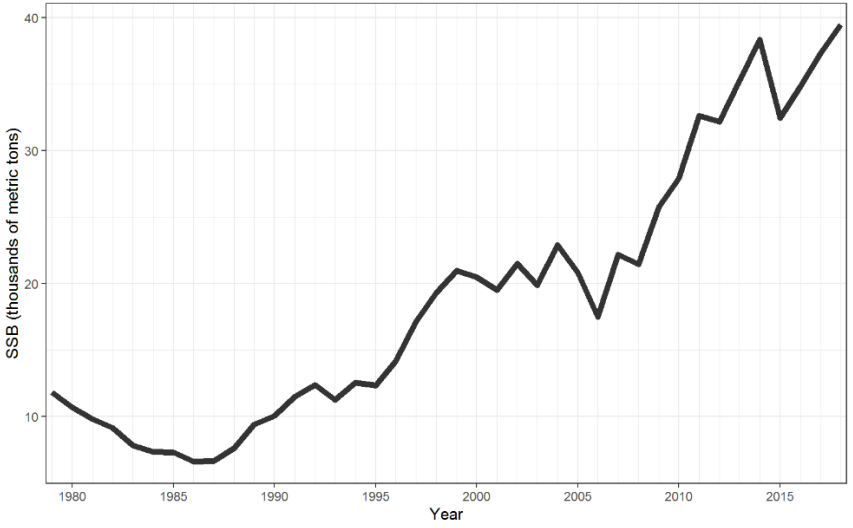
- Model uncertainty estimates likely underestimated
  - Growth, M, fishery selectivity not estimated
- Trends are more certain than the absolute scale
  - Certainty of trend more important due to use of trend based reference points
- Methods to address model uncertainty:
  - Sensitivity analysis
  - Historical retrospective analysis
  - Retrospective analysis

GOM/GBK Model Results









GOM Abundance Indicators

SPAWNING STOCK ABUNDANCE
Mean weight (g) per tow of mature females

Survey	NEFSC fall	NEFSC spring	ME/NH fall	ME/NH spring	MA 514 fall	MA 514 spring
1981	175.32	400.28			502.65	430.53
1982	39.45	113.58			626.48	151.21
1983	206.03	234.21			844.76	67.08
1984	234.64	443.81			593.77	126.47
1985	499.62	2771.23			919.56	93.81
1986	267.97	502.99			231.88	112.97
1987	85.35	497.40			194.34	148.62
1988	186.56	244.92			200.58	88.14
1989	325.69	247.15			293.61	230.26
1990	216.65	516.20			1048.72	241.94
1991	247.11	430.56			335.80	165.54
1992	193.95	453.31			512.83	212.89
1993	284.34	484.30			120.59	229.72
1994	430.32	720.67			783.17	285.01
1995	464.96	390.15			520.26	171.71
1996	734.25	872.53			569.39	156.53
1997	568.34	1083.76			235.18	114.78
1998	381.81	1182.44			282.79	170.21
1999	1444.07	807.41			365.53	282.12
2000	585.66	1281.05	4430.55		533.40	236.55
2001	511.25	1498.42	2446.85	690.89	165.74	235.85
2002	1789.42	2022.04	4638.64	1436.34	324.34	175.73
2003	985.93	2343.63	3949.63	1226.05	129.67	72.99
2004	685.89	2773.35	3610.67	907.07	120.27	259.35
2005	465.35	1670.29	4805.25	1990.08	248.23	489.12
2006	681.87	1810.96	3698.94	1327.93	240.27	410.97
2007	445.78	1536.47	3163.24	1437.85	176.95	139.94
2008	805.10	1894.91	4080.36	1107.00	559.70	300.35
2009	1787.92	1864.92	6906.45	1747.30	630.52	219.83
2010	2850.60	2476.79	5793.51	1886.61	1424.75	211.52
2011	2317.94	2089.39	6169.40	2013.80	1268.44	267.51
2012	3215.29	3516.38	4174.85	2287.55	889.87	124.81
2013	3299.56	2499.71	5363.14	2007.92	1135.54	300.86
2014	4979.28	3083.09	5891.58	3010.73	768.88	382.81
2015	3553.44	3665.39	8488.62	2233.05	1947.04	418.46
2016	3692.26	5142.42	7691.01	2613.49	3712.66	1119.26
2017	3274.69	6566.80	4629.68	2530.74	2309.44	564.30
2018	2093.20	3555.09	5242.34	2005.07	2782.55	550.68
2014-2018 mean	3518.57	4402.56	6388.65	2478.62	2304.11	607.10
25th	272.06	487.57	4015.00	1355.03	242.26	149.27
median	539.79	1389.74	4638.64	1938.34	526.83	224.78
75th	1789.05	2443.50	5842.54	2178.24	878.60	296.52

FULL RECRUIT ABUNDANCE (SURVEY)
Abundance of lobsters > 82 mm CL (sexes combined)

Survey	NEFSC fall	NEFSC spring	ME/NH fall	ME/NH spring	MA 514 fall	MA 514 spring
1981	0.316	0.475			1.913	1.834
1982	0.060	0.278			2.817	0.571
1983	0.287	0.259			3.070	0.516
1984	0.391	0.431			4.146	0.496
1985	0.747	2.293			3.977	0.505
1986	0.625	0.721			1.709	0.537
1987	0.216	0.587			0.521	0.550
1988	0.192	0.363			1.513	0.557
1989	0.515	0.377			2.271	0.797
1990	0.351	0.575			4.934	0.969
1991	0.492	0.608			3.177	0.687
1992	0.296	0.489			2.341	0.867
1993	0.540	0.642			0.626	1.007
1994	0.692	0.925			3.164	0.758
1995	1.347	0.623			2.506	0.592
1996	1.212	1.336			2.501	0.335
1997	0.940	1.361			1.691	0.628
1998	0.607	1.288			0.885	0.484
1999	2.086	0.679			1.920	0.719
2000	0.836	1.802	16.322		2.200	0.976
2001	0.851	2.025	10.590	3.250	0.718	0.524
2002	2.526	2.381	14.607	5.180	1.031	0.430
2003	1.530	3.174	14.395	3.452	0.430	0.220
2004	1.613	3.409	13.679	3.524	0.330	0.779
2005	0.837	2.185	19.818	6.935	0.600	0.972
2006	1.107	2.214	14.210	6.054	1.023	0.674
2007	0.689	1.991	12.547	5.333	0.472	0.353
2008	1.226	2.565	19.351	4.082	1.559	0.668
2009	2.491	2.204	29.727	7.382	1.722	0.539
2010	4.189	3.519	22.976	7.291	2.286	0.395
2011	4.272	2.893	24.447	9.045	3.805	0.547
2012	4.621	4.579	16.890	10.569	3.169	0.308
2013	4.501	3.287	20.796	9.988	3.722	0.868
2014	7.911	3.717	25.711	11.424	2.928	0.770
2015	4.775	5.430	37.607	9.923	5.691	1.251
2016	4.642	6.554	31.537	12.303	7.385	2.422
2017	4.819	7.022	19.245	10.078	6.127	1.640
2018	2.293	4.185	22.345	6.748	6.725	1.263
2014-2018 mean	4.888	5.382	27.289	10.095	5.771	1.469
25th	0.521	0.612	14.501	5.218	1.152	0.518
median	0.895	1.896	19.351	7.113	2.278	0.648
75th	2.441	3.104	23.711	9.972	3.175	0.868

RECRUIT ABUNDANCE (SURVEY)
Abundance of lobsters 71 - 80 mm CL (sexes combined)

Survey	NEFSC fall	NEFSC spring	ME/NH fall	ME/NH spring	MA 514 fall	MA 514 spring
1981	0.065	0.127			4.800	6.431
1982	0.353	0.274			3.893	2.772
1983	0.848	0.283			9.714	1.772
1984	0.263	0.193			6.131	2.166
1985	1.312	0.194			9.498	4.442
1986	1.063	0.225			3.828	2.992
1987	0.578	0.469			1.169	2.424
1988	1.040	0.520			4.137	2.496
1989	1.265	0.000			7.529	4.452
1990	1.822	0.409			15.363	6.123
1991	1.503	0.577			7.554	2.743
1992	1.153	0.516			9.007	4.324
1993	0.980	0.220			3.196	5.138
1994	2.330	0.187			13.867	7.542
1995	1.537	1.553			12.181	4.547
1996	4.144	0.662			11.961	3.106
1997	1.749	1.898			6.480	4.590
1998	1.997	1.536			7.542	4.524
1999	2.716	1.210			8.730	4.252
2000	2.561	3.556	24.093		8.890	4.247
2001	1.347	1.171	17.811	9.280	1.586	4.312
2002	1.488	1.434	22.413	22.002	4.999	3.408
2003	0.397	1.203	18.316	10.647	0.667	1.962
2004	2.132	0.782	12.293	7.546	1.295	2.467
2005	0.764	0.582	25.895	18.507	2.124	4.398
2006	1.163	2.300	18.304	18.066	5.295	6.094
2007	0.762	1.457	16.819	15.912	1.583	0.767
2008	2.139	0.998	31.607	17.878	6.145	2.537
2009	2.343	1.990	32.665	24.717	8.907	3.202
2010	2.957	1.427	37.354	17.663	9.529	2.201
2011	5.402	3.997	46.092	39.254	14.981	5.243
2012	3.225	4.694	37.120	36.547	11.349	3.030
2013	6.560	3.989	37.859	34.504	12.158	4.818
2014	8.461	3.823	41.947	50.793	7.051	3.353
2015	7.847	5.683	67.994	38.513	17.862	7.091
2016	9.373	5.668	60.069	50.832	17.409	13.582
2017	8.904	4.817	48.130	48.424	13.628	7.853
2018	5.516	4.917	55.839	42.769	25.618	5.247
2014-2018 mean	8.020	4.982	54.796	46.266	16.313	7.425
25th	1.045	0.424	20.364	17.717	4.303	2.751
median	1.643	1.187	32.665	23.359	7.548	4.282
75th	2.897	2.222	44.019	39.069	11.808	5.058

SURVEY LOBSTER ENCOUNTER RATE
Proportion of postive tows

Survey	NEFSC fall	NEFSC spring	ME/NH fall	ME/NH spring	MA 514 fall	MA 514 spring
1981	0.250	0.438			0.725	0.857
1982	0.185	0.364			0.698	0.500
1983	0.328	0.265			0.756	0.756
1984	0.359	0.281			0.756	0.756
1985	0.492	0.381			0.674	0.707
1986	0.471	0.333			0.829	0.684
1987	0.242	0.426			0.543	0.848
1988	0.304	0.306			0.583	0.762
1989	0.359	0.190			0.952	0.783
1990	0.324	0.424			0.946	0.857
1991	0.319	0.415			0.943	0.872
1992	0.246	0.403			0.774	0.927
1993	0.388	0.412			0.816	0.971
1994	0.400	0.449			0.930	1.000
1995	0.357	0.408			0.927	0.932
1996	0.543	0.538			0.955	0.911
1997	0.348	0.638			0.861	0.930
1998	0.400	0.516			0.686	0.757
1999	0.425	0.507			0.909	0.727
2000	0.420	0.612	0.936		0.977	0.932
2001	0.400	0.565	0.863	0.877	0.717	0.932
2002	0.530	0.750	0.945	0.938	0.732	0.913
2003	0.439	0.686	0.854	0.922	0.550	0.818
2004	0.313	0.866	0.860	0.891	0.564	0.844
2005	0.362	0.768	0.907	0.953	0.674	0.951
2006	0.600	0.724	0.932	0.933	0.881	0.909
2007	0.429	0.721	0.849	0.966	0.542	0.511
2008	0.493	0.841	0.864	0.924	0.750	0.826
2009	0.628	0.820	0.923	0.978	0.867	0.889
2010	0.750	0.851	0.959	0.979	0.977	0.872
2011	0.743	0.833	0.959	0.990	0.854	0.891
2012	0.778	0.864	0.977	0.980	0.950	0.909
2013	0.733	0.867	0.929	1.000	0.955	0.957
2014	0.709	0.903	0.989	1.000	0.957	0.787
2015	0.687	0.928	0.963	1.000	0.951	0.977
2016	0.753	0.938	0.964	1.000	0.974	0.957
2017	0.773	0.864	0.941	0.992	0.977	0.841
2018	0.714	0.857	0.958	0.983	0.902	0.844
2014-2018 mean	0.727	0.898	0.963	0.995	0.952	0.881
25th	0.350	0.413	0.885	0.934	0.719	0.784
median	0.423	0.589	0.936	0.979	0.858	0.865
75th	0.621	0.839	0.959	0.991	0.949	0.929

GOM YOY Abundance Indicators

YOUNG-OF-YEAR INDICES					
	YOY	YOY	YOY	YOY	YOY
Survey	ME 511	ME 512	ME 513 East	ME 513 West	MA 514
1981					
1982					
1983					
1984					
1985					
1986					
1987					
1988					
1989			1.640		
1990			0.770		
1991			1.540		
1992			1.300		
1993			0.450		
1994			1.610		
1995		0.020	0.660		0.559
1996		0.050	0.470		0.000
1997		0.050	0.460		0.167
1998		0.000	0.140		0.021
1999		0.040	0.650		0.354
2000	0.000	0.100	0.130	0.294	0.188
2001	0.240	0.430	2.080	1.350	0.378
2002	0.128	0.290	1.380	0.953	0.889
2003	0.218	0.270	1.750	1.285	0.684
2004	0.165	0.360	1.750	1.068	1.198
2005	1.628	1.360	1.770	0.916	0.817
2006	0.488	1.130	0.840	1.085	0.322
2007	0.848	1.340	2.010	1.417	1.217
2008	0.415	0.830	1.080	0.898	0.241
2009	0.688	0.480	1.250	0.412	0.130
2010	0.285	0.720	0.800	0.618	0.446
2011	0.410	1.100	2.330	0.974	0.539
2012	0.535	0.730	1.060	0.243	0.077
2013	0.095	0.200	0.480	0.119	0.038
2014	0.160	0.430	0.833	0.282	0.094
2015	0.145	0.220	0.430	0.051	0.000
2016	0.063	0.211	0.467	0.052	0.056
2017	0.160	0.360	0.700	0.235	0.092
2018	0.268	0.322	0.708	0.155	0.019
2014-2018 mean	0.159	0.309	0.628	0.155	0.052

25th	0.153	0.175	0.523	0.239	0.071
median	0.240	0.341	0.837	0.618	0.214
75th	0.451	0.723	1.593	1.021	0.544

GBK Abundance Indicators

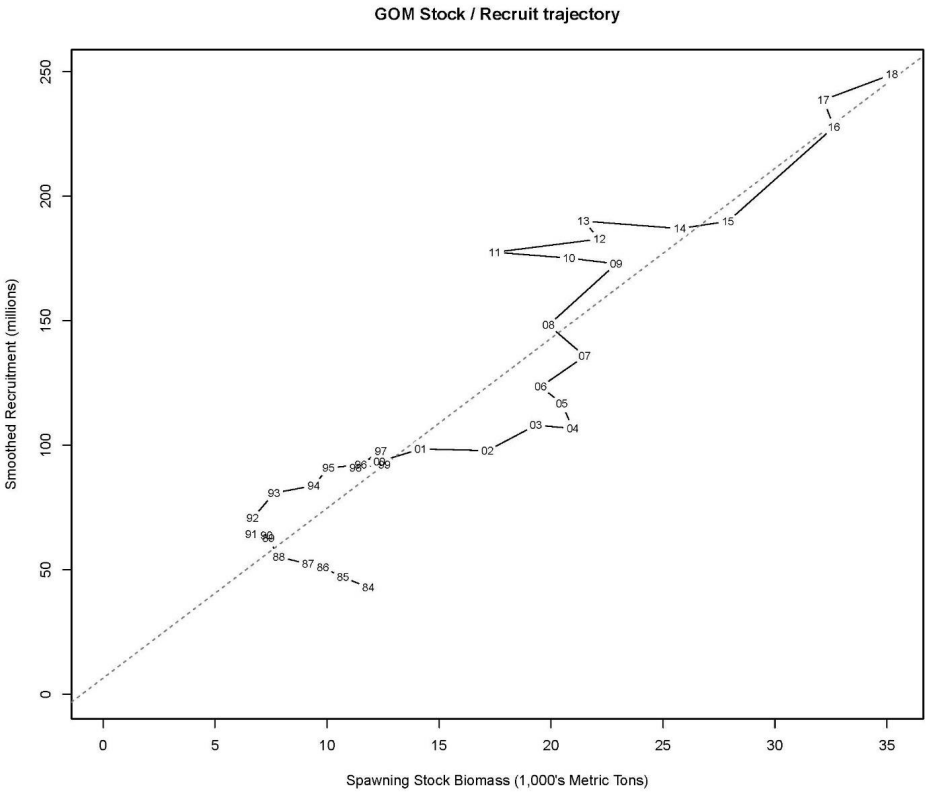
SPAWNING STOCK ABUNDANCE		
Mean weight (g) per tow of mature females		
Survey	*NESFC*	
	fall	*spring*
1981	707.14	69.71
1982	670.07	123.96
1983	643.84	152.05
1984	397.33	45.17
1985	504.87	39.00
1986	491.96	307.05
1987	537.31	113.27
1988	695.27	307.49
1989	933.18	161.43
1990	761.64	103.62
1991	848.03	164.32
1992	817.25	213.11
1993	626.81	126.03
1994	774.61	41.77
1995	939.85	71.74
1996	1051.09	482.61
1997	754.00	62.46
1998	993.56	64.67
1999	1363.68	395.66
2000	945.69	132.57
2001	1756.38	313.41
2002	2183.80	341.90
2003	1030.19	842.92
2004	1557.16	298.95
2005	1404.20	491.00
2006	2123.43	465.72
2007	1859.53	728.26
2008	3074.33	1827.61
2009	3703.99	1336.34
2010	2120.51	1126.52
2011	4681.76	1113.11
2012	2696.38	1510.08
2013	2530.26	1369.39
2014	3012.69	1833.98
2015	3743.71	1509.13
2016	3020.98	2138.96
2017	6627.18	3749.60
2018	9630.86	725.09
2014-2018 mean	5207.09	1991.35
25th	755.91	124.47
median	1040.64	310.45
75th	2443.64	1045.56

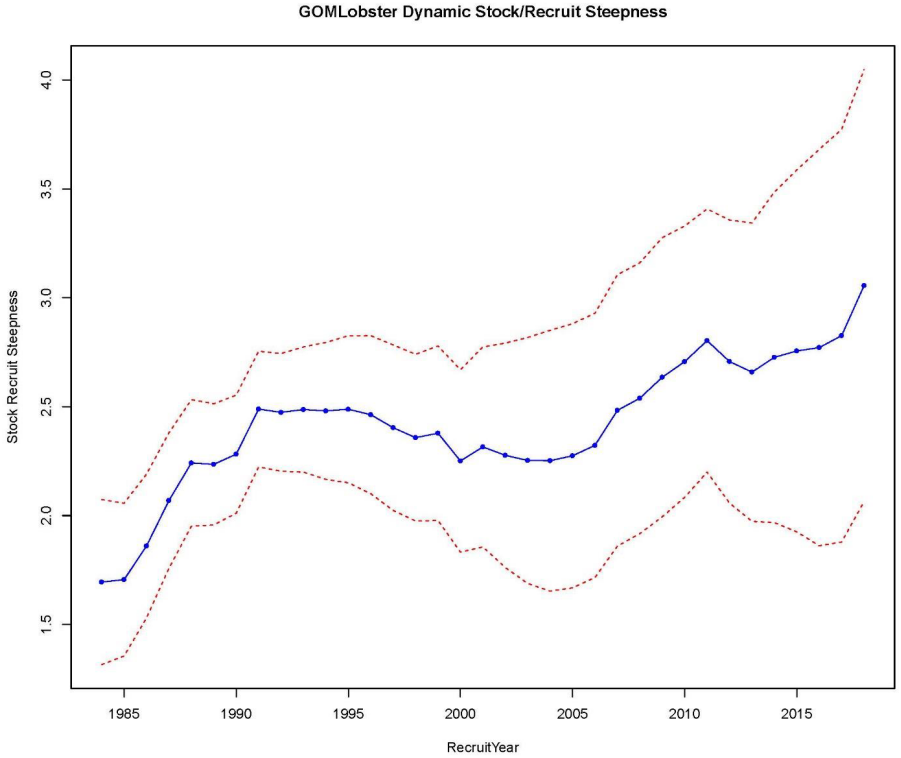
FULL RECRUIT ABUNDANCE (SURVEY)		
Abundance of lobsters ≥ 90 mm CL (sexes combined)		
Survey	*NEFSC*	
	fall	*spring*
1981	0.813	0.129
1982	0.819	0.250
1983	0.747	0.255
1984	0.687	0.075
1985	0.678	0.178
1986	0.821	0.400
1987	0.530	0.158
1988	0.918	0.471
1989	1.104	0.272
1990	0.755	0.114
1991	1.035	0.234
1992	0.831	0.396
1993	0.694	0.313
1994	0.888	0.088
1995	0.781	0.104
1996	0.955	0.541
1997	1.093	0.090
1998	0.856	0.090
1999	1.322	0.580
2000	1.021	0.267
2001	1.646	0.471
2002	2.124	0.578
2003	0.874	0.893
2004	1.555	0.335
2005	1.281	0.533
2006	1.555	0.540
2007	1.623	0.721
2008	2.571	1.520
2009	2.670	1.122
2010	1.514	1.264
2011	3.606	1.071
2012	2.095	1.562
2013	2.285	0.978
2014	2.310	1.856
2015	3.504	1.371
2016	2.697	2.188
2017	5.699	4.292
2018	7.722	0.876
2014-2018 mean	4.386	2.116
25th	0.824	0.238
median	1.099	0.471
75th	2.117	0.957

RECRUIT ABUNDANCE (SURVEY)		
Abundance of lobsters 71 - 80 mm CL (sexes combined)		
Survey	*NEFSC*	
	fall	*spring*
1981	0.286	0.073
1982	0.433	0.155
1983	0.292	0.167
1984	0.407	0.046
1985	0.167	0.220
1986	0.600	0.495
1987	0.442	0.315
1988	0.405	0.242
1989	0.117	0.169
1990	0.326	0.320
1991	0.298	0.170
1992	0.566	0.128
1993	0.289	0.684
1994	0.125	0.080
1995	0.197	0.028
1996	0.378	0.012
1997	0.647	0.000
1998	0.361	0.012
1999	0.238	0.031
2000	0.445	0.268
2001	0.571	0.429
2002	0.489	0.091
2003	0.328	0.227
2004	0.277	0.074
2005	0.129	0.072
2006	0.098	0.221
2007	0.189	0.054
2008	0.126	0.134
2009	0.220	0.139
2010	0.050	0.105
2011	0.299	0.024
2012	0.096	0.082
2013	0.131	0.066
2014	0.103	0.067
2015	0.097	0.041
2016	0.104	0.111
2017	0.370	0.155
2018	0.138	0.035
2014-2018 mean	0.162	0.082
25th	0.129	0.057
median	0.288	0.108
75th	0.398	0.207

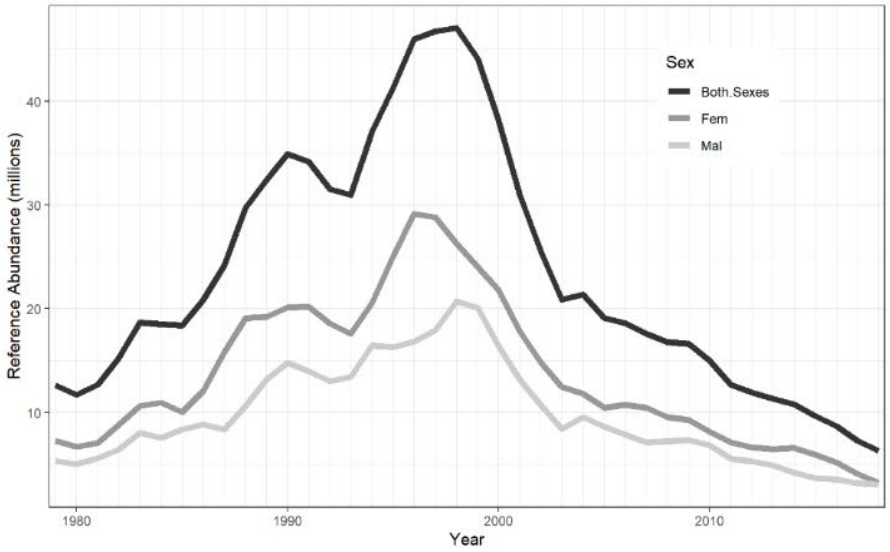
SURVEY LOBSTER ENCOUNTER RATE		
Proportion of postive tows		
Survey	*NEFSC*	
	fall	*spring*
1981	0.524	0.247
1982	0.432	0.227
1983	0.378	0.179
1984	0.354	0.122
1985	0.346	0.192
1986	0.359	0.272
1987	0.354	0.174
1988	0.395	0.342
1989	0.377	0.147
1990	0.432	0.182
1991	0.455	0.179
1992	0.486	0.261
1993	0.364	0.224
1994	0.384	0.114
1995	0.418	0.143
1996	0.388	0.162
1997	0.470	0.103
1998	0.397	0.101
1999	0.564	0.156
2000	0.403	0.215
2001	0.494	0.213
2002	0.550	0.286
2003	0.438	0.273
2004	0.531	0.184
2005	0.577	0.165
2006	0.538	0.225
2007	0.461	0.261
2008	0.548	0.294
2009	0.541	0.337
2010	0.628	0.381
2011	0.686	0.279
2012	0.560	0.349
2013	0.648	0.317
2014	0.611	0.370
2015	0.586	0.264
2016	0.549	0.448
2017	0.613	0.396
2018	0.585	0.293
2014-2018 mean	0.589	0.354
25th	0.396	0.175
median	0.478	0.226
75th	0.558	0.291

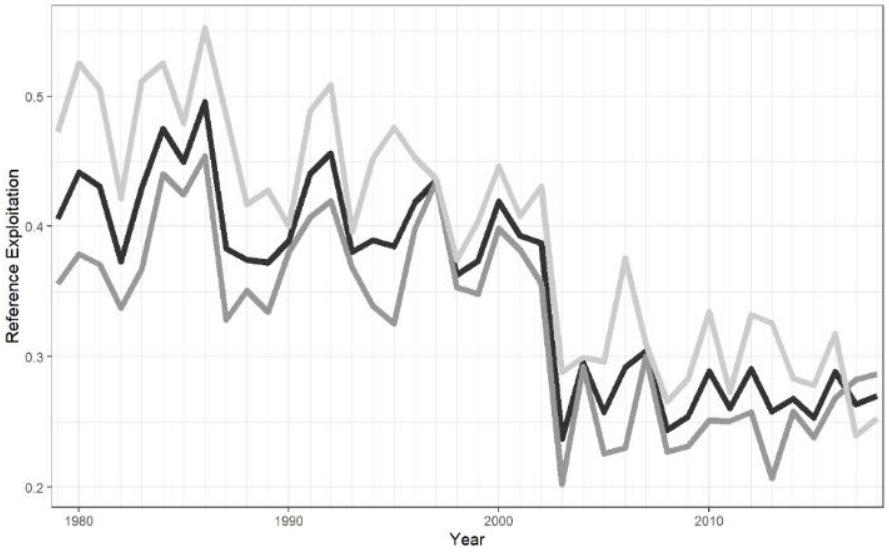
GOM/GBK Productivity

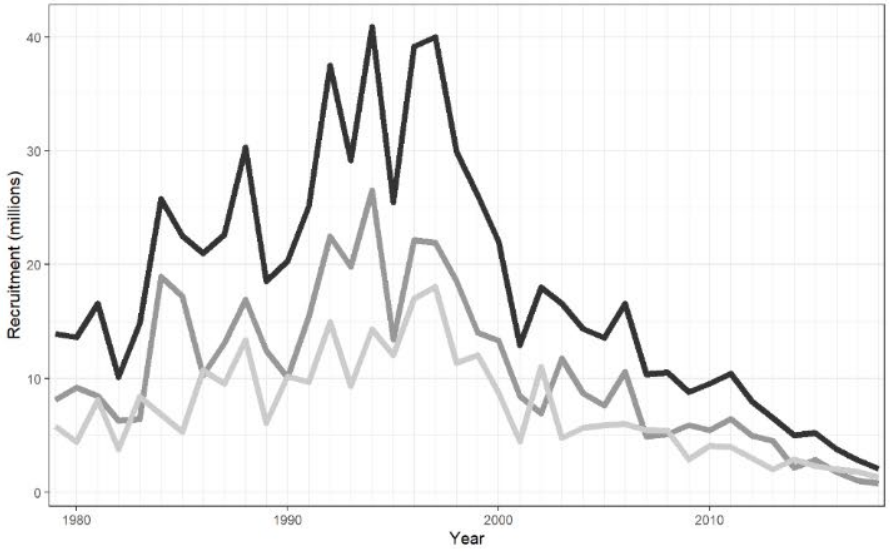


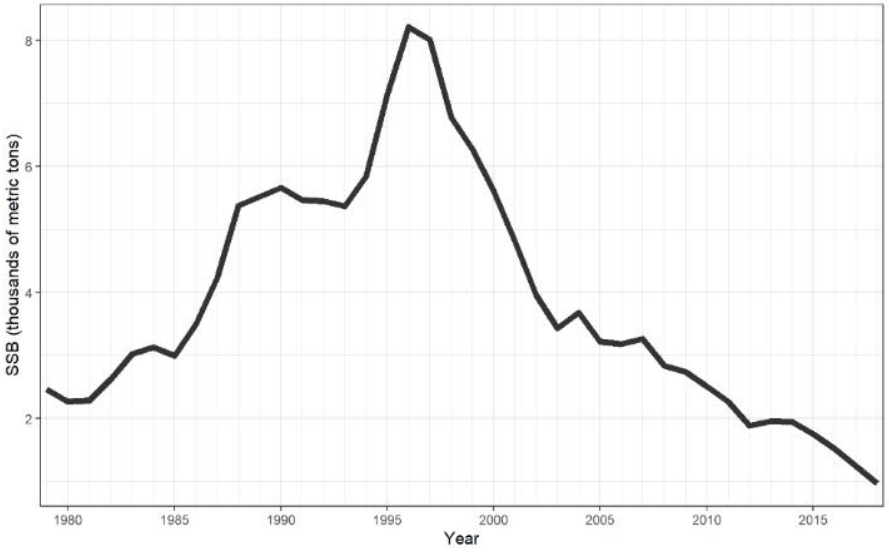


SNE Model Results









SNE 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	287.65	18.07	6.30	73.87	255.62	164.27		
1982	203.09	174.54	48.71	24.18	131.10	57.23		
1983	267.00	47.98	0.44	56.01	176.29	239.41		
1984	369.26	63.80	3.24	36.87	349.26	370.13	139.16	165.48
1985	201.41	196.74	1.22	26.92	213.46	97.06	97.88	59.51
1986	88.56	80.85	81.27	14.43	272.20	237.48	115.45	109.15
1987	261.40	92.45	38.83	27.53	667.41	162.10	113.10	81.59
1988	220.75	222.83	9.54	34.42	1283.60	174.86	146.13	117.35
1989	184.95	73.51	222.38	59.54	725.77	213.39	90.01	148.10
1990	279.83	103.72	48.70	104.70	705.49	420.60	161.26	133.44
1991	306.24	75.17	102.09	192.87	807.81	1104.94	132.32	136.85
1992	261.40	85.55	160.17	44.81	604.69	191.01	75.32	116.25
1993	230.50	111.19	79.70	21.17	2130.72	2593.97	61.69	88.30
1994	75.64	50.02	96.41	59.77	1116.00	237.34	100.84	63.92
1995	207.19	13.64	9.10	69.26	941.36	272.75	74.02	102.55
1996	300.13	60.86	47.12	40.43	1572.57	489.68	85.33	86.02
1997	178.41	183.39	25.91	169.54	1639.65	552.05	113.78	112.62
1998	286.22	65.04	49.06	98.40	668.72	436.41	95.73	158.33
1999	111.00	178.53	17.42	69.30	472.64	494.87	65.61	127.30
2000	160.39	81.30	16.31	123.23	475.67	475.67	53.51	98.93
2001	142.59	54.45	20.92	14.02	475.97	657.20	99.85	55.78
2002	121.52	199.02	0.00	35.35	156.58	631.88	58.22	76.97
2003	100.05	43.62	0.00	4.24	401.74	124.69	43.99	66.50
2004	91.76	66.43	37.10	2.24	500.92	684.81	56.26	41.01
2005	156.50	61.00	99.82	19.03	660.55	469.77	46.75	62.75
2006	103.25	123.36	0.00	55.81	763.79	1123.68	29.87	40.30
2007	72.33	45.35	41.19	9.18	797.95	261.33	50.40	78.04
2008	36.19	77.18	0.00	17.19	1151.59	270.49	54.20	94.30
2009	71.07	38.33	2.82	25.42	508.45	314.65	81.53	65.46
2010	178.41	66.61	123.39	28.66	297.48	233.24		59.64
2011	169.87	35.39	35.75	5.95	289.10	221.92	10.01	32.06
2012	403.66	46.58	11.75	7.78	58.33	104.41	3.48	32.57
2013	98.02	57.05	22.30	29.04	10.56	64.96	12.27	15.08
2014	65.20		0.06	20.77	61.53	21.35	4.99	14.52
2015	87.86	61.26	48.64	1.06	120.22	16.47	13.81	9.63
2016	129.05	60.67	19.52	12.26	91.72	273.25	0.00	25.72
2017		34.39	99.44	14.87	161.88	45.38	0.00	1.10
2018	137.81	32.77	0.10	0.00	178.31	51.29	0.00	7.41
2014-2018 mean	104.98	47.27	33.55	9.79	122.73	81.55	3.76	11.68
25th	100.05	47.98	4.00	14.54	187.10	162.64	33.40	40.66
median	169.87	65.04	24.11	28.09	475.82	250.37	63.65	76.97
75th	261.40	92.45	48.97	58.66	754.29	474.19	99.35	110.89

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	0.375	0.056	0.000	0.025	0.056	0.046		
1982	0.223	0.195	0.075	0.023	0.058	0.029		
1983	0.306	0.049	0.000	0.070	0.176	0.113		
1984	0.437	0.061	0.065	0.025	0.258	0.314	2.446	3.868
1985	0.190	0.098	0.000	0.000	0.097	0.098	0.759	0.810
1986	0.083	0.158	0.048	0.000	0.130	0.179	2.235	0.707
1987	0.337	0.086	0.046	0.051	0.392	0.038	1.459	0.972
1988	0.323	0.090	0.000	0.025	1.024	0.116	1.633	0.801
1989	0.431	0.116	0.205	0.074	0.262	0.048	1.030	1.433
1990	0.381	0.070	0.051	0.050	0.511	0.095	2.066	1.351
1991	0.346	0.059	0.229	0.191	0.538	0.512	1.633	2.889
1992	0.348	0.098	0.230	0.052	0.400	0.119	2.896	1.195
1993	0.249	0.143	0.123	0.024	1.147	2.077	1.517	0.713
1994	0.145	0.037	0.000	0.000	0.690	0.125	2.832	0.546
1995	0.252	0.007	0.013	0.052	0.381	0.071	2.290	1.871
1996	0.309	0.038	0.065	0.077	0.848	0.190	1.761	1.684
1997	0.176	0.267	0.024	0.102	1.143	0.100	3.175	3.720
1998	0.493	0.000	0.040	0.000	0.214	0.220	1.263	3.232
1999	0.125	0.101	0.000	0.165	0.293	0.262	1.482	2.673
2000	0.164	0.126	0.074	0.080	0.350	0.341	0.786	1.951
2001	0.165	0.105	0.022	0.026	0.119	0.351	0.296	1.691
2002	0.111	0.124	0.000	0.086	0.025	0.268	0.053	1.192
2003	0.125	0.073	0.000	0.059	0.357	0.073	0.587	0.296
2004	0.141	0.053	0.039	0.000	0.357	0.486	0.263	0.356
2005	0.171	0.101	0.066	0.000	0.275	0.372	0.217	0.242
2006	0.179	0.098	0.000	0.138	0.310	0.791	0.026	0.309
2007	0.127	0.038	0.051	0.013	0.439	0.171	0.091	0.401
2008	0.103	0.079	0.000	0.025	0.857	0.190	0.284	0.663
2009	0.101	0.056	0.000	0.013	0.381	0.214	0.268	0.361
2010	0.182	0.070	0.154	0.071	0.167	0.140		0.312
2011	0.195	0.062	0.072	0.000	0.140	0.209	0.013	0.111
2012	0.390	0.056	0.025	0.023	0.023	0.068	0.013	0.098
2013	0.132	0.128	0.026	0.072	0.000	0.023	0.035	0.102
2014	0.108		0.000	0.023	0.023	0.000	0.013	0.037
2015	0.136	0.089	0.049	0.024	0.047	0.000	0.013	0.036
2016	0.146	0.037	0.049	0.000	0.091	0.182	0.000	0.121
2017		0.046	0.072	0.000	0.136	0.023	0.025	0.019
2018	0.173	0.025	0.000	0.031	0.091	0.023	0.000	0.014
2014-2018 mean	0.141	0.049	0.034	0.016	0.077	0.045	0.010	0.045
25th	0.136	0.053	0.000	0.013	0.102	0.069	0.039	0.269
median	0.179	0.073	0.039	0.025	0.268	0.132	0.673	0.707
75th	0.323	0.101	0.066	0.071	0.398	0.251	1.633	1.558

RECRUIT ABUNDANCE (SURVEY)
Abundance of lobsters 71 - 80 mm CL (sexes combined)

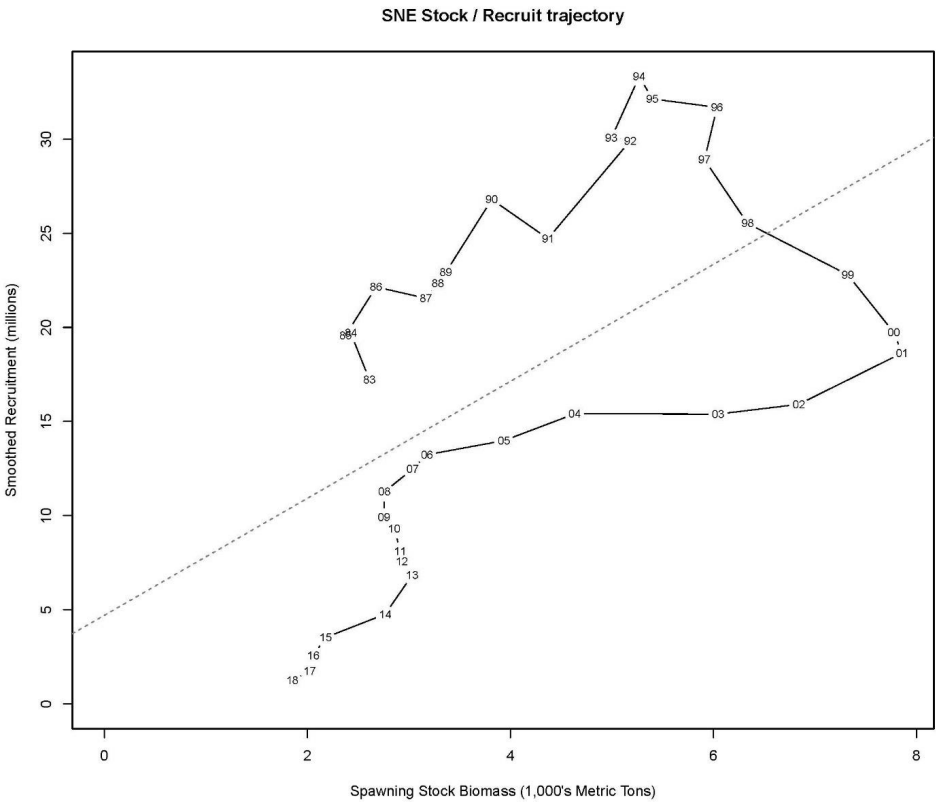
Survey	NEFSC		MA		RI		CT	
	Fall	spring	fall	spring	Fall	spring	Fall	spring
1981	0.983	0.127	0.066	0.657	1.310	0.892		
1982	0.653	0.713	0.039	0.101	0.638	0.257		
1983	0.783	0.324	0.044	0.095	0.426	0.944		
1984	0.529	0.145	0.013	0.422	1.355	1.029	7.957	10.885
1985	0.829	1.710	0.088	0.333	0.968	0.279	4.270	3.209
1986	0.359	0.208	0.193	0.168	1.278	0.911	6.542	2.933
1987	0.534	0.739	0.168	0.266	3.137	0.788	7.427	3.271
1988	0.672	0.434	0.160	0.238	4.048	0.465	5.437	1.995
1989	1.339	0.124	0.420	0.139	3.262	0.905	5.843	5.332
1990	0.855	0.620	0.315	2.338	2.689	2.167	8.271	7.570
1991	0.597	0.397	0.868	1.231	3.103	4.767	11.414	11.564
1992	0.940	0.140	0.554	0.097	1.971	0.619	11.774	11.363
1993	0.424	0.734	0.517	0.249	8.294	7.808	16.833	8.400
1994	0.391	0.218	0.420	0.947	3.881	1.000	12.706	5.480
1995	0.622	0.007	0.028	1.127	4.500	1.333	12.669	13.123
1996	1.672	0.313	0.320	0.398	6.545	1.595	12.079	12.317
1997	1.187	1.321	0.123	1.437	6.095	2.575	27.692	16.876
1998	1.096	0.799	0.110	1.112	3.238	1.634	13.967	26.200
1999	0.444	2.048	0.194	0.734	2.073	1.714	14.148	26.959
2000	1.154	0.622	0.134	0.552	1.825	1.537	8.270	13.371
2001	0.375	0.388	0.027	0.182	2.167	2.973	7.414	10.803
2002	0.468	1.340	0.000	0.336	0.725	2.683	2.748	8.108
2003	0.422	0.448	0.000	0.070	0.929	0.293	4.083	3.516
2004	0.289	0.271	0.000	0.052	1.476	1.865	3.366	2.377
2005	0.206	0.134	0.000	0.079	2.525	1.070	1.539	2.258
2006	0.255	0.279	0.034	0.086	2.238	3.628	1.402	2.166
2007	0.360	0.235	0.000	0.074	2.683	0.683	1.217	2.918
2008	0.266	0.275	0.013	0.158	2.952	0.643	1.342	2.514
2009	0.167	0.102	0.047	0.161	1.357	1.143	1.433	1.332
2010	0.314	0.144	0.189	0.054	1.214	0.442		1.386
2011	0.276	0.082	0.000	0.186	1.023	0.419	0.200	0.452
2012	0.361	0.085	0.213	0.065	0.182	0.295	0.085	0.481
2013	0.266	0.070	0.037	0.108	0.023	0.159	0.060	0.239
2014	0.327		0.000	0.043	0.136	0.023	0.051	0.167
2015	0.183	0.010	0.298	0.074	0.372	0.047	0.081	0.161
2016	0.405	0.390	0.134	0.049	0.250	0.568	0.000	0.204
2017		0.059	0.162	0.129	0.409	0.136	0.000	0.047
2018	0.265	0.080	0.013	0.023	0.682	0.182	0.013	0.000
2014-2018 mean	0.295	0.135	0.121	0.063	0.370	0.191	0.029	0.116
25th	0.314	0.127	0.016	0.081	0.776	0.424	1.248	1.359
median	0.424	0.275	0.099	0.164	1.651	0.908	4.853	3.209
75th	0.783	0.620	0.194	0.416	3.065	1.624	10.628	10.844

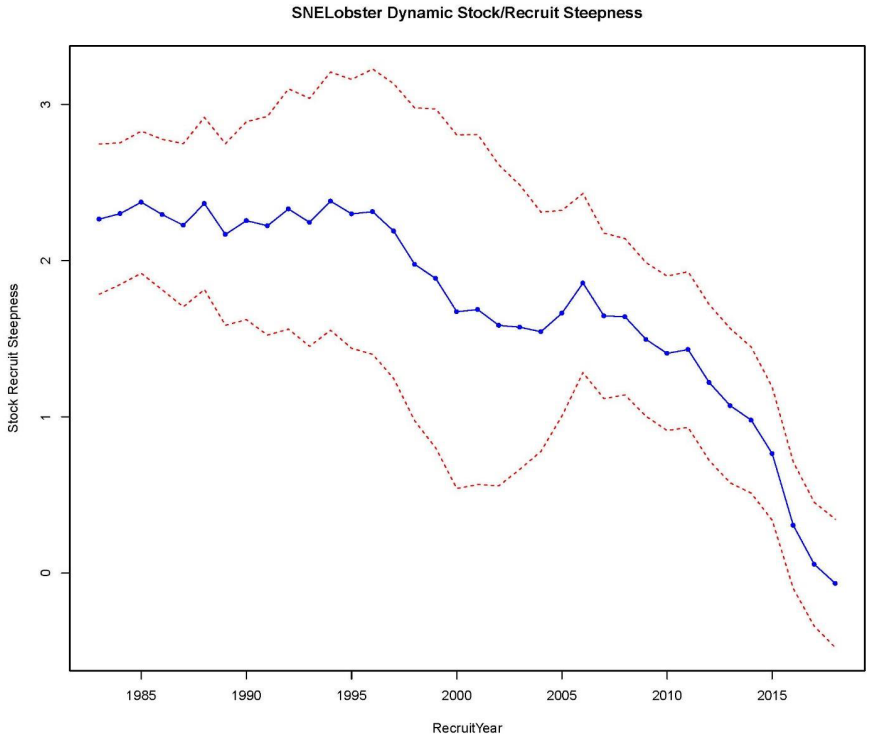
SNE Abundance Indicators

SURVEY LOBSTER ENCOUNTER RATE Proportion of postive tows								
Survey	NEFSC		MA		RI		CT	
	Fall	spring	fall	spring	Fall	spring	Fall	spring
1981	0.446	0.179	0.150	0.375	0.408	0.492		
1982	0.331	0.238	0.211	0.282	0.435	0.300		
1983	0.264	0.133	0.161	0.211	0.368	0.465		
1984	0.306	0.076	0.184	0.400	0.435	0.586	0.757	0.625
1985	0.322	0.198	0.216	0.513	0.500	0.311	0.688	0.565
1986	0.248	0.169	0.385	0.390	0.463	0.643	0.608	0.672
1987	0.205	0.126	0.184	0.278	0.471	0.346	0.763	0.633
1988	0.272	0.089	0.211	0.389	0.548	0.488	0.663	0.650
1989	0.386	0.129	0.333	0.500	0.571	0.524	0.625	0.750
1990	0.414	0.134	0.436	0.658	0.533	0.643	0.763	0.725
1991	0.314	0.128	0.395	0.405	0.692	0.767	0.772	0.808
1992	0.319	0.208	0.229	0.514	0.571	0.405	0.684	0.769
1993	0.261	0.112	0.265	0.538	0.706	0.500	0.748	0.733
1994	0.252	0.085	0.200	0.513	0.571	0.575	0.742	0.726
1995	0.319	0.036	0.125	0.436	0.667	0.548	0.675	0.767
1996	0.381	0.086	0.162	0.300	0.758	0.786	0.775	0.664
1997	0.270	0.233	0.205	0.450	0.714	0.750	0.813	0.708
1998	0.314	0.115	0.132	0.541	0.548	0.585	0.709	0.825
1999	0.274	0.223	0.206	0.405	0.585	0.762	0.788	0.775
2000	0.314	0.125	0.154	0.447	0.625	0.683	0.725	0.812
2001	0.214	0.195	0.179	0.282	0.595	0.649	0.575	0.767
2002	0.219	0.171	0.027	0.282	0.450	0.610	0.588	0.725
2003	0.248	0.096	0.025	0.135	0.405	0.512	0.638	0.706
2004	0.179	0.092	0.030	0.282	0.500	0.541	0.663	0.605
2005	0.178	0.076	0.152	0.342	0.450	0.488	0.544	0.625
2006	0.226	0.134	0.026	0.425	0.619	0.791	0.513	0.613
2007	0.183	0.127	0.100	0.342	0.537	0.439	0.525	0.700
2008	0.209	0.092	0.103	0.325	0.524	0.548	0.650	0.625
2009	0.296	0.163	0.053	0.500	0.405	0.571	0.550	0.492
2010	0.298	0.098	0.235	0.225	0.452	0.465		0.538
2011	0.323	0.130	0.050	0.175	0.233	0.302	0.275	0.457
2012	0.329	0.119	0.154	0.175	0.159	0.273	0.200	0.432
2013	0.256	0.102	0.077	0.184	0.091	0.205	0.150	0.283
2014	0.255		0.077	0.128	0.227	0.068	0.101	0.258
2015	0.254	0.055	0.053	0.103	0.163	0.116	0.100	0.267
2016	0.228	0.154	0.105	0.083	0.136	0.295	0.025	0.250
2017		0.072	0.158	0.075	0.227	0.159	0.025	0.078
2018	0.253	0.075	0.059	0.108	0.182	0.091	0.013	0.087
2014-2018 mean	0.247	0.089	0.090	0.099	0.187	0.146	0.053	0.188
25th	0.25	0.09	0.08	0.21	0.40	0.32	0.52	0.52
median	0.27	0.13	0.16	0.34	0.49	0.51	0.64	0.65
75th	0.32	0.16	0.21	0.44	0.57	0.60	0.74	0.73

YOUNG-OF-YEAR INDICES				
	YOY	YOY	Larvae	Postlarvae
Survey	MA	RI	CT / ELIS Summer	CT_NY / WLIS Summer
1981				
1982				
1983				14.480
1984			0.429	6.890
1985			0.527	66.750
1986			0.898	4.580
1987			0.775	18.980
1988			0.739	49.270
1989			0.739	5.880
1990		1.127	0.806	19.660
1991		1.449	0.546	9.970
1992		0.634	1.435	14.120
1993		0.513	1.186	26.230
1994		1.208	0.975	96.520
1995	0.167	0.340	1.463	18.200
1996	0.000	0.151	0.305	12.070
1997	0.083	0.958	0.209	13.692
1998	0.200	0.543	0.547	4.850
1999	0.033	0.908	2.830	39.703
2000	0.333	0.278	0.777	14.279
2001	0.100	0.722	0.319	9.460
2002	0.100	0.248	0.638	1.988
2003	0.034	0.702	0.251	2.600
2004	0.034	0.396	0.453	6.100
2005	0.134	0.535	0.490	6.900
2006	0.168	0.444	0.709	1.700
2007	0.100	0.538	0.372	18.100
2008	0.000	0.139	0.374	8.100
2009	0.033	0.056	0.193	7.620
2010	0.000	0.083	0.350	9.910
2011	0.034	0.000	0.262	5.900
2012	0.000	0.089	0.124	2.770
2013	0.134	0.194	0.159	
2014	0.066	0.222	0.059	
2015	0.000	0.167	0.190	
2016	0.000	0.028	0.447	
2017	0.000	0.028	0.100	
2018	0.000	0.028	0.165	
2014-2018 mean	0.013	0.094	0.192	
25th	0.000	0.139	0.257	5.950
median	0.034	0.340	0.453	9.940
75th	0.109	0.634	0.757	18.175

SNE Model Productivity





Current Reference Points

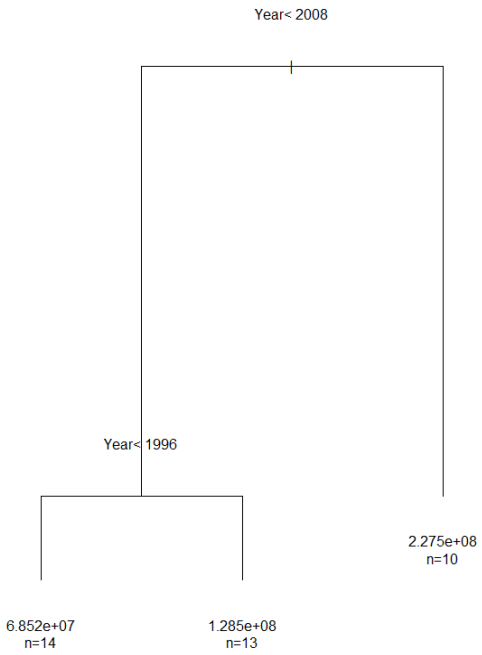
- Issues
  - Regime shift analysis indicates regimes in drivers of lobster survival and other vital rates
  - Current conditions not comparable to reference period conditions – abundance in both stocks has changed considerably since
  - Environmental conditions expected to continue to shift in the future

New Recommended Reference Points

- Reference abundance analyzed for regime shifts implicit of environmental drivers with rpart

- Detected regimes used to structure reference points

GOM/GBK



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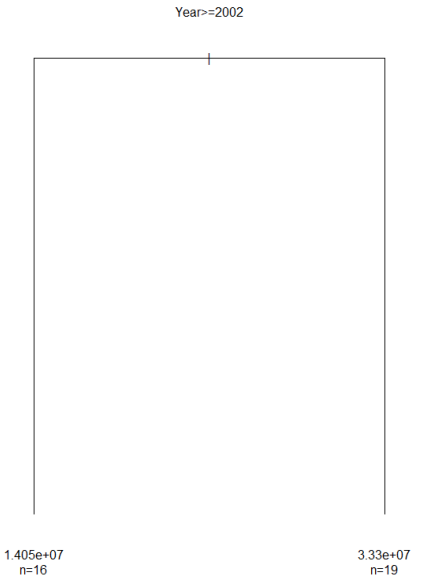
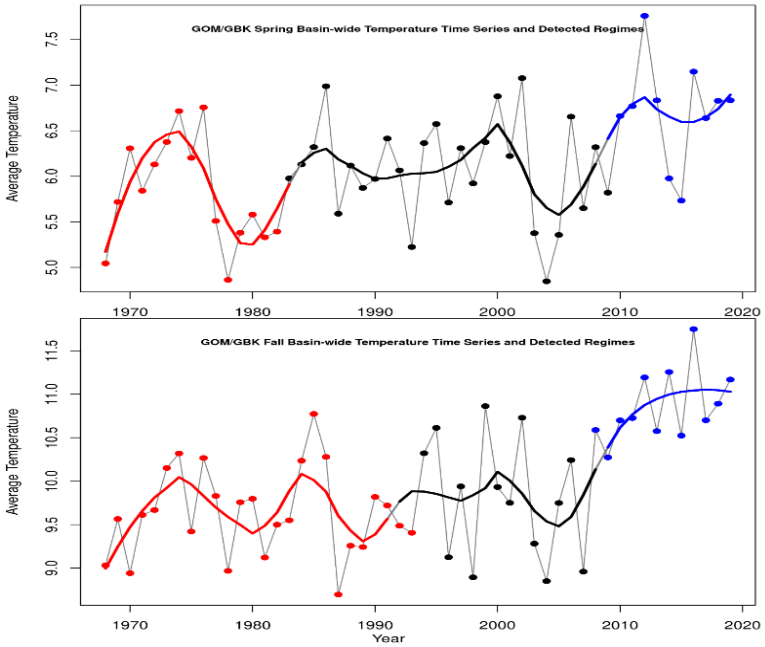
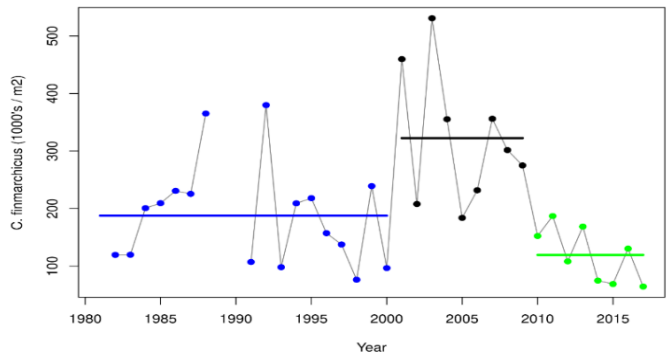


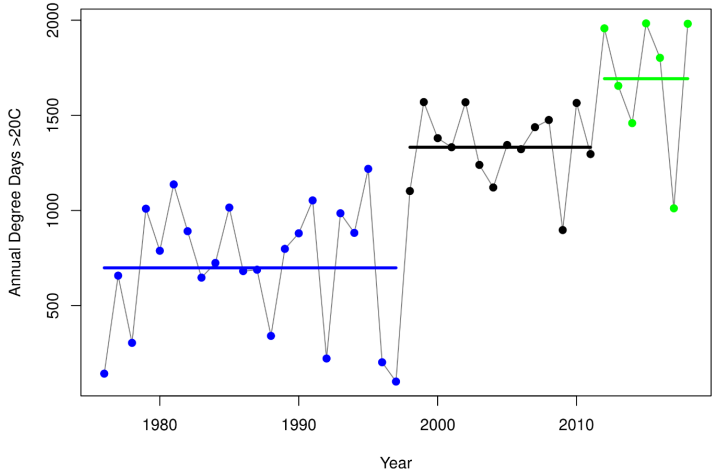
Environmental Regime Shift

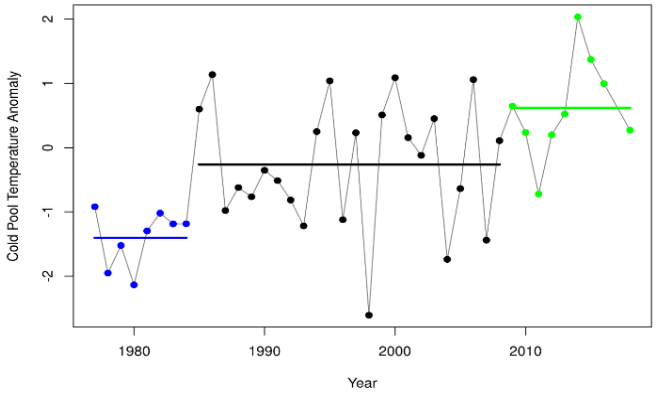
GOM/GBK





SNE





Reference Abundance RPs

- Fishery/Industry Target (GOMGBK only)
  - 25th percentile of high abundance regime
    - Recommended post-assessment economics analysis

- Abundance Limit (GOMGBK only)
  - Median of moderate abundance regime
  - Depleted if 3-year avg ref abundance < Abundance Limit
    - Recommended take management action to halt the decline

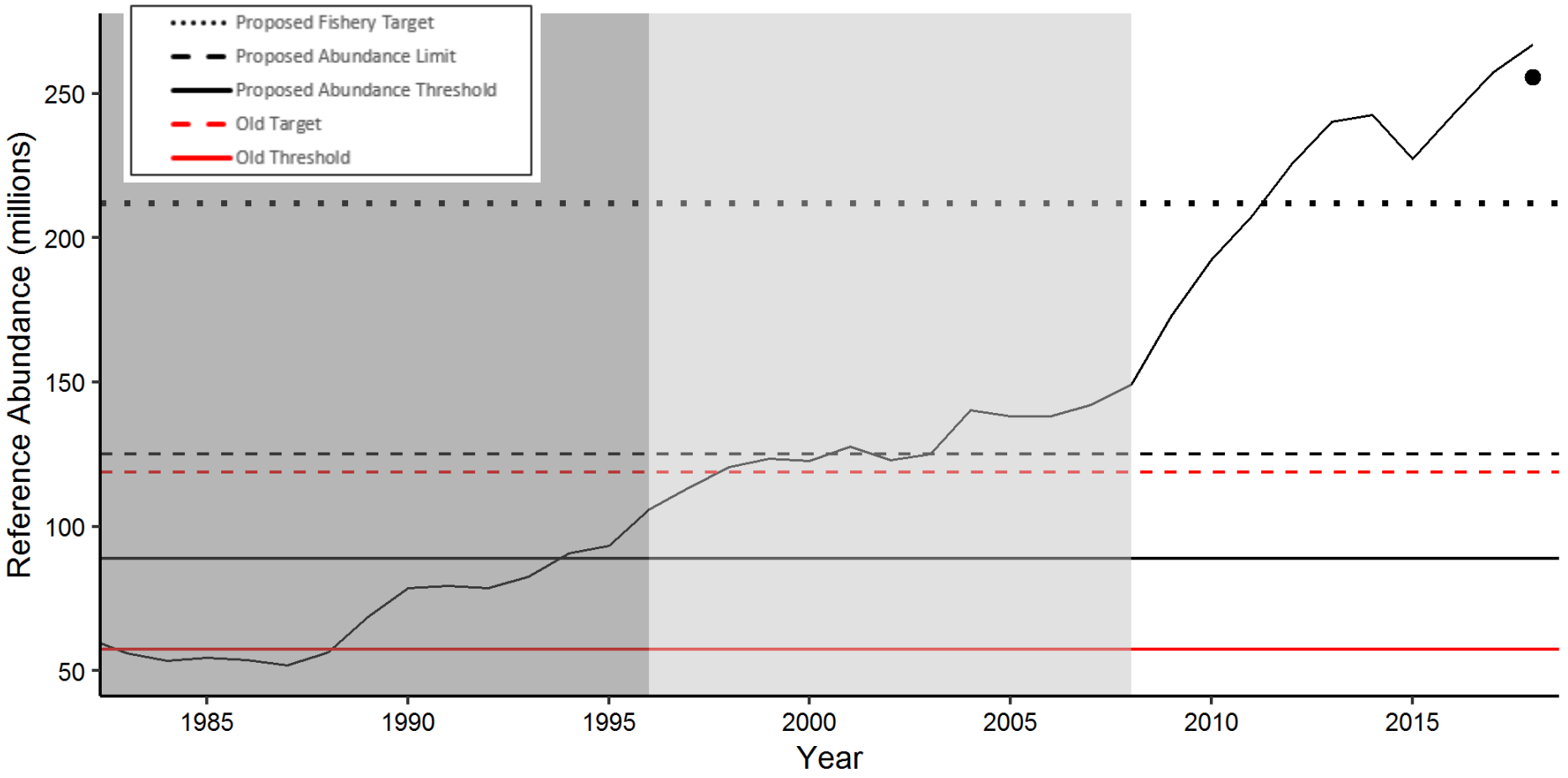
- Abundance Threshold (both stocks)
  - Average of three highest years during the low abundance regime
  - Significantly depleted if 3-year avg ref abundance < Abundance Threshold
    - significant action to halt the decline of abundance and increase reproductive capacity and recruitment, such as a moratorium

Exploitation RPs

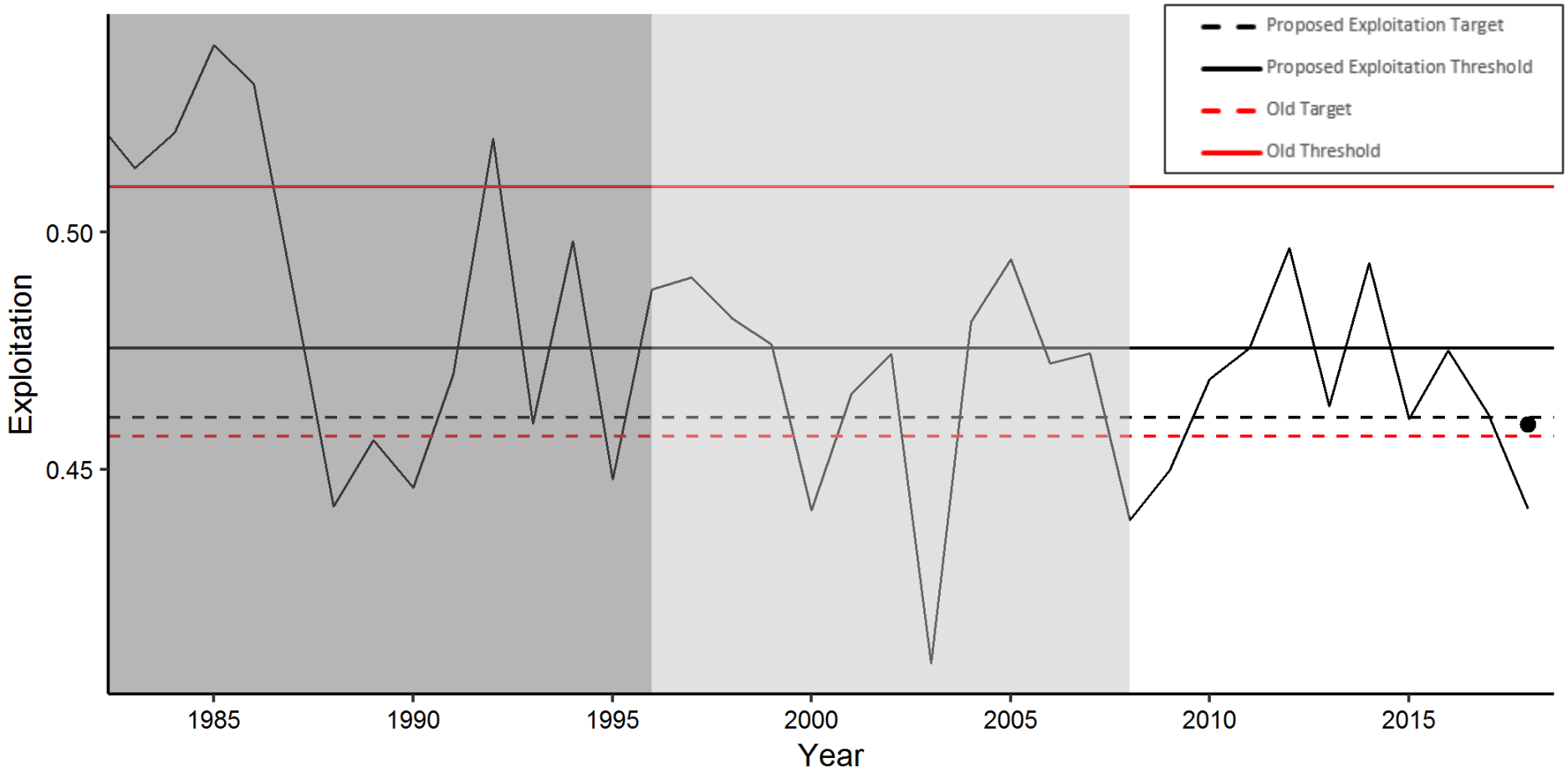
- Target
  - 25th percentile of exploitation estimates during the current abundance regime
  - Fishing mortality is favorable if three-year average exploitation $\leq$ Target

- Threshold
  - 75th percentile of exploitation estimates during the current abundance regime
  - Experiencing overfishing if three-year average exploitation > Threshold
  - Recommended action is to initiate additional research to better understand the cause of increased exploitation and determine if management action is necessary

GOMGBK Abundance RPs

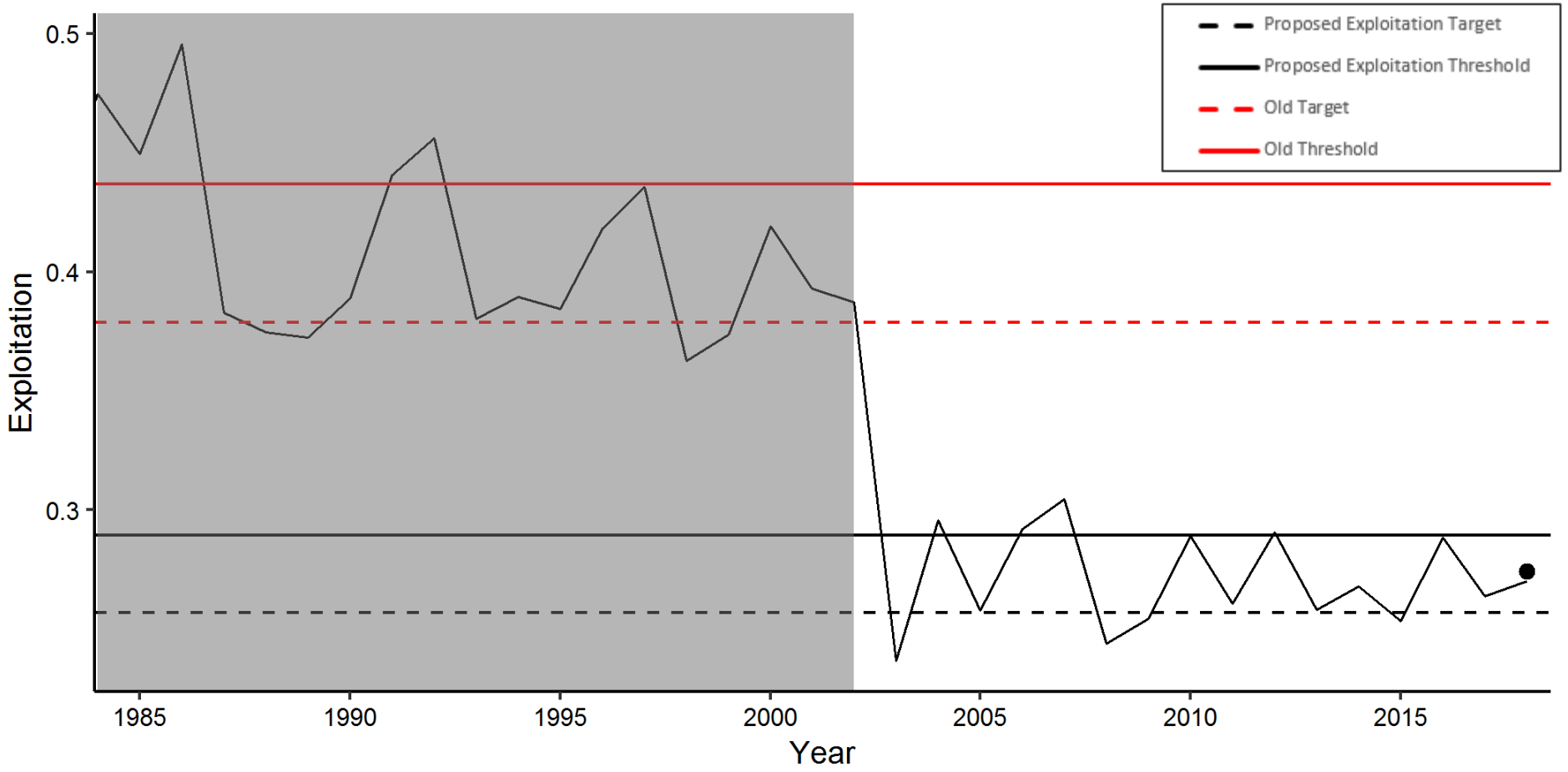


GOMGBK Exploitation RPs



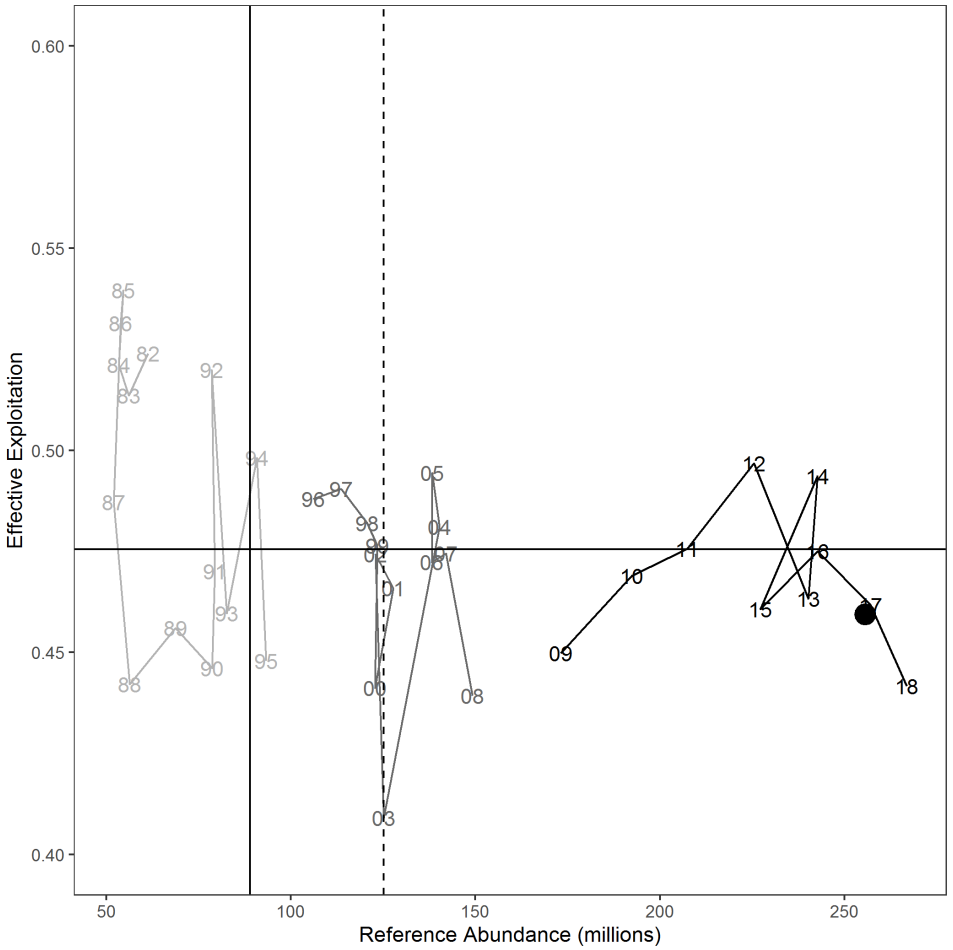
SNE Abundance RPs

SNE Exploitation RPs



GOMGBK Stock Status

- Reference abundance is not depleted
  - 2016-2018 average abundance (256 million lobsters) > Fishery/Industry Target (212 million lobsters)
- Overfishing in not occurring
  - 2016-2018 average exploitation (0.459) < Target (0.461)
- No management action recommended

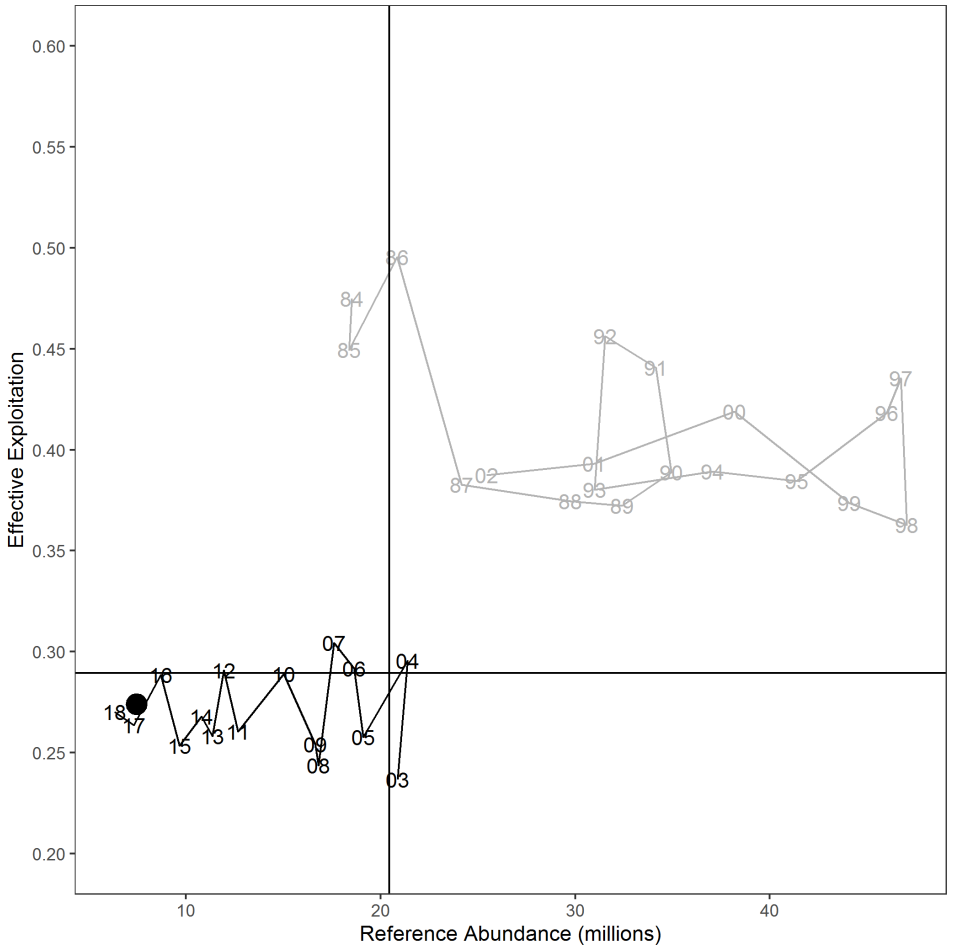


GOMGBK Considerations

- Stockwide recruit+ abundance is at all time highs, however trends differ at smaller spatial scale
- Encounter rates indicate distribution expanding in offshore waters
  - Will remain important to determine catchability and true abundance signals in overall trends
- Fishery efficiency of exploiting legal abundance without clear affect to abundance and catchability changes make interpretation of exploitation time series difficult
- YOY trends concerning, particularly in the southwestern portion of the stock – need to monitor subsequent data sets closely (see Data Update Process)
- Concerning trend in effort suggesting some SNE effort is shifting to GBK – need improved effort data to better track this trend
- Stress indicators remain relatively low, but are trending up, particularly in the southwest portion of the stock

SNE Stock Status

- Reference abundance is significantly depleted
  - 2016-2018 average abundance (7 million lobsters) < Abundance Threshold (20 million lobsters)
- Overfishing in not occurring
  - 2016-2018 average exploitation (0.274) < Threshold (0.290), but > Target (0.257)
- Significant management action is necessary to provide the best chance of stabilizing or improving abundance and reproductive capacity



SNE Considerations

- Stockwide abundance is at all time lows and is in recruitment failure
- Encounter rates indicate distribution contracting both inshore and offshore
- Landings have continued to decline to a time series low in 2018
- Stress indicators indicate stressful environment that may be having lethal and sublethal effects
- Mechanisms have resulted in decreased recruitment rate that will pose significant challenges to stock rebuilding

Data Update Process

- Purpose: support more timely response to concerning stock trajectories between stock assessments

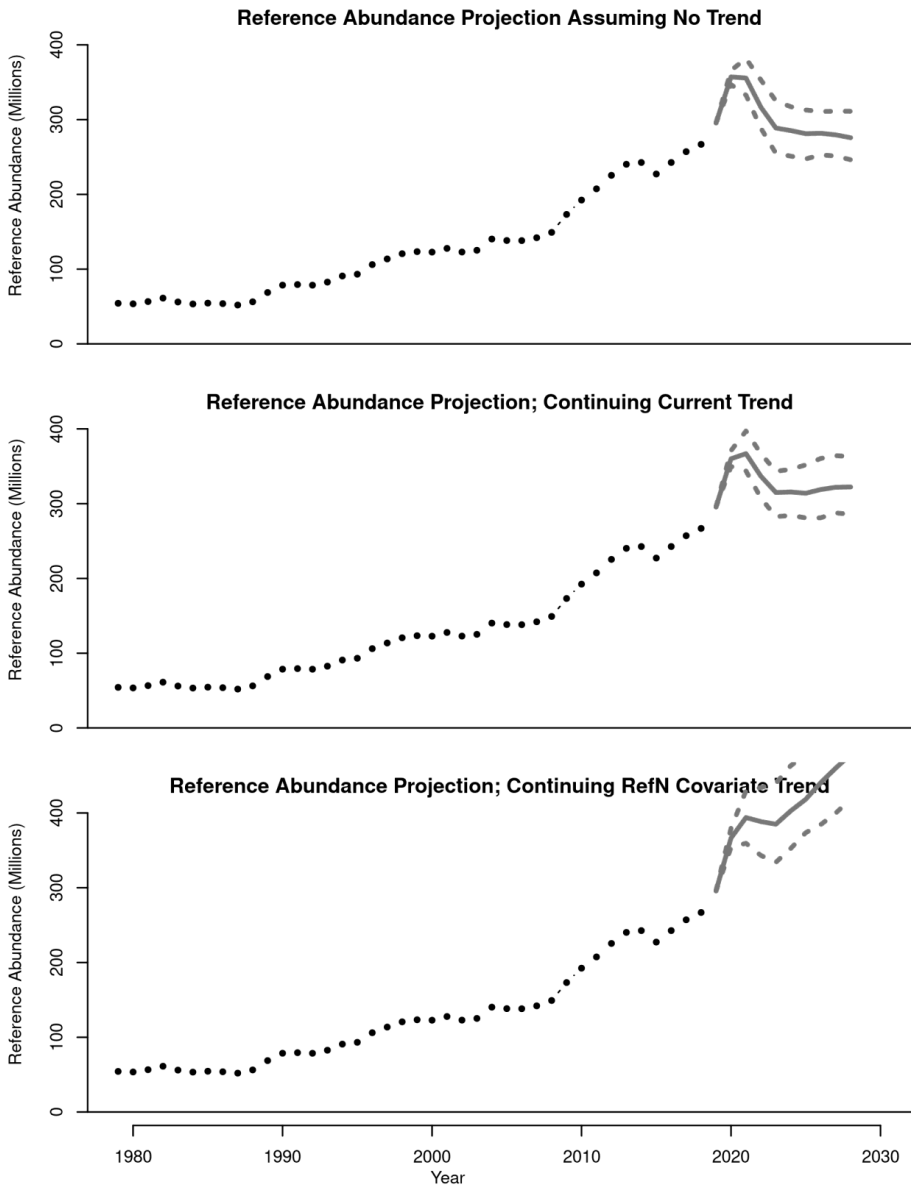
- Annual reviews of:
  - Trawl survey recruit abundance (71-80 mm lobsters) and encounter rate indicators
  - Ventless trap survey sex-specific model-based abundance indices (53mm+)
  - YOY settlement indicators

Projections

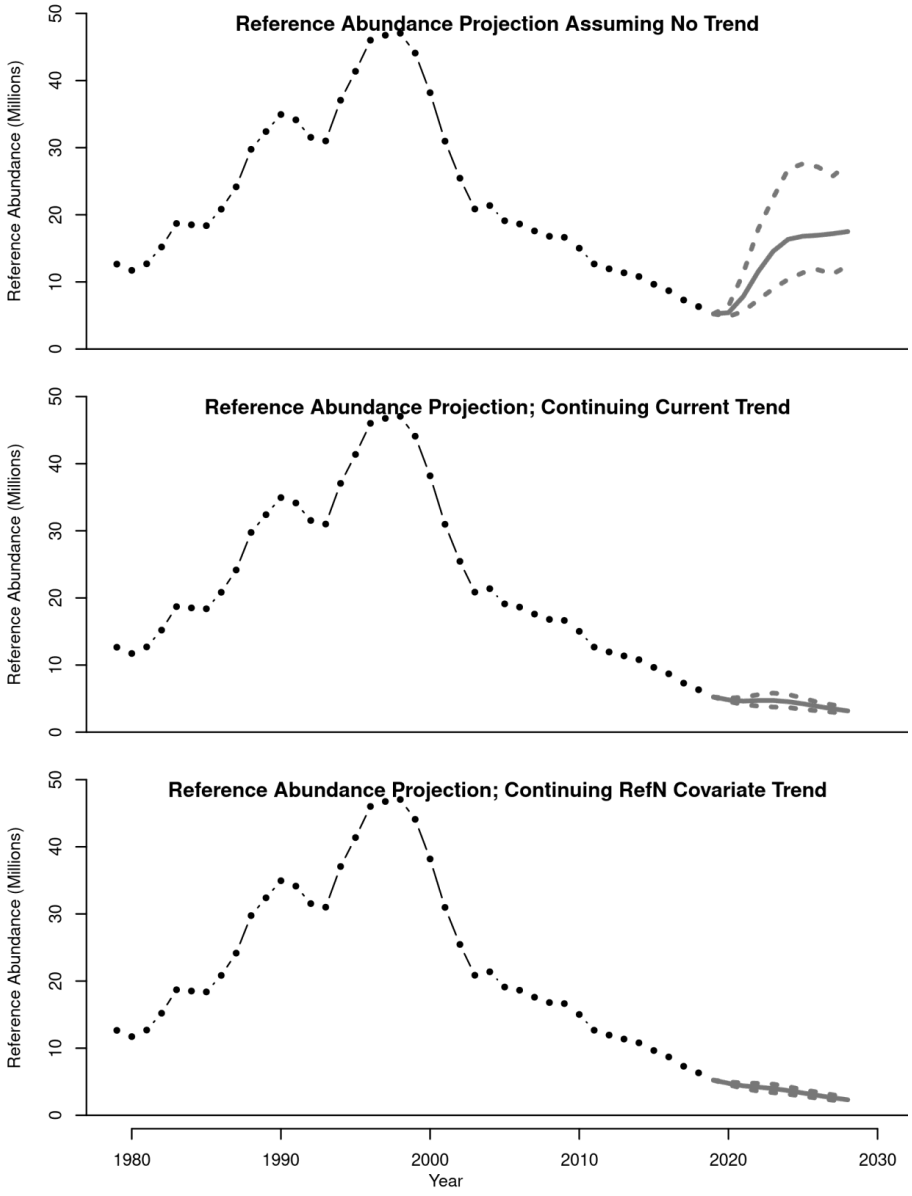
- 3 sets of projections:
  - Basecase projections: Stock projections based on the new basecase models, projected ahead 10 years.
    - An additional scenario for SNE included no F
  - Sensitivity projections: Stock projections based on each sensitivity run, projected ahead 10 years.
  - Prior Projections: Stock projections with the basecase from the previous assessment, projected ahead to 2019 and compared to the new basecase model.

- 3 sets of recruitment based on the assessment model recruitment estimates for the current regime (SNE: 2003-2017, GOMGBK: 2009-2017)
  - No Trend
  - Current Trend
  - Covariate Trend

GOM/GBK Base Case Projections



SNE Base Case Projections



Questions?

Review Panel Report
American Lobster Stock Assessment

American Lobster Fishery Management Board

October 19, 2020

Stock Assessment Peer Review Process

- American Lobster Stock Assessment Subcommittee and Technical Committee developed new stock assessment
- ASMFC Peer Review Workshop August 10-14, 2020
- Scientific review focused on data inputs, model results, and overall quality of assessment

Products

- ASMFC Stock Assessment and Review Report
- http://www.asmfc.org/species/american-lobster

Stock Assessment Review Process

Scientific Peer Review Panel

- Chair + 3 additional Technical Reviewers, with expertise in
  - Lobster Biology and Population Dynamics
  - Stock Assessment Modeling
  - Climate Change Effects on Marine Populations

Michael Celestino (Chair), New Jersey Division of Fish and Wildlife,

Port Republic, New Jersey

Dr. Adam Cook, Fisheries and Oceans Canada, Dartmouth, Nova Scotia

Dr. William Harford, Nature Analytics, Mississauga, Ontario

Dr. Rebecca Selden, Wellesley College, Department of Biology, Massachusetts

Review Panel Overall Findings

- The SAS thoughtfully completed their TORs and the assessment is suitable for management.
- UMM should be the basis of stock status and management advice
  - Trends in UMM outputs are less uncertain than their scale.
- Stock status determination
  - GOMGBK - stock is at time series high abundance and is not depleted nor experiencing overfishing
  - SNE - time series low abundance, significantly depleted, but not experiencing overfishing

Review Findings

✓ **ToR 1:** *Evaluate thoroughness & treatment of data used in assessment*

Panel Conclusions

- Data considered/evaluated & included/omitted appropriately
- Environmental covariate excellent addition

Recommendation: *Further exploration of VTS*

Recommendation: *Growth transition matrix should be focus of future research*

Review Findings

✓ **ToR 2:** *Evaluate methods and models used to estimate population parameters and reference points*

Panel Conclusions

- Use of life history information appropriate
- UMM is the preferred model for stock status determination.

Recommendation: *Incorporation of time-varying life history parameters; expansion of GTM*

Recommendation: *Further evaluation of discard mortality, natural mortality*

Recommendation: *Explore potential for indicator-based management*

Review Findings

✓ **ToR 3:** *Evaluate identification and characterization of environmental/climatic drivers*

Panel Conclusions

- Breadth of drivers thoughtfully considered; comprehensive of set likely to be important for population dynamics
- Dynamic linear model analysis positive advancement and helpful for hypothesis generation
- Increase in suitable settlement habitat in GOMGBK

Recommendation: *Consider alternative methods to determine time series breakpoints*

Recommendation: *Formally assess correspondence in breakpoint timing across different environmental variables*

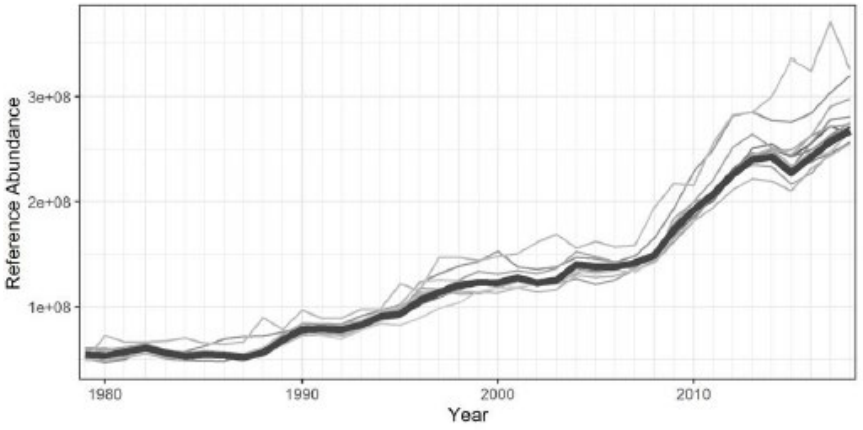
Review Findings

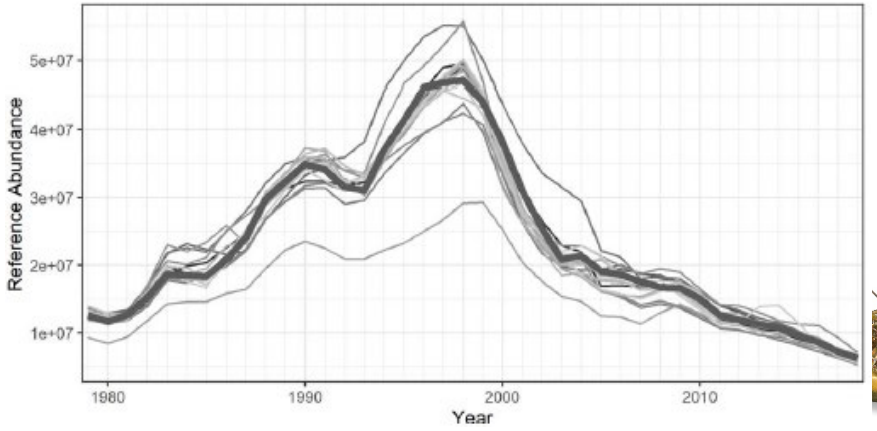
✓ **ToR 4:** *Evaluate estimates of stock abundance and exploitation*

Panel Conclusions

- Trends in abundance and exploitation less uncertain than their scale
- Model diagnostics suggest reasonable fits to data

Recommendation: *Updating GTM high priority; time varying*





Review Findings

✓ **ToR 5:** *Evaluate methods used to characterize uncertainty*

Panel Conclusions

- Asymptotic standard errors underestimate uncertainty
- Uncertainty adequately explored through sensitivity runs

✓ **ToR 6:** *Evaluate diagnostic analyses*

Panel Conclusions

- Sensitivity runs -> thorough set of alternate configurations
- Retrospective patterns GOMGBK: mild, trends stable; SNE: less stable

Recommendation: *Evaluate starting values*

Review Findings

✓ **ToR 7:** *Evaluate indicator-based analyses*

Panel Conclusions

- Strength of the assessment

Recommendation: *Consider how quantiles will be continued through update years, in between assessments*

Recommendation: *Further development of science-based rule that would trigger earlier than scheduled stock assessment*

Recommendation: *Modifications/additional indicators suggested*

Review Findings

✓ **ToR 8:** *Evaluate current and recommended reference points; recommend stock status*

Panel Conclusions

- Regime-based reference points and use of multi-year averages to determine stock status commendable and appropriate
- GOMGBK: not depleted, not experiencing overfishing
- SNE: significantly depleted, not experiencing overfishing

Recommendation: *Consider alternate smoothing algorithms that are robust to trends*

Recommendation: *MSE could inform alternate range of exploitation values*

Addendum XXVI: Update on Data Element Implementation

October 2020

Data Group Progress

- All data elements from Ad 26 will be ready for collection from state and federal lobster only permit holders for Jan 2021
  - Includes additional elements to better characterize the fishery with respect to Atl. Large Whales
    - Traps hauled by effort (area plus gear)
    - Total traps by effort
    - Total traps overall
    - Number of strings hauled
    - Number of buoy lines by effort
    - Total number of buoy lines.
    - A combination of area plus 10’ square or lat/long.

Request for Data

- While all of the jurisdictions are working to provide each of the data elements, HOW the elements are gathered is important

- Data elements can be gathered in 3 ways:
  - Collected
  - Calculated
  - Estimated

Request for Data from NOAA

1. # of trap hauls in effort (stat reporting area)
2. # of traps in water in effort (stat reporting area)
3. Traps/trawl hauled in effort (stat reporting area)
4. # buoy lines in effort (stat reporting area)
5. # buoy lines in the water

Recommendation

- Send a letter to GARFO requesting changes to how data is gathered for 5 of the lobster data elements
  - # of trap hauls in effort
  - # of trap in water in effort
  - Traps/trawl hauled in effort
  - # buoy lines in effort
  - # buoy lines in the water

Report on Electronic Tracking Pilot Program

Bill DeVoe, MEDMR and Story Reed, MADMF
American Lobster Management Board
October 19, 2020

Approach

- Initiated by the adoption of Addendum XXVI to the American Lobster Fishery Management Plan, which established a one-year pilot electronic tracking program
- Established Atlantic States Marine Fisheries Commission (ASMFC) Lobster Electronic Tracking Subcommittee
- Subcommittee determined that multiple devices should be tested in a variety of geographical areas from Southern New England to the Gulf of Maine on federal lobster vessels

Devices

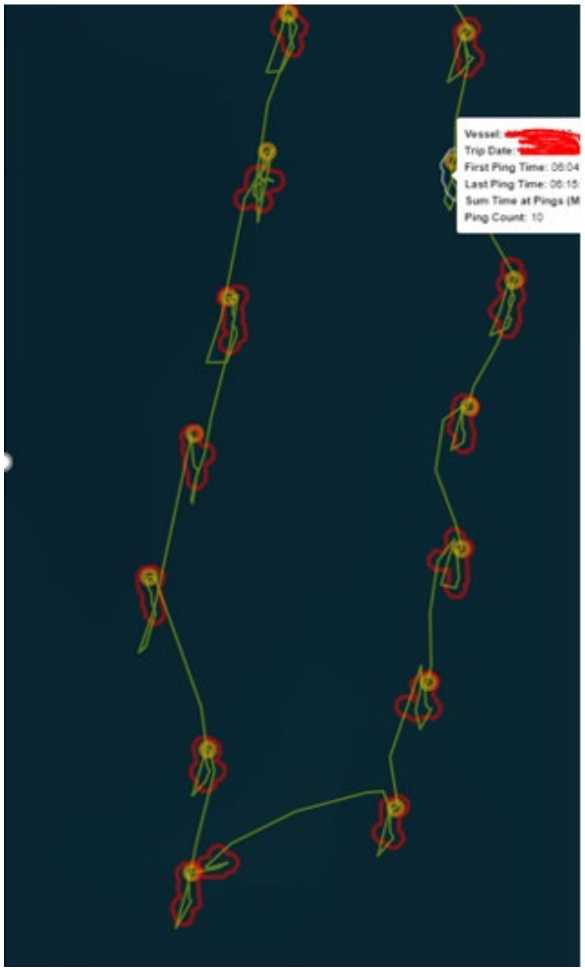
- Tested devices from Succorfish, Rock7, and Pelagic Data Systems
- Devices used cellular and satellite networks
- Goal of 1 minute ping rate
- Deployed June 2019 – May 2020

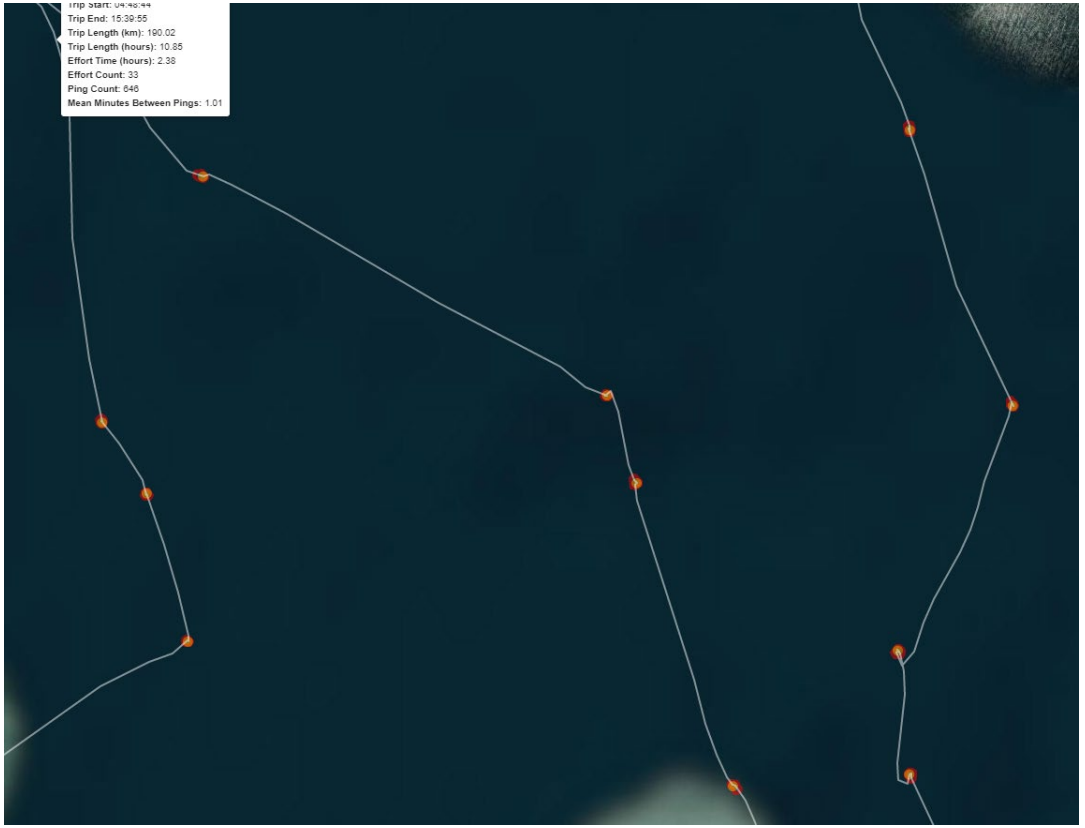
Results

- All devices performed satisfactorily, delivering vessel positions as expected
- Cellular based systems are considerably cheaper than satellite and permit faster ping rates
- Greatest cause of failure was loss of power from vessel to device
- Some devices had better features in terms of integration/interface and add-on hardware

Results

- One-minute ping rate allowed programmatic detection/quantification of trawls as small as triples





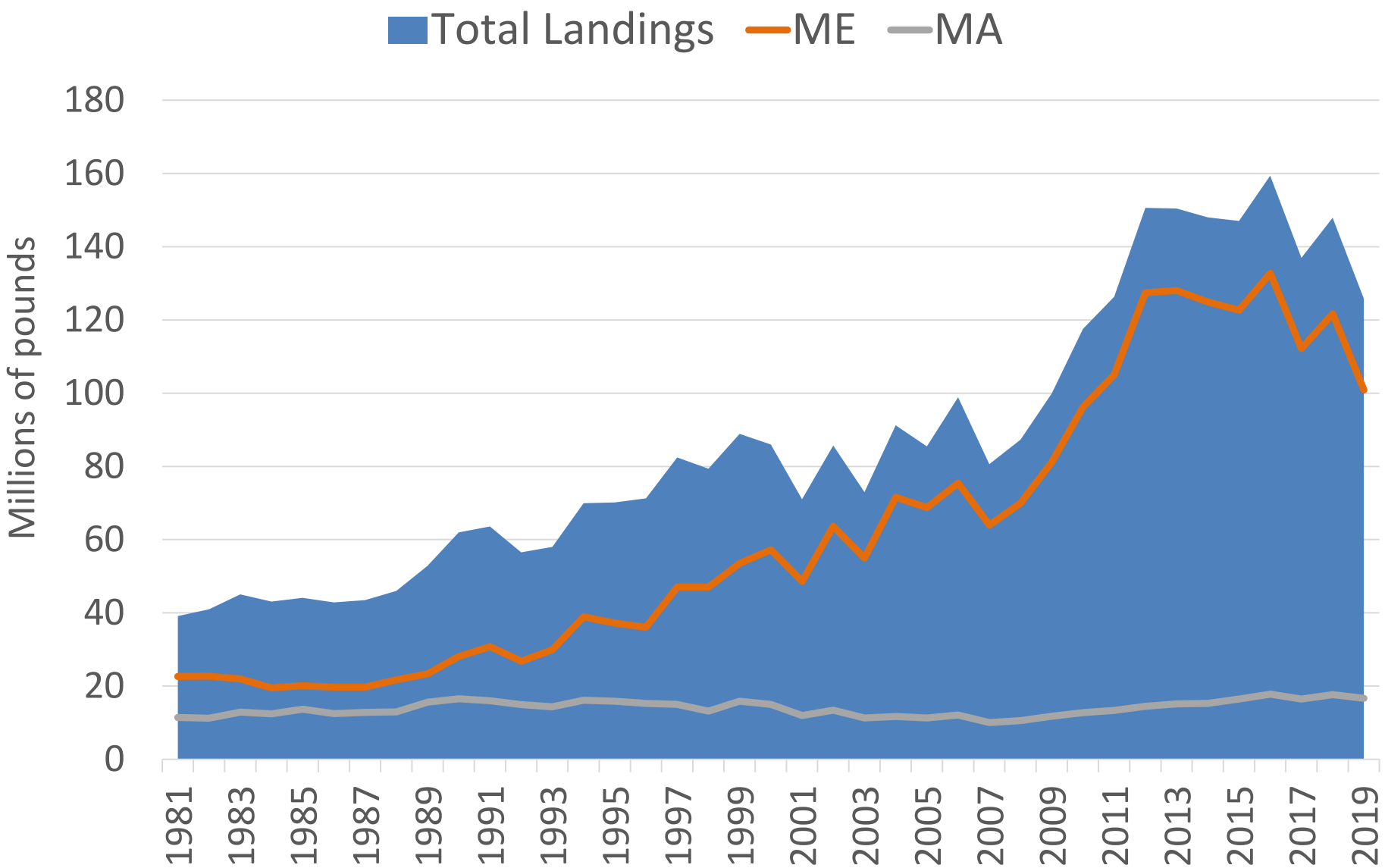
Recommendations/Future Work

- One-minute ping rate essential
- Multiple vendors could meet requirements for high-ping rate VMS in the lobster fishery
- Installation of devices on many vessels requires a significant amount of staff/technicians
- Significant data integration work remains – tracking data needs be linked to harvester reports
- Possible further hardware testing – hauler sensors, environmental sensors, etc

American Lobster
FMP Review for the 2019 Fishing Year

American Lobster Management Board
October 19, 2020

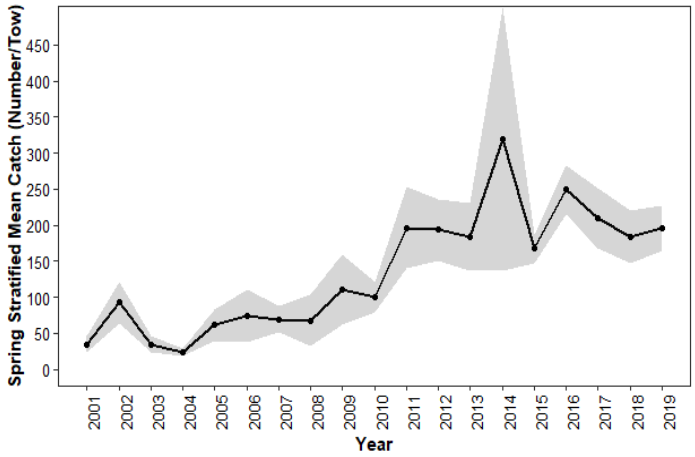
Commercial Landings



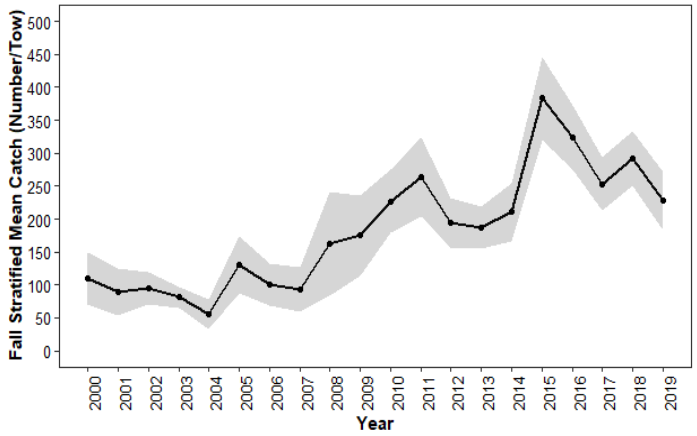
Fishery Monitoring – Trawl

ME/NH Trawl Survey

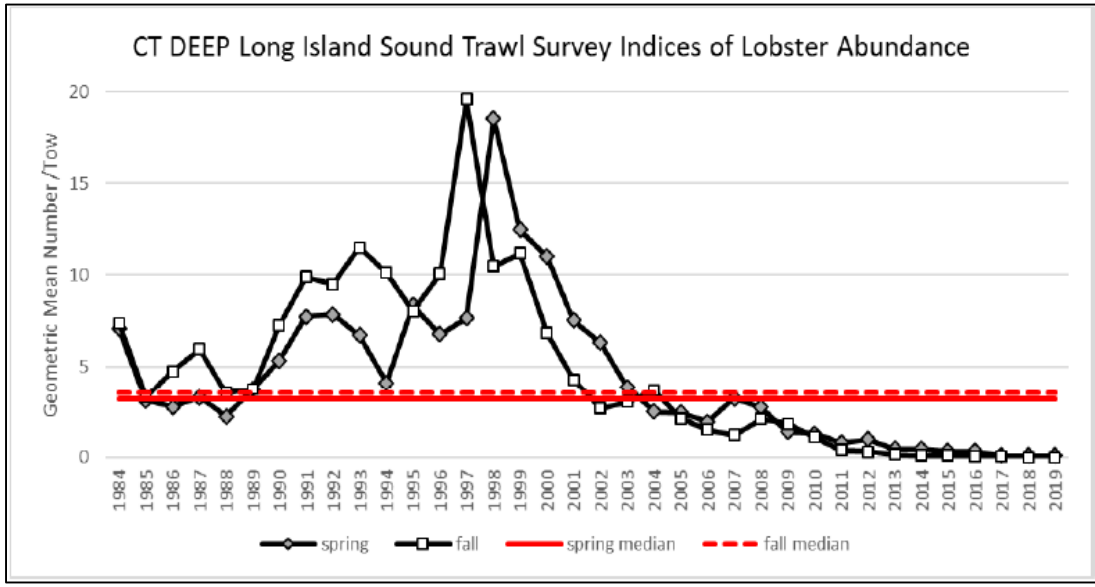
Spring



Fall

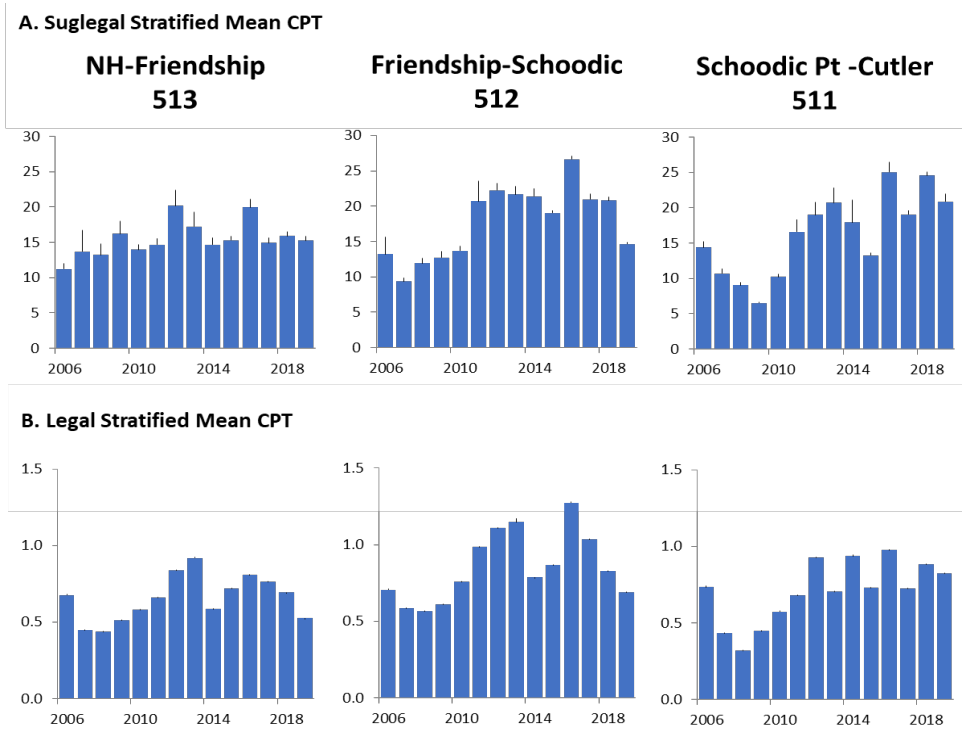


LIS Trawl Survey

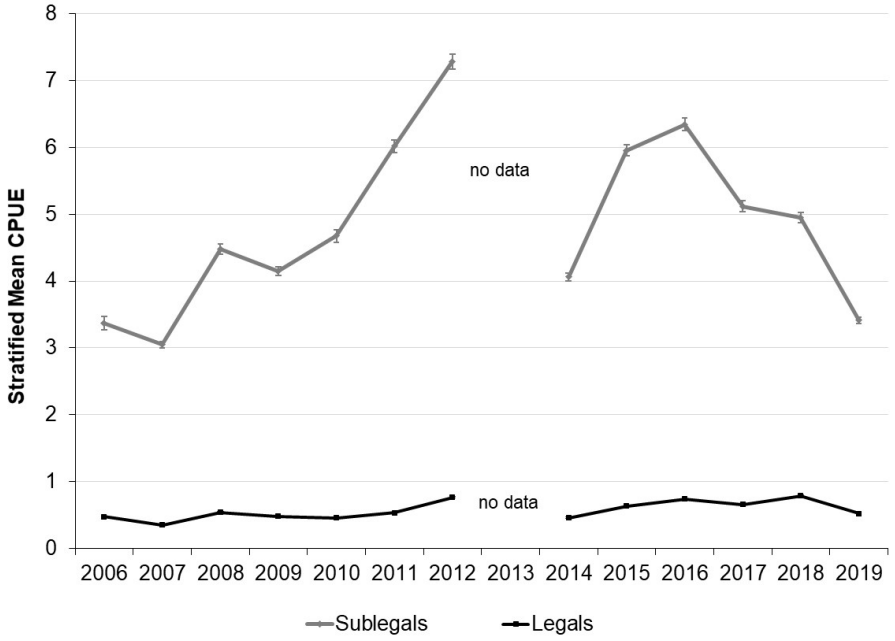


Fishery Monitoring – VTS

ME VTS

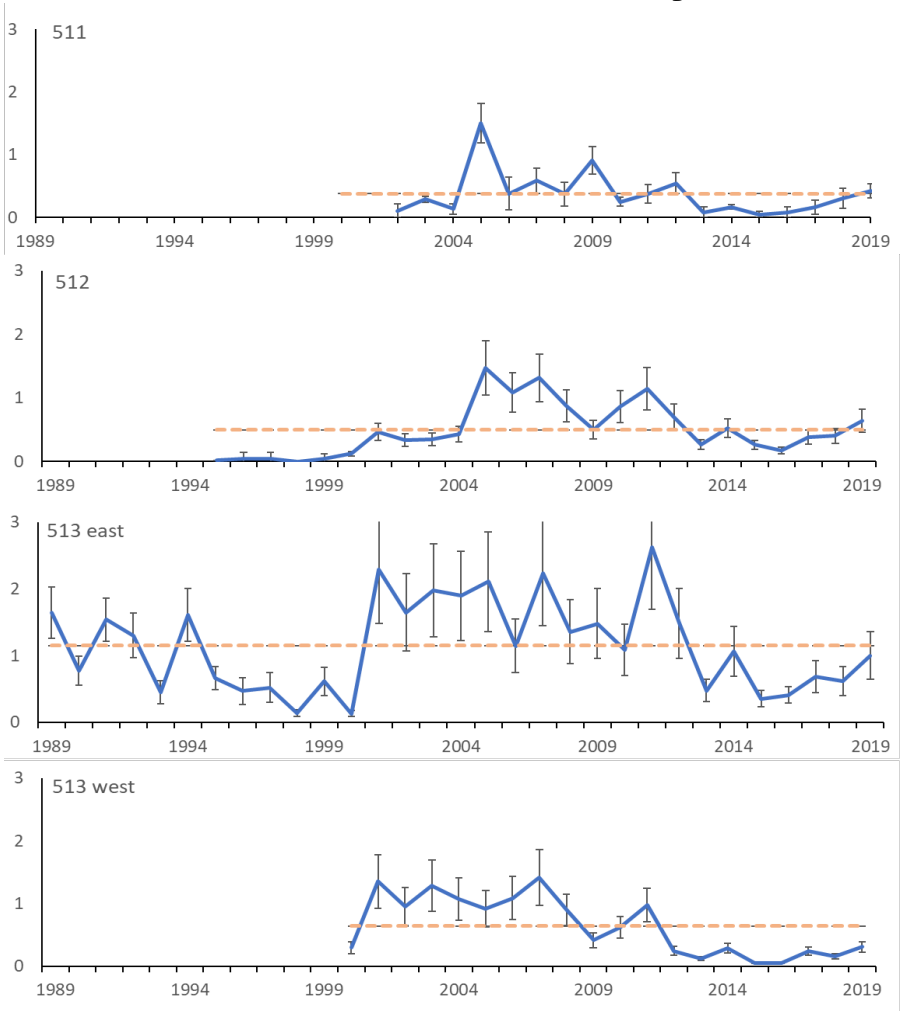


MA VTS – in GOM

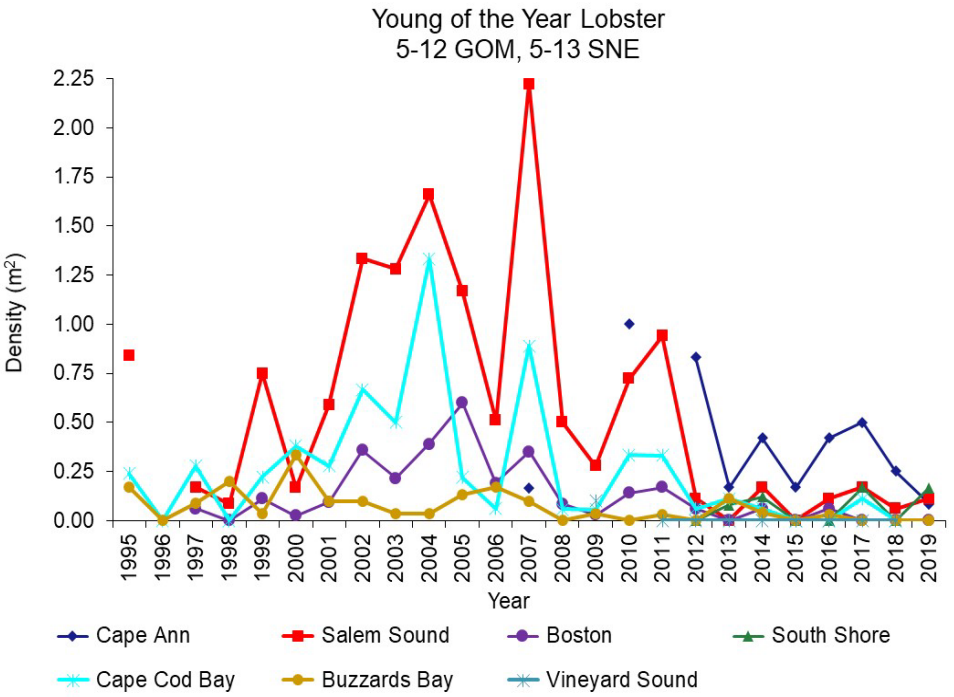


Fishery Monitoring – YOY

ME YOY Survey



MA YOY Survey



Status of Management

Addendum XXVI

- Original implementation deadline was January 1, 2019
- Implementation deadline delayed to January 1, 2020 for *Section 3.1.3: Harvester Reporting Data Components*
  - Did not delay implementation of fishery independent/dependent provisions or start of 5 year timeline for 100% harvester reporting
- Implementation of *Section 3.1.4. Spatial Resolution of Harvester Data* was delayed to January 1, 2021
  - To allow for changes to data collection platforms

State Compliance

Compliance

- New Jersey only completed 3 sea/port sampling trips (did not meet Addendum XXVI minimum requirement)
- CT did not conduct any sea sampling; noted staffing and budget constraints
- Massachusetts and Connecticut were unable to provide compliance reports by the August 1 deadline
- Otherwise, states in compliance with FMP

De Minimis

De Minimis

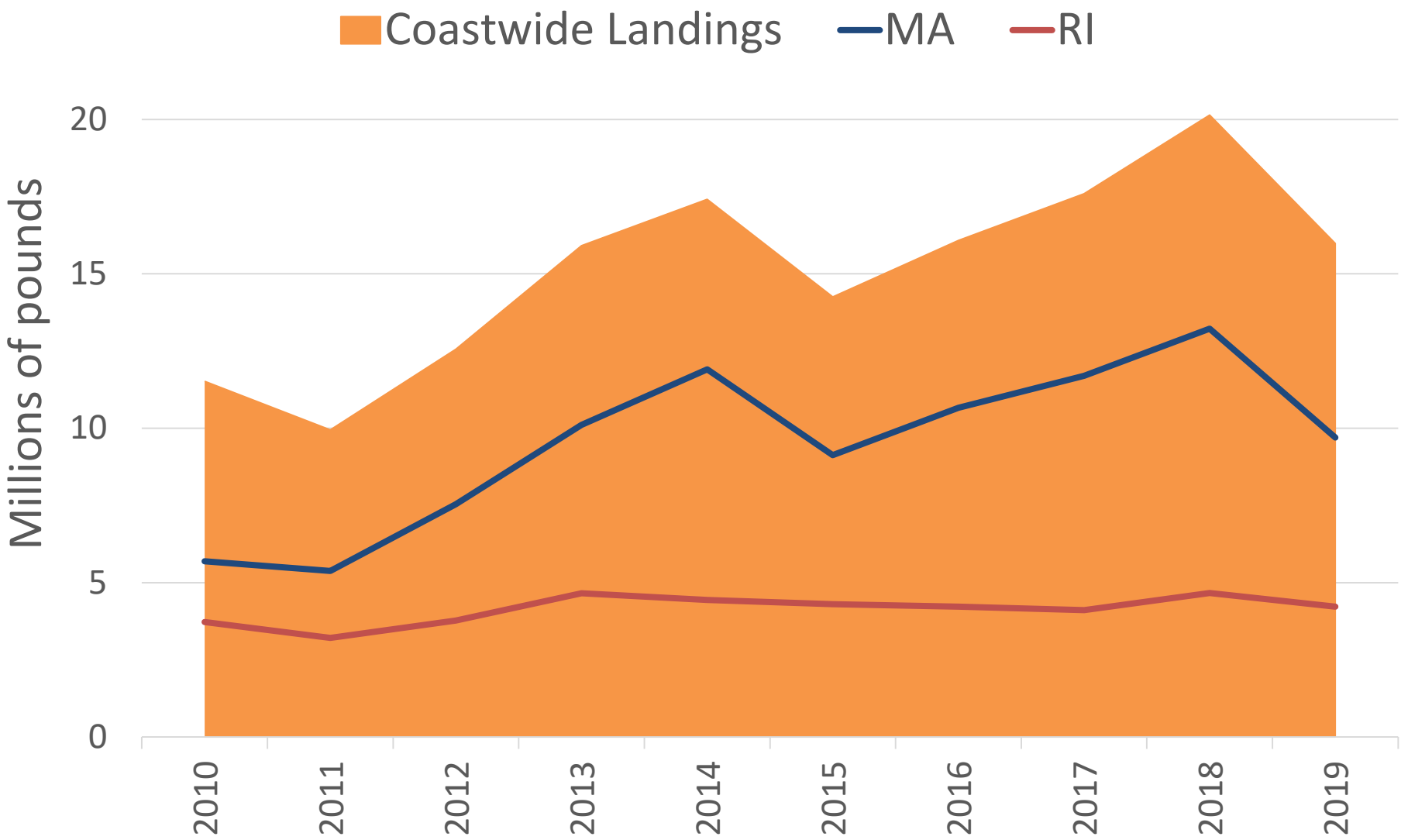
- Most recent 2 year average of commercial landings under 40,000 lbs
- Requests: DE, MD, VA
- All three states qualify

PRT Recommendations

- The PRT recommends the Board approve the *de minimis* requests of DE, MD, and VA.
- Review the monitoring requirements in SNE given the stock status and difficulty obtaining sea sampling trips.
- The PRT recommends coastwide consideration be given to the transfer of tags between traps to eliminate the issuance of exchange tags
- The PRT recommends the continue efforts to improve effort quantification in the lobster fishery.
- The PRT recommends research is conducted on lobster growth, maturity, and connectivity, as well as settlement and larval dynamics.
- Engage with the Committee on Economic and Social Sciences (CESS) to consider socioeconomic metrics that could be used to characterize changes in the fishery.

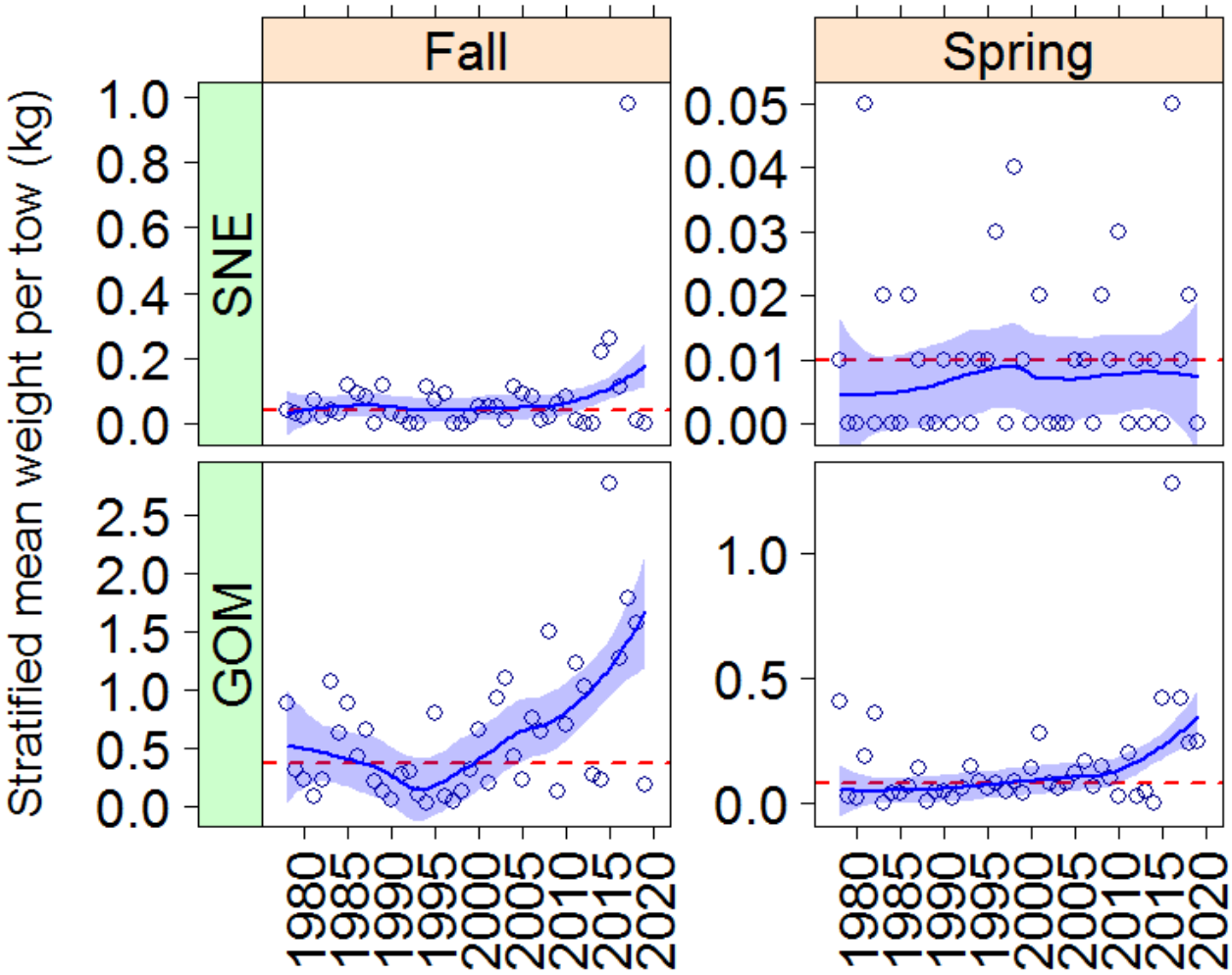
Jonah Crab
FMP Reviews for the 2018 and 2019 Fishing Years

Commercial Landings



Fishery Monitoring - Trawl

MA Trawl Survey



Status of Stock

- Status of Jonah crab resource is relatively unknown and no coastwide stock assessment has been conducted
- Recent studies related to Jonah crab:
  - Maturity of males vs. females (MA, CFRF)
  - Migrations patterns (MA, NH, ME, AOLA)
  - Mortality associated with declawing (NH)
  - Growth per molt (URI)
  - Reproductive biology (UMES)
- Pre-assessment data workshop scheduled for November 2020

Status of Management

FMP

- Permits and participation
- 4.75” minimum size, no tolerance
- Prohibition on retention of egg-bearing females
- 50 whole crab recreational limit

Addendum I

- 1,000 crab bycatch limit for non-trap gear and non-lobster trap gear

Addendum II

- Coastwide standard for claw harvest and definition of bycatch

Addendum III

- Improved harvester reporting and data collection

State Compliance

- New York has not yet implemented the full suite of measures in FMP and Addenda. The 1000 crab bycatch limit for non-trap and non-lobster trap gear not been implemented.
  - NY has indicated that it is unclear how long it will take to change the legislation, though these requirements are being met in practice.
- The PRT notes that MA and CT have been unable to meet the August 1 deadline for compliance reports for the last two years.

De Minimis

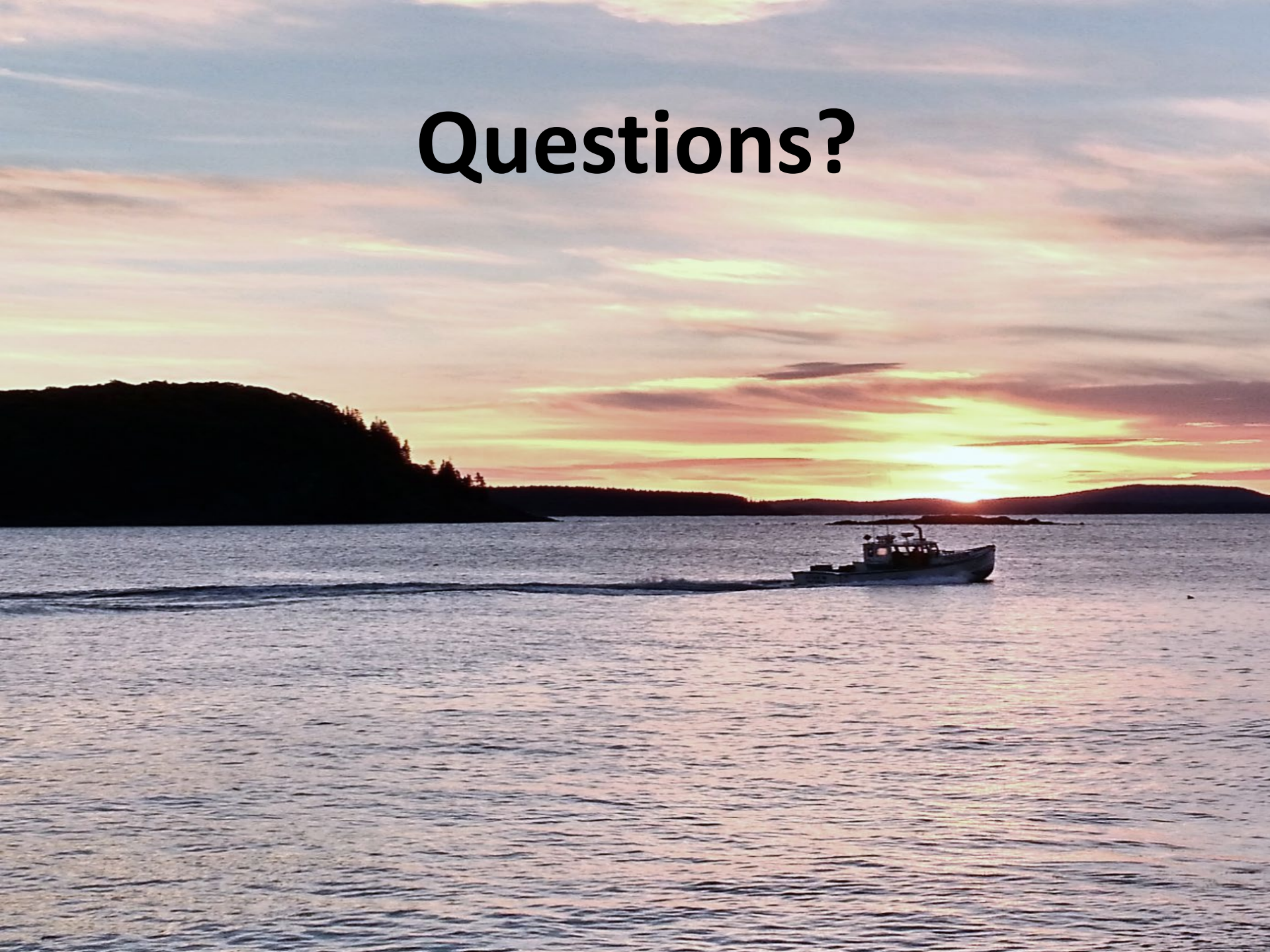
- States may qualify if, for the 3 preceding years, their average commercial landings constitute less than 1% of average coastwide commercial catch
- DE, MD, and VA apply and meet *de minimis* requirement
- The PRT recommends the Board approve the *de minimis* requests

PRT Recommendations

- The PRT raises concerns about the lack of Jonah crab regulations in NY. These issues were first raised in the 2017 compliance reports and have not been addressed.
- Jurisdictions with crab-only fishermen should report on their collective effort.
- Continue research of the Jonah crab species so that a coastwide stock assessment can be completed.
- LEC should review compliance in the Jonah crab fishery, given it is a fairly new FMP

Board Action:

- **Consider approval of the Lobster FMP Review for the 2019 fishing year, state compliance reports, and *de minimis* status for DE, MD, and VA.**
- **Consider approval of the Jonah Crab FMP Reviews for the 2018 and 2019 fishing years, state compliance reports, and *de minimis* status for DE, MD, and VA**


Questions?