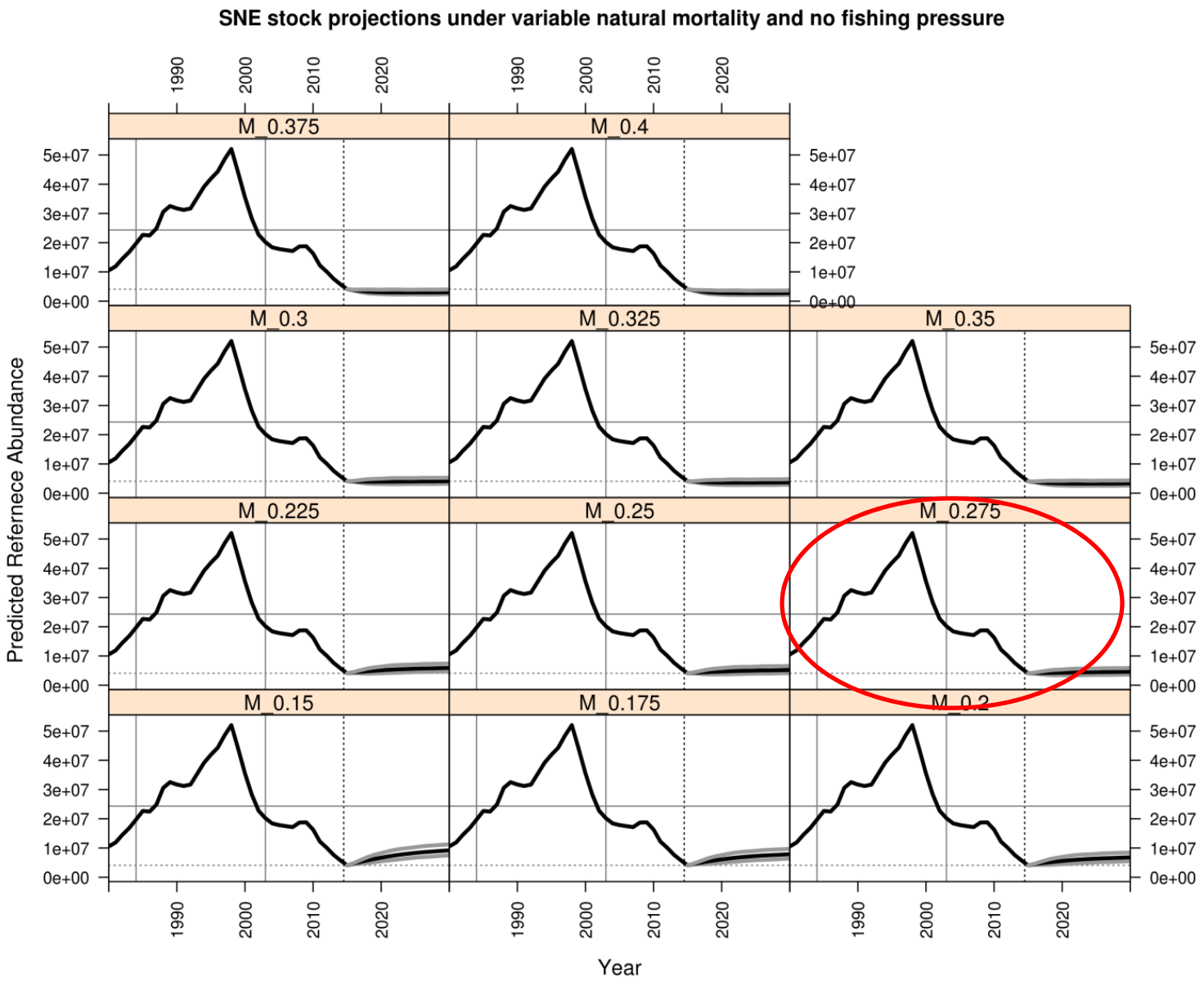
SNE Projections

ASMFC Lobster Technical Committee

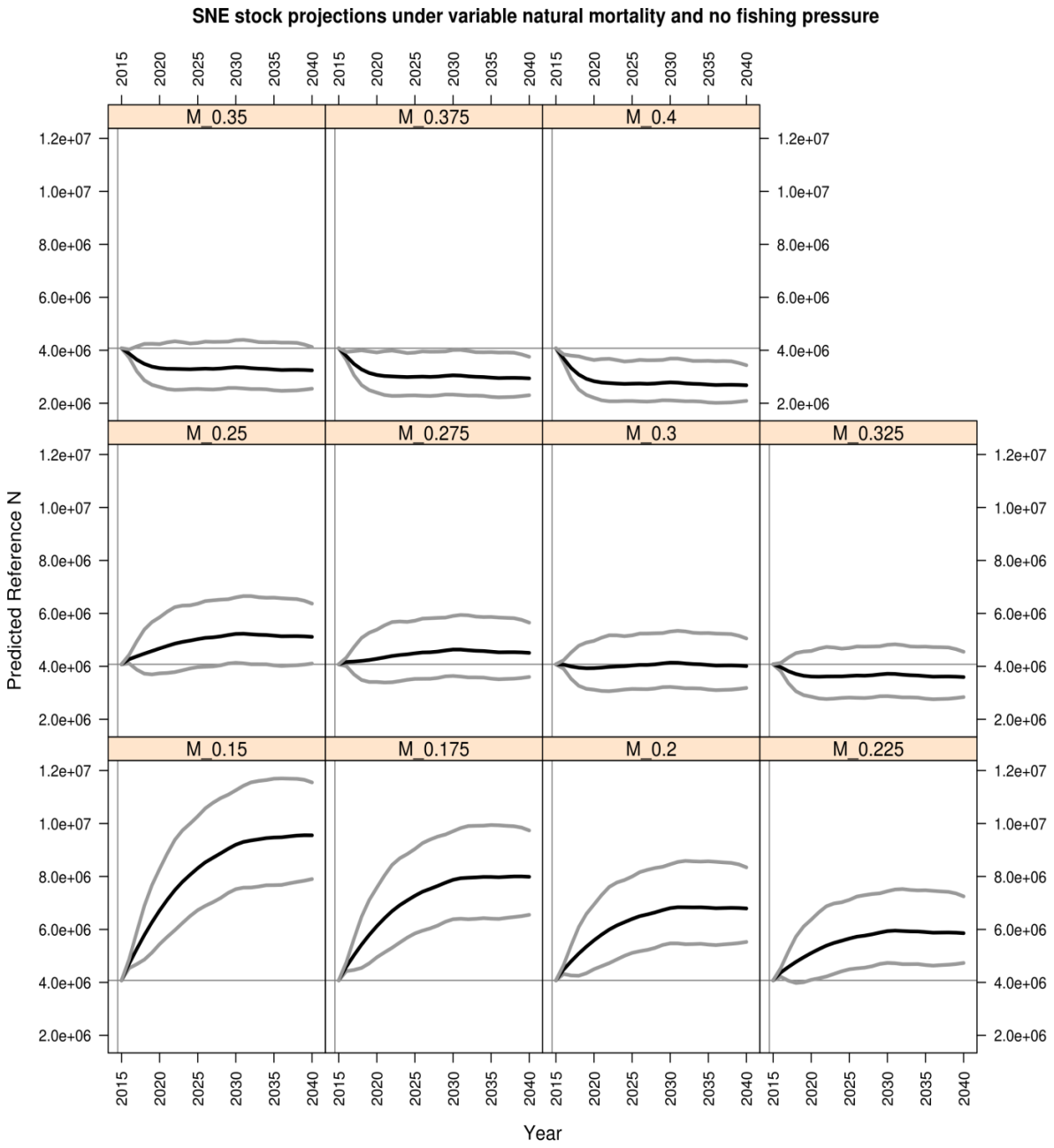
SNE Projections

- Constant Recruitment Scenarios
  - Recruitment assumed to be independent of SSB
    - **Sensitivity of Stock to M**
      - F = 0.00
      - M varied from 0.15 to 0.5
    - **Sensitivity of Stock to F**
      - M = 0.285
      - F varied from 0% to 100% of current harvest

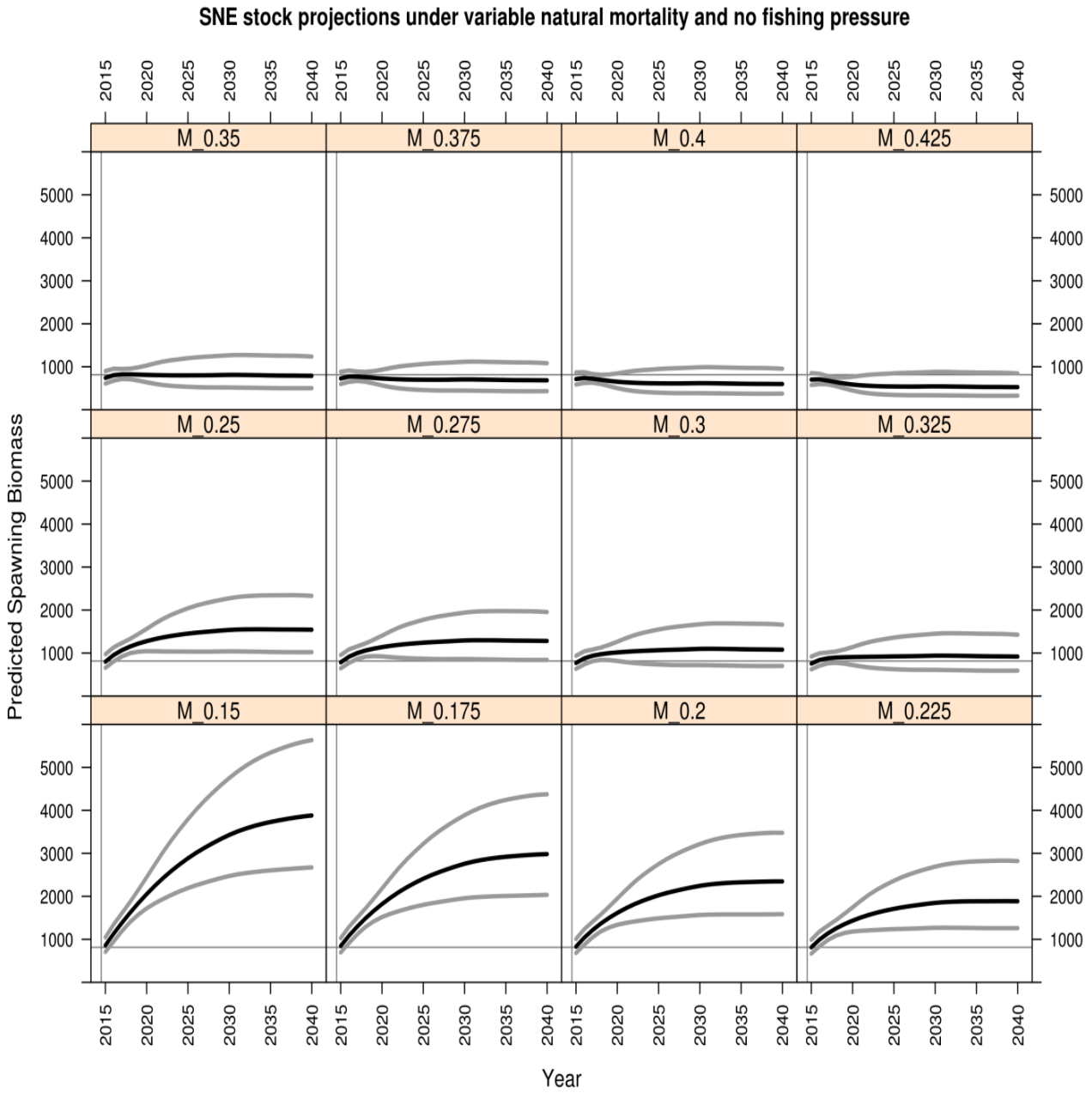
M – ranges from 0.15 to 0.40, F = 0.00



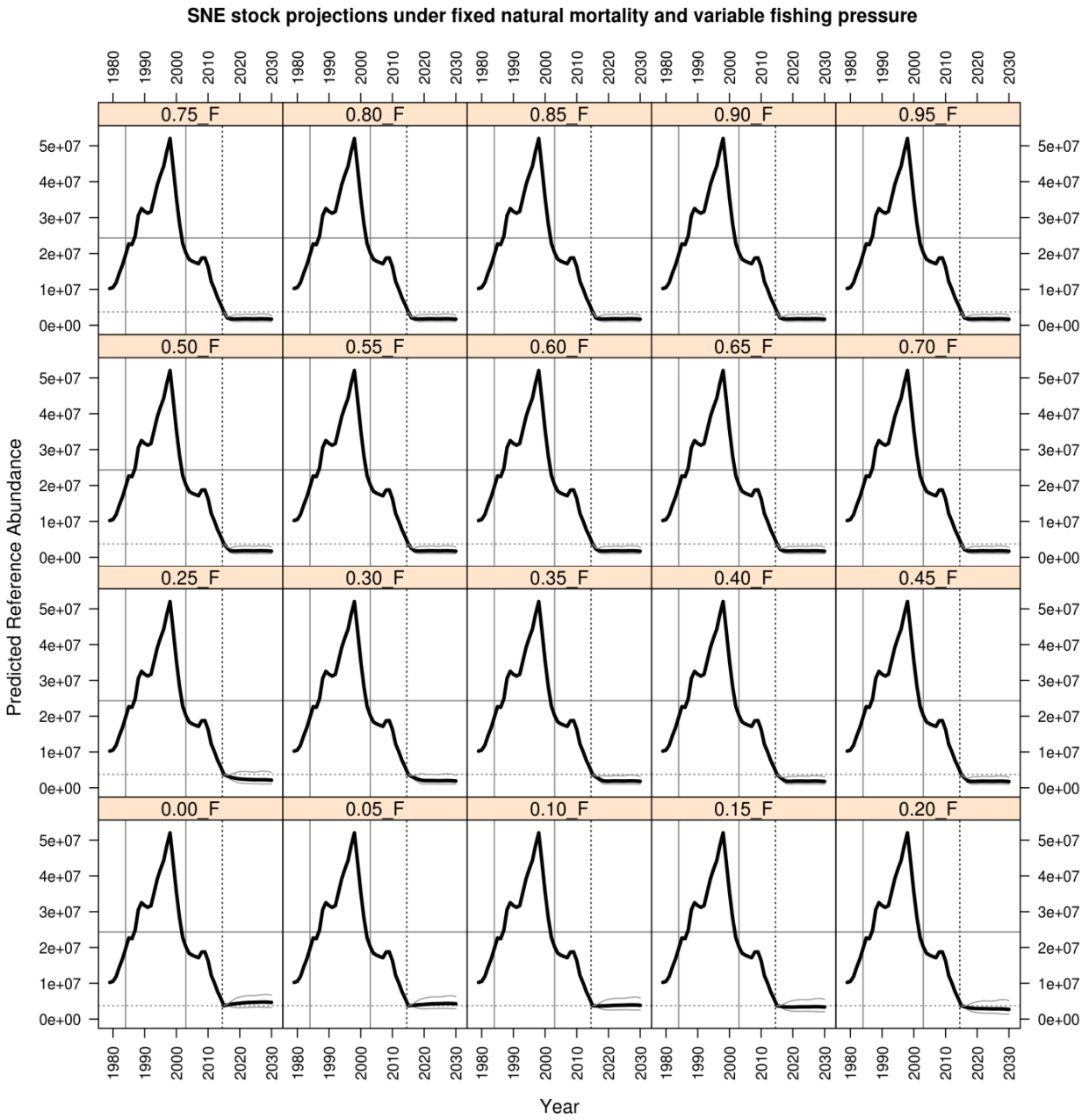
M – ranges from 0.15 to 0.40, F = 0.00



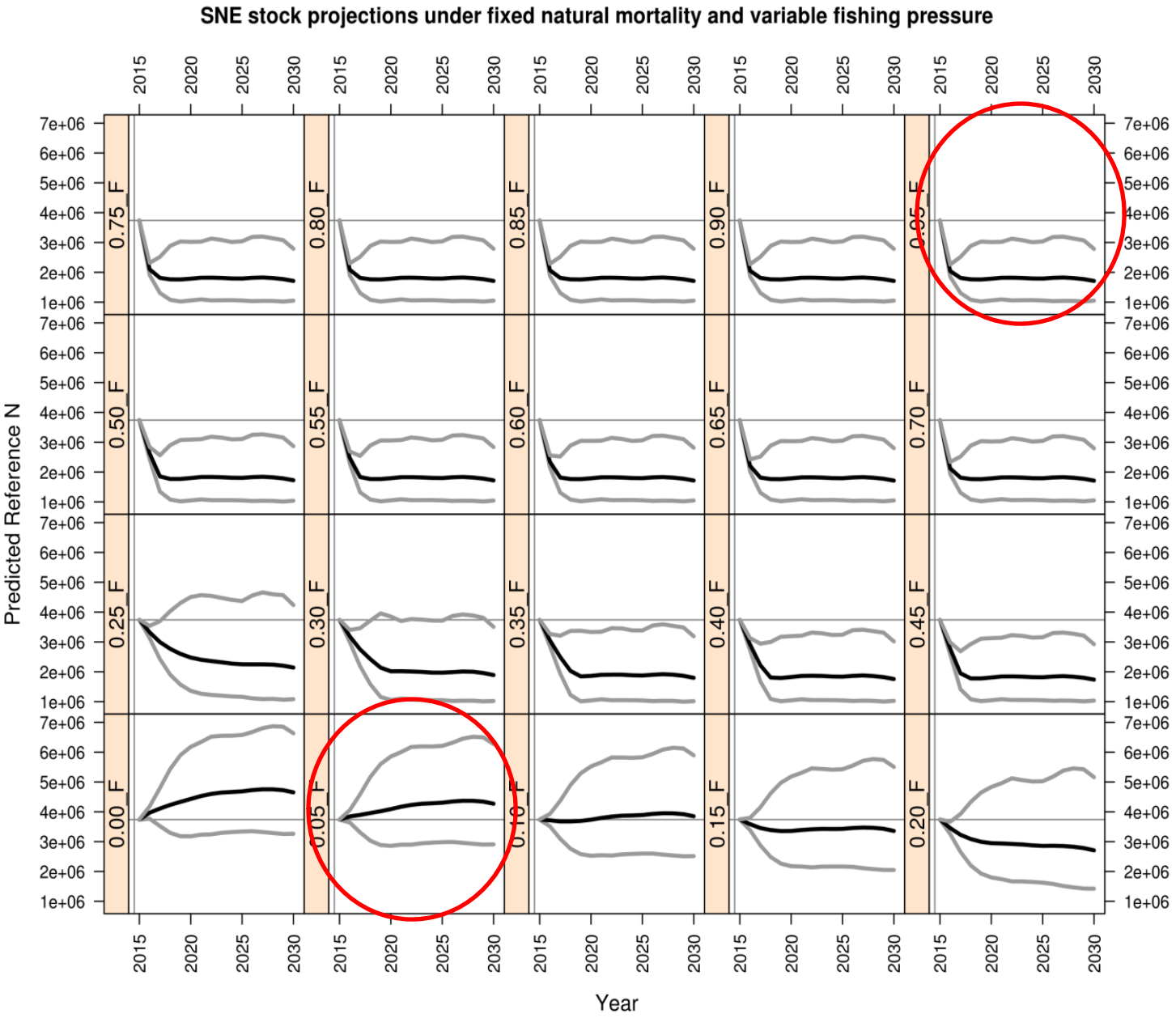
M – ranges from 0.15 to 0.40, F = 0.00



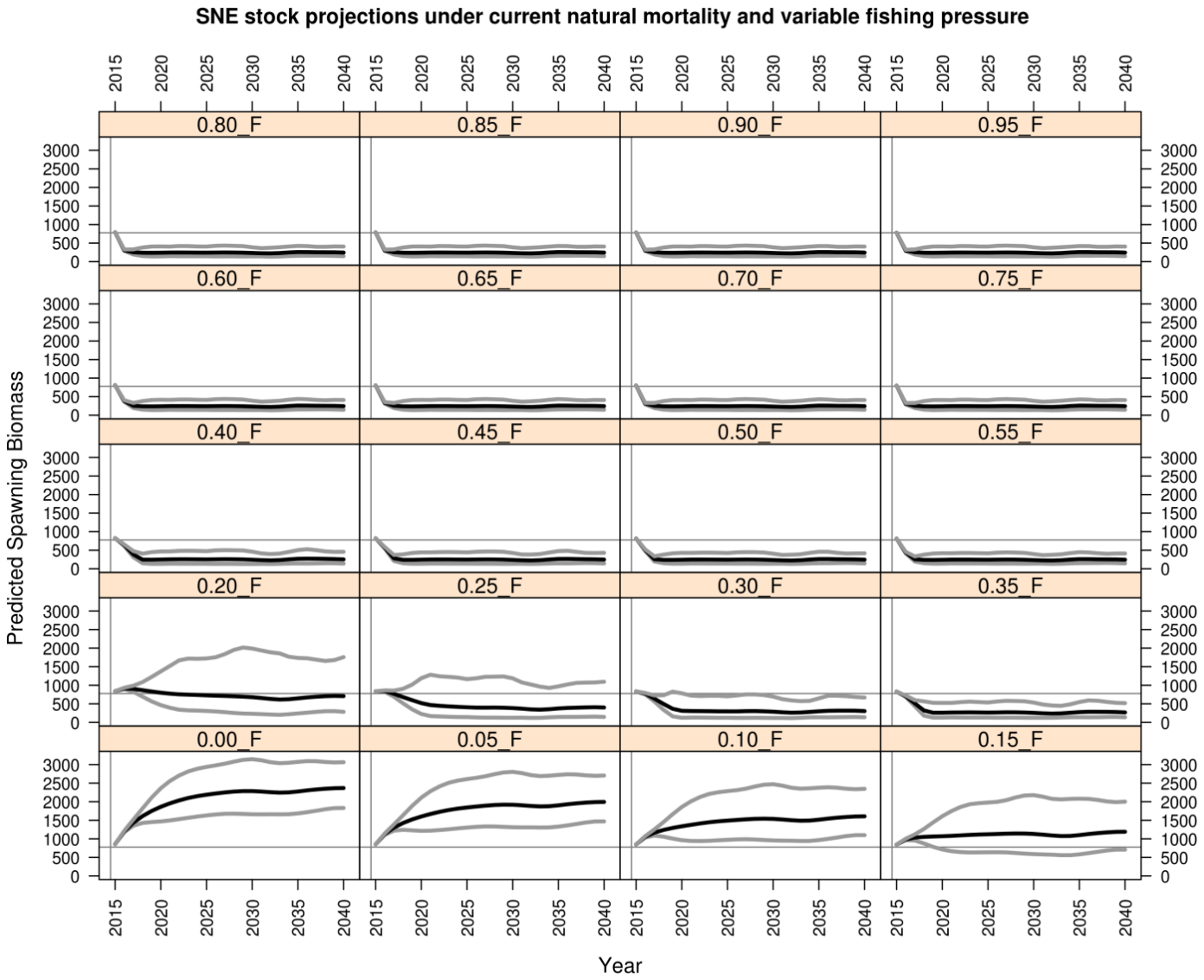
M = 0.285, F – varies from 0 to 95%



M = 0.285, F – varies from 0 to 95%



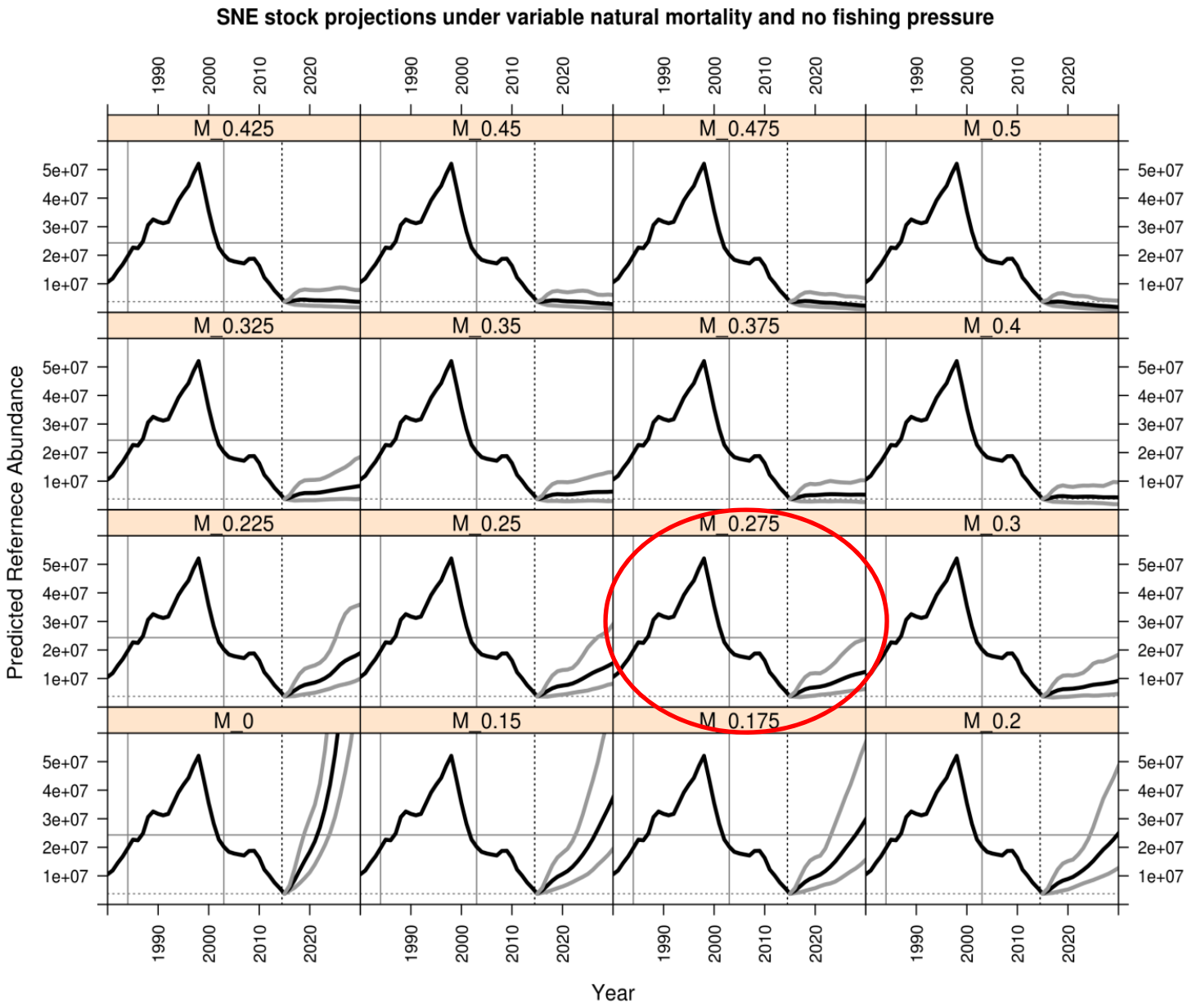
M = 0.285, F – varies from 0 to 95%



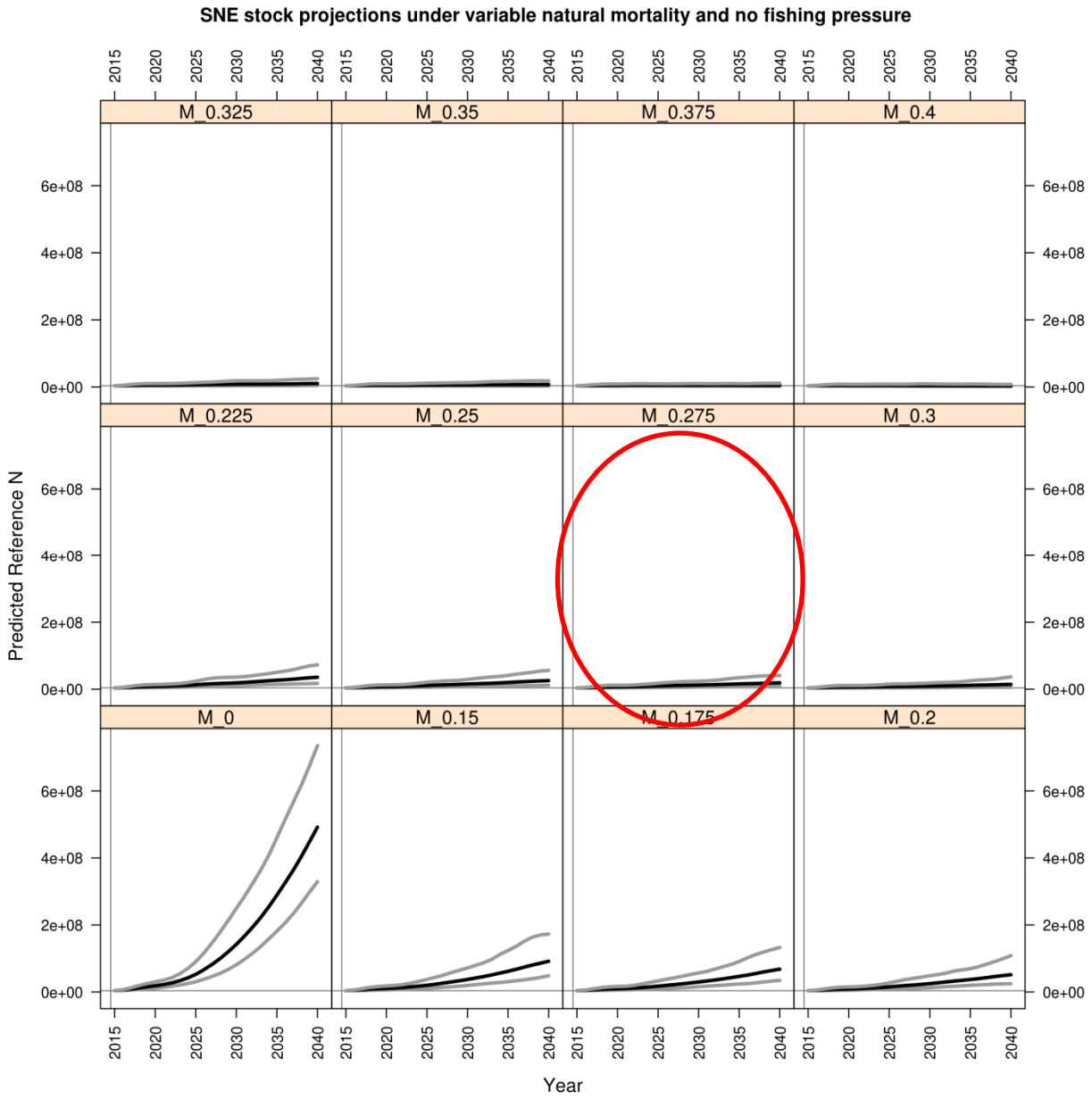
SNE Projections

- Beverton-Holt Stock Recruitment Scenarios
  - future recruitment linked to SSB
    - **Sensitivity of Stock to M**
      - F = 0.00
      - M varied from 0.15 to 0.5
    - **Sensitivity of Stock to F**
      - M = 0.285
      - F varied from 0% to 100% of current harvest

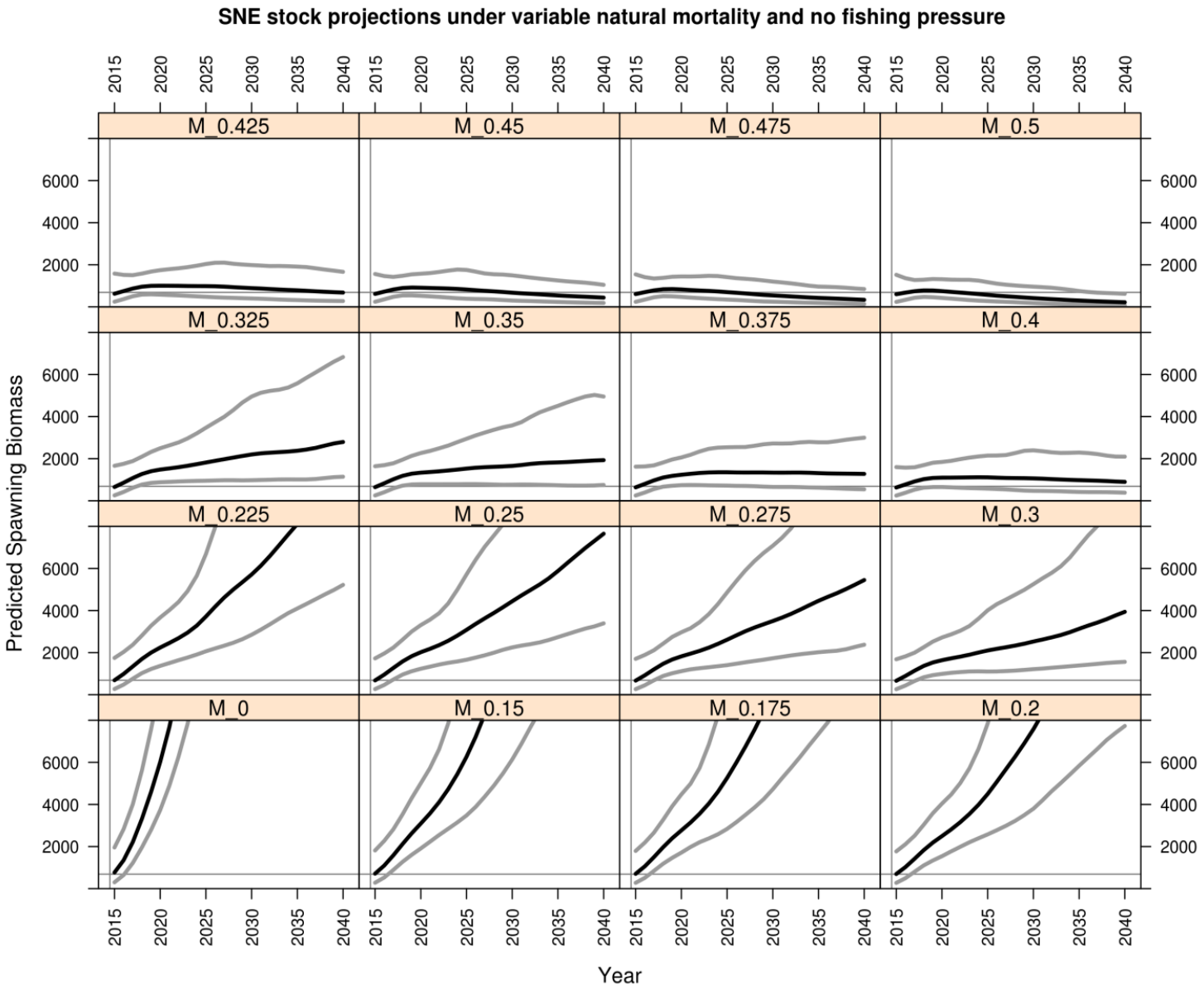
M – ranges from 0.15 to 0.40, F = 0.00



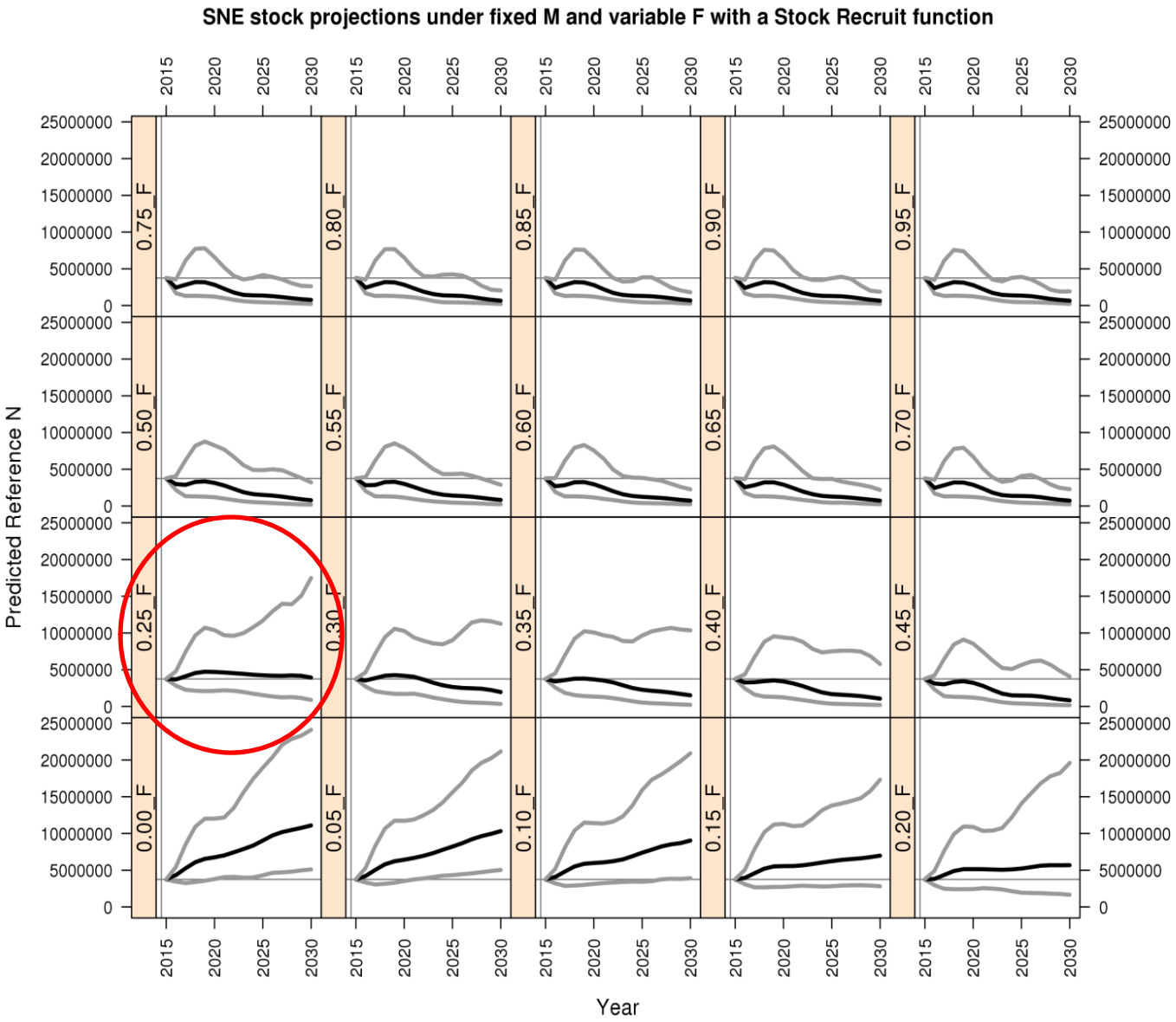
M – ranges from 0.15 to 0.40, F = 0.00



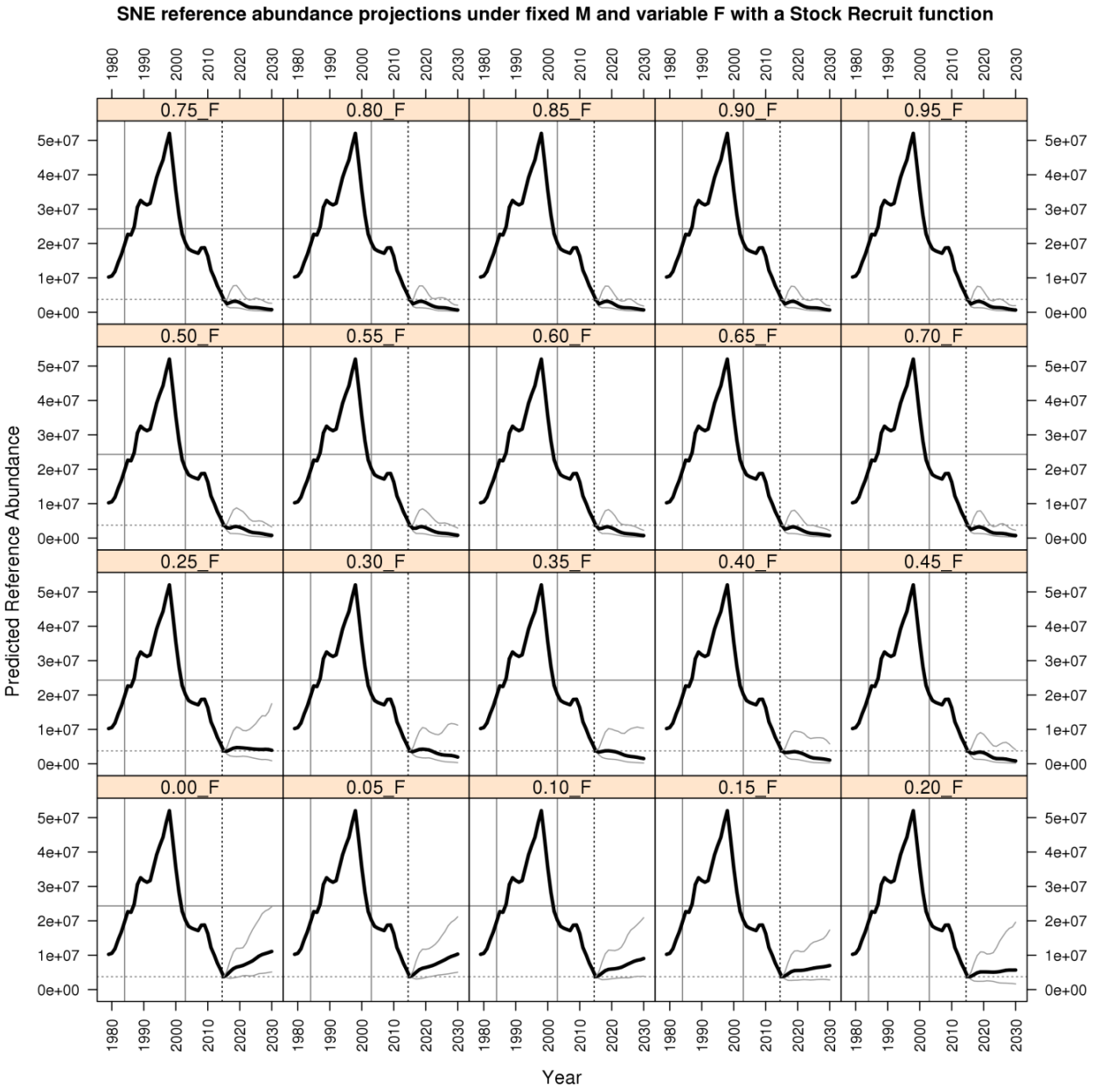
M – ranges from 0.0 to 0.50, F = 0.00



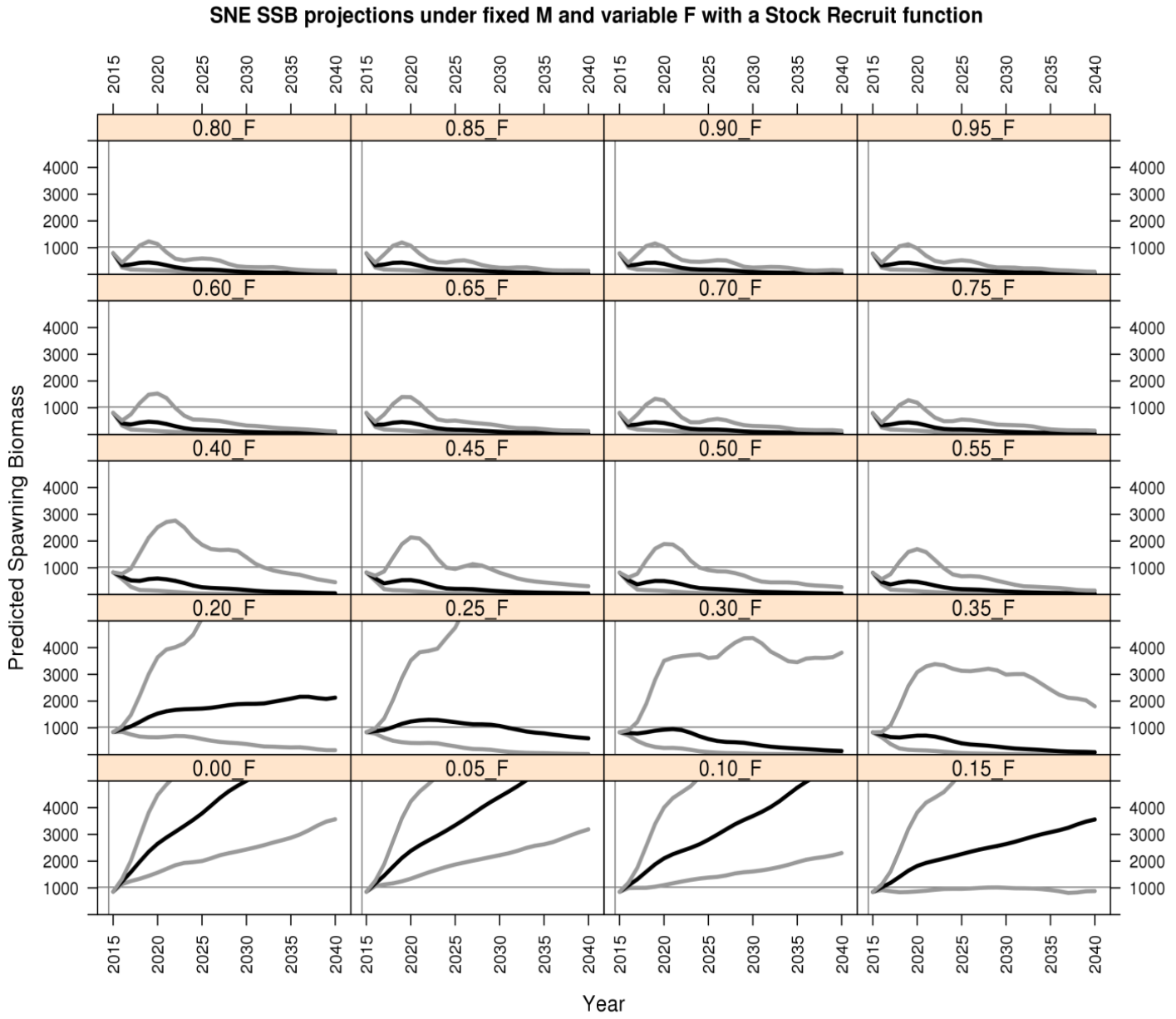
M = 0.285, F – varies from 0 to 95%



M = 0.285, F – varies from 0 to 95%



M = 0.285, F – varies from 0 to 95%



SNE Projections

- "Realistic Scenario" – (constant recruitment – M stays constant)
  - Assuming M doesn't change a 90% reduction in harvest would be necessary to stabilize the stock at current levels
  - At current levels of M only modest increases in abundance are possible even in the absence of fishing
  - Threshold abundance reference points are not obtainable in the foreseeable future even in the absence of fishing

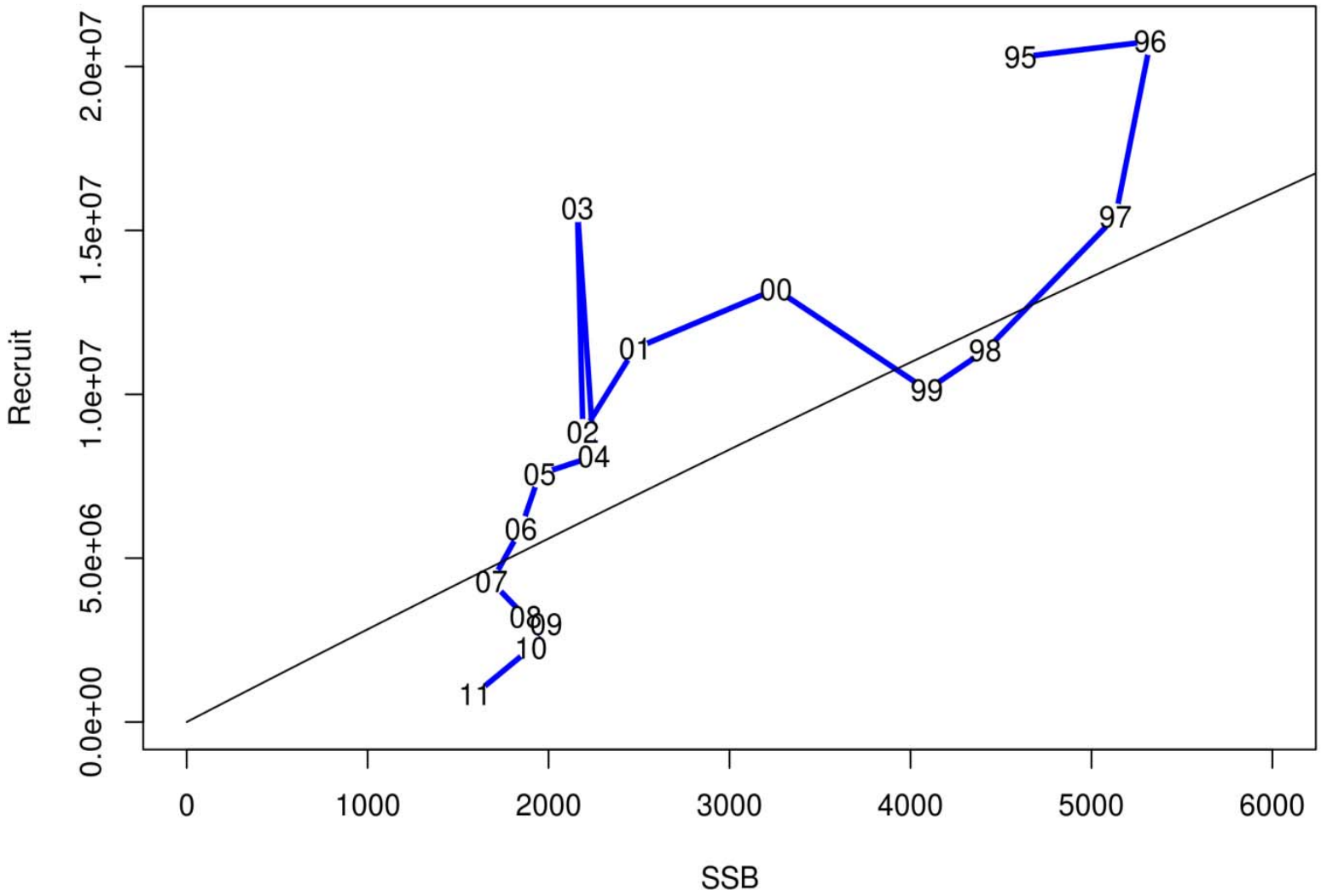
SNE Projections

- "Optimistic Scenario" – (assumes Beverton-Holt S/R relationship)
  - Assuming M doesn't change a 75% reduction in harvest would be necessary to stabilize the stock at current levels
  - At current levels of M only modest increases in abundance are possible even in the absence of fishing
  - Threshold abundance reference points are not obtainable in the foreseeable future even in the absence of fishing
  - Substantial improvement to the stock would require a substantial decline in M and very little F

SNE Stock Projections

- Empirical evidence suggests that the constant recruitment scenario is most realistic
- Stock-recruitment relationship appears to be decoupled
- SNE stock demonstrating signs of depensation
- SNE stock remains in recruitment failure

SNE Lobster Stock-Recruitment Relationship



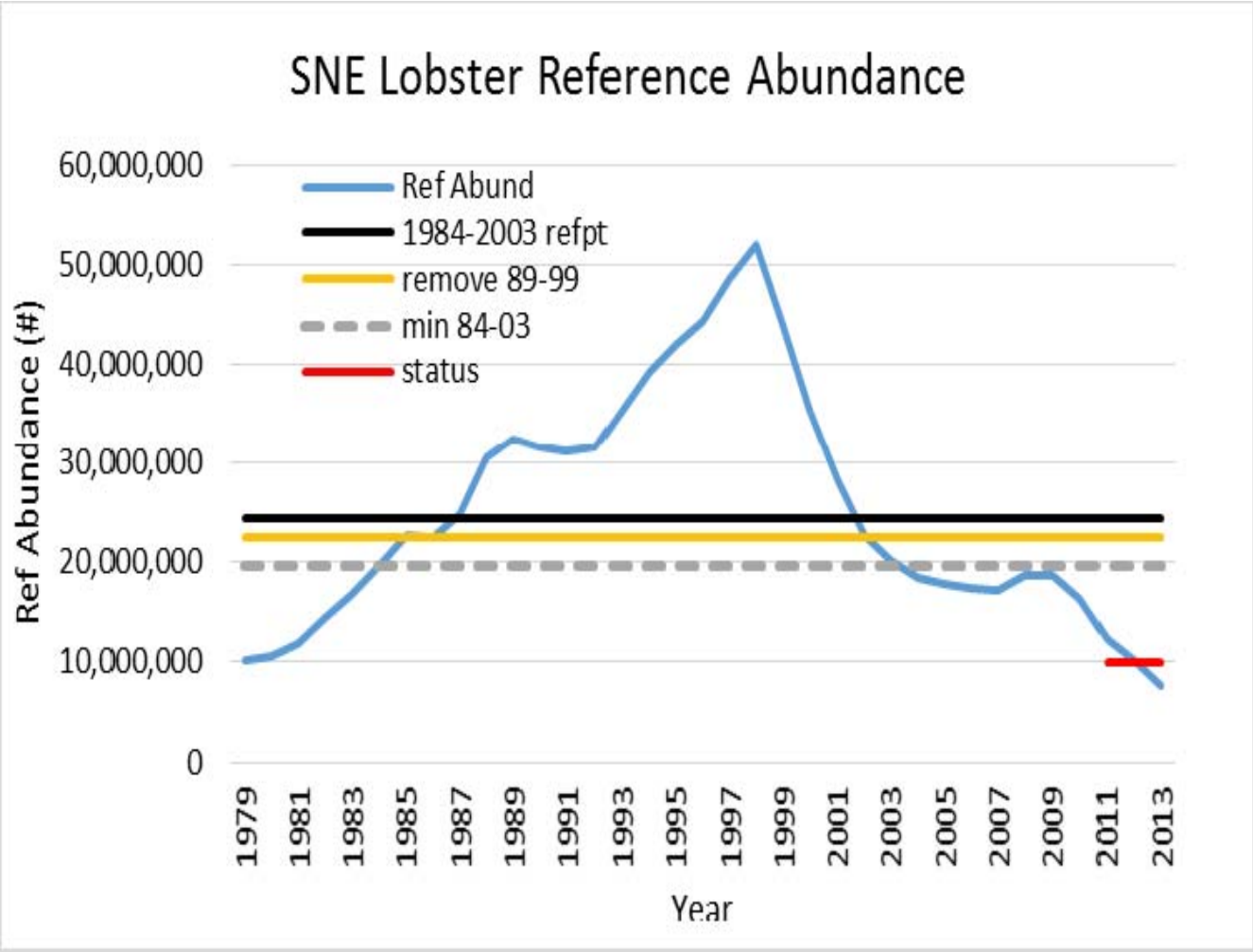
Depensation

- Potential causes
  - Reduced mating success (Allee effects)
  - Increased M
    - Disease
    - Environmentally mediated declines in larval survivorship
    - Increased Predation

TC Report to the Board

- Reference Points
- Inshore/Offshore Connectivity
- Fishery Dependent Data Update
- Fishery Independent Data Update

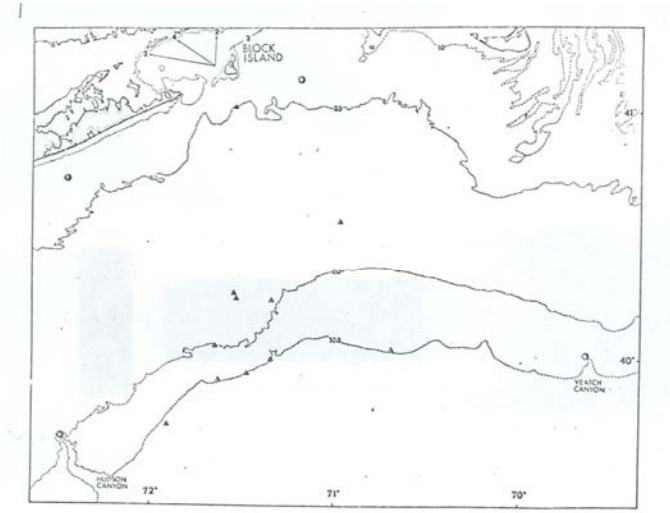
SNE Abundance Reference Points



Current threshold abundance reference points not obtainable at M = 0.285 ….. even with F = 0.00

Inshore/Offshore Connectivity

- Adults
  - Connectivity via seasonal inshore-offshore migrations is well documented in the primary literature
    - Buzzards Bay ---> Mid-shelf – Canyons – (MADMF unpublished, Pugh et.al 2011)
    - Rhode Island Sound ---> Mid-shelf – Canyons (Fogarty et. al. 1980)
    - Eastern LIS ----> Mid-shelf – Canyons (Lund 1973, CTDEP 2008, Dominion Nuclear 2015)
    - Coastal NJ/New York Bight ---> Mid-shelf – Canyons (Andrews 1980)
    - SNE Canyons ---> Inshore SNE (Cooper and Uzmann 1971, Andrews 1980)



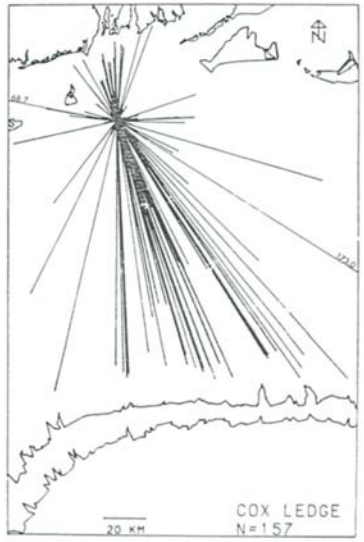
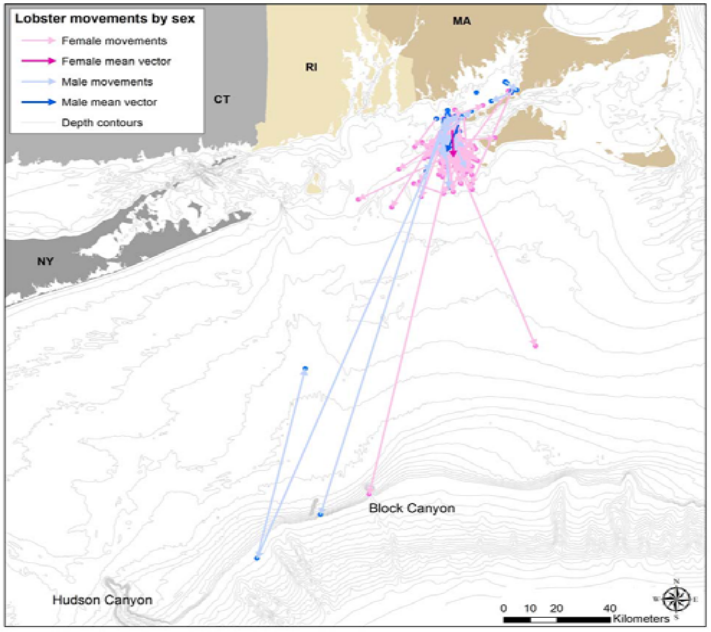
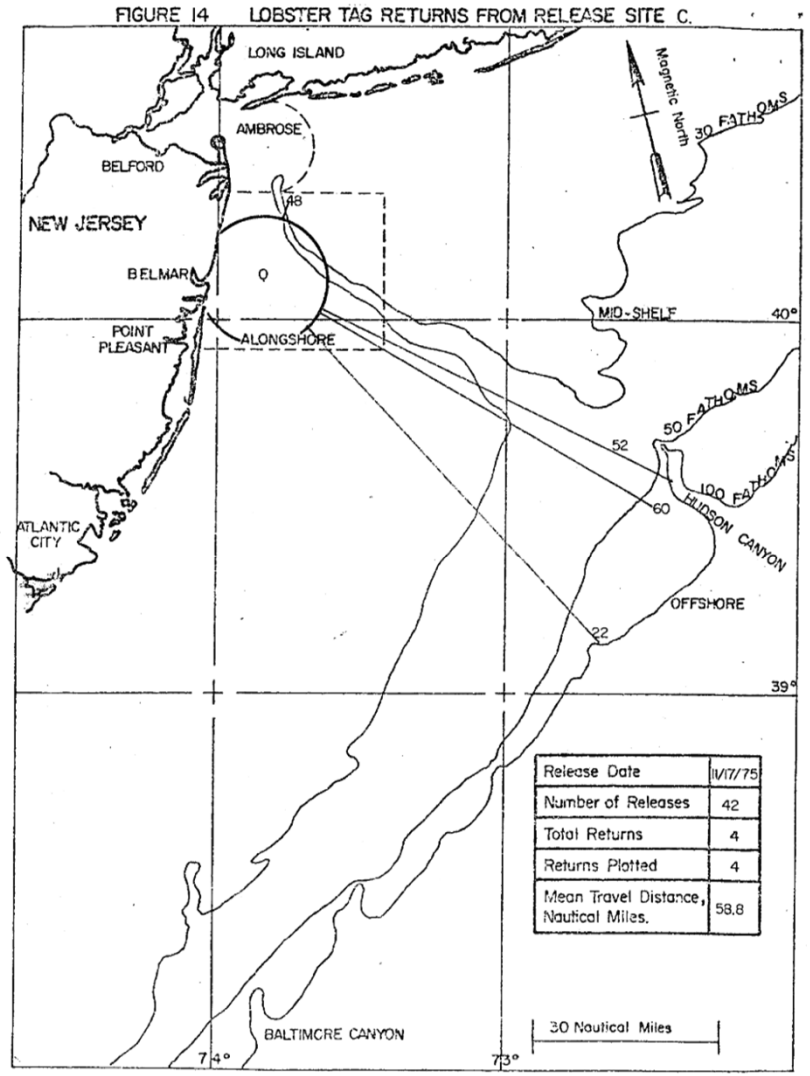
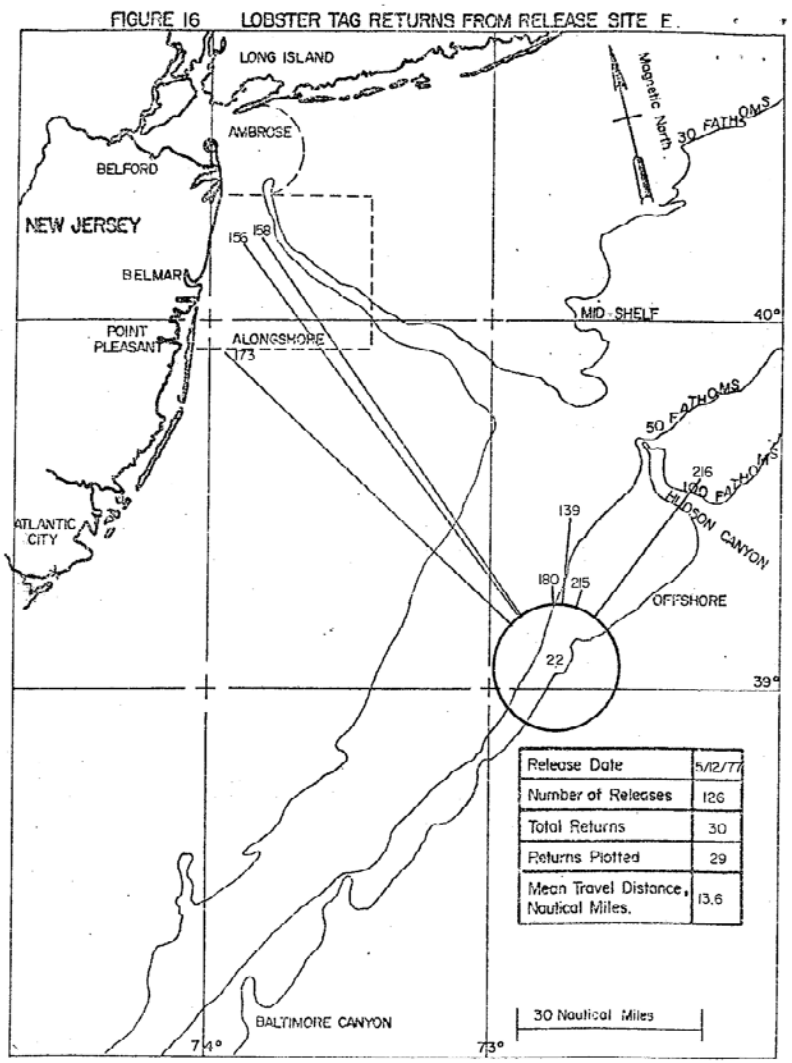


FIGURE 9.—Straight line distance between release and recapture sites for American lobster tagged and released on Cox Ledge, off Rhode Island. Release location is a composite of four release sites on Cox Ledge. Total distance travelled is noted for tracks which are truncated by borders.



Andrews 1980





Cooper and Uzmann 1971

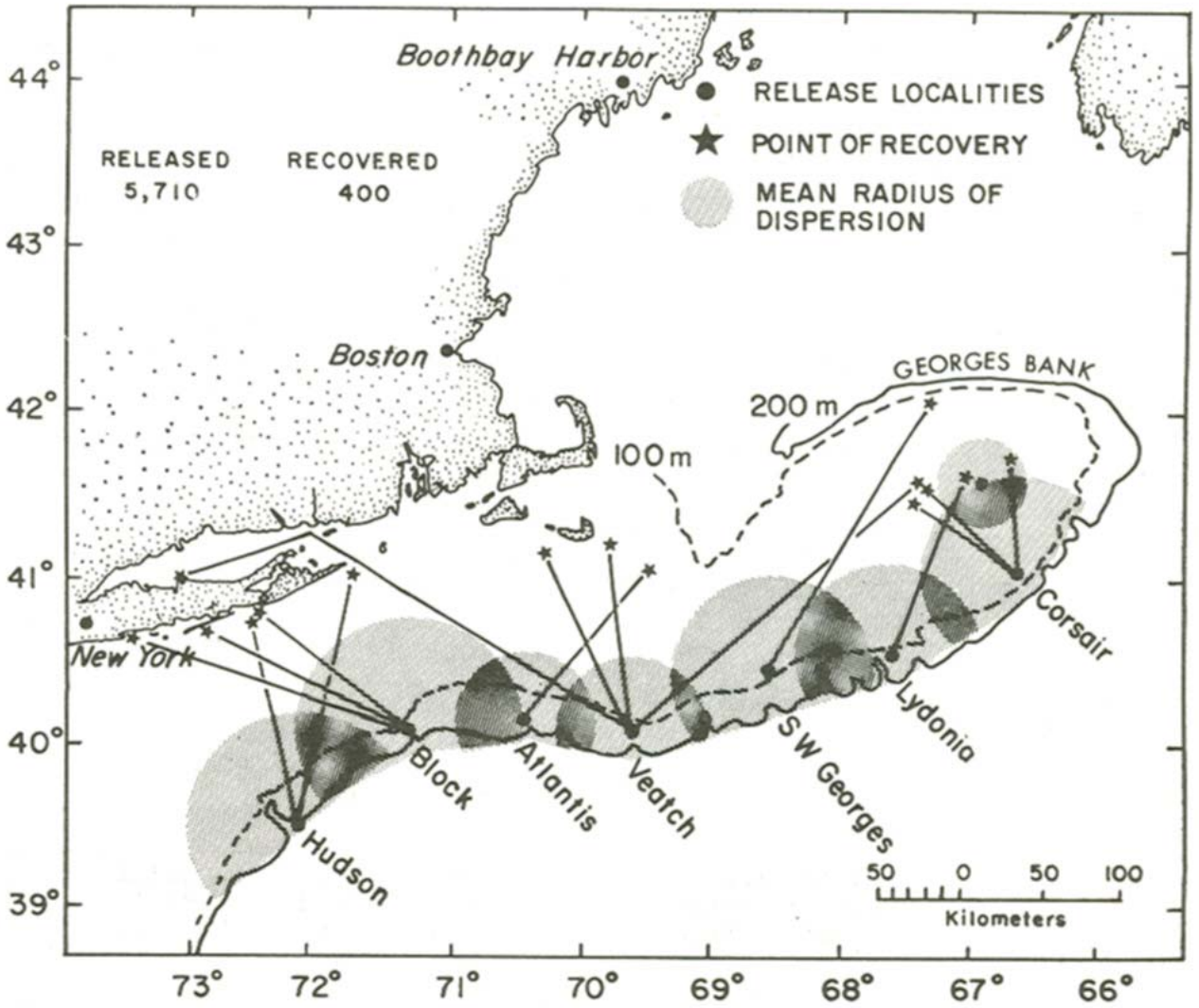
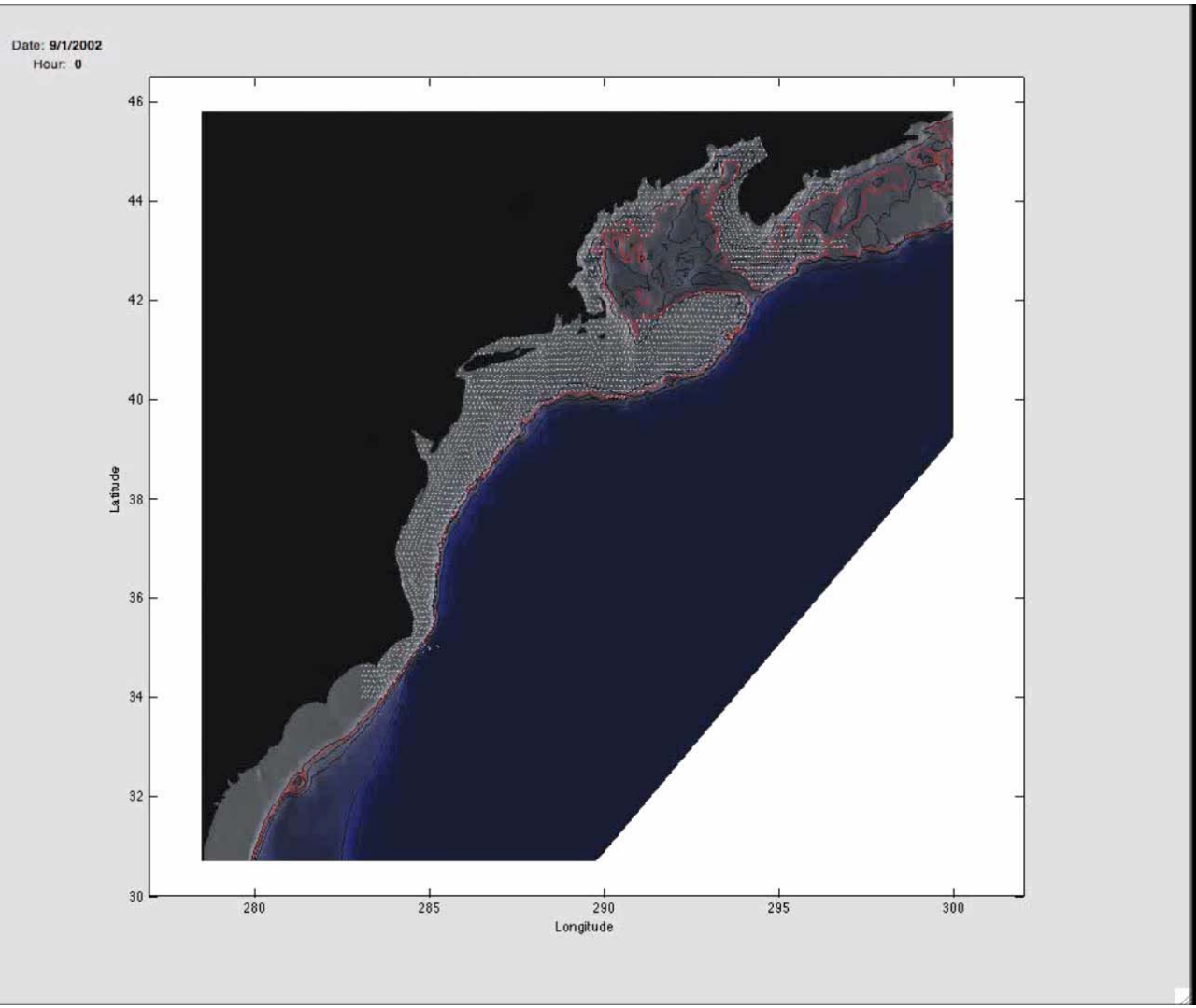


Fig. 1. Mean dispersion of tagged lobsters and examples of the longest shoalward migrations.

Inshore/Offshore Connectivity

- Larvae
  - Passive drifters in first 3 stages which last 2 to 4 weeks
  - Limited swimming ability in stage 4
  - Post-larval settlement is highly dependent on the location of hatch
  - Coastal Embayments –
    - Dominated by tidal and wind driven currents.
    - Depend on “local” larval supply
  - SNE Shelf
    - Dominated by a strong coastal current that runs from the northeast to the southwest
    - Depend on “upstream” larval supply

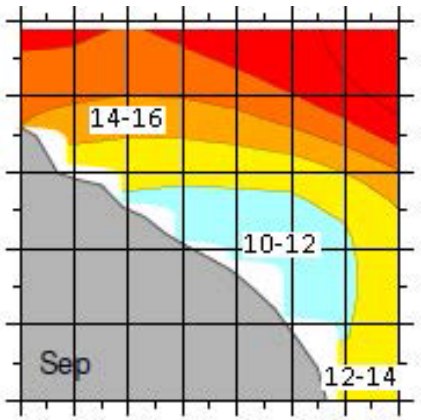

Date: 9/1/2002
Hour: 0
46
44
42
40
38
36
34
32
30
Latitude
280
285
290
295
300
Longitude

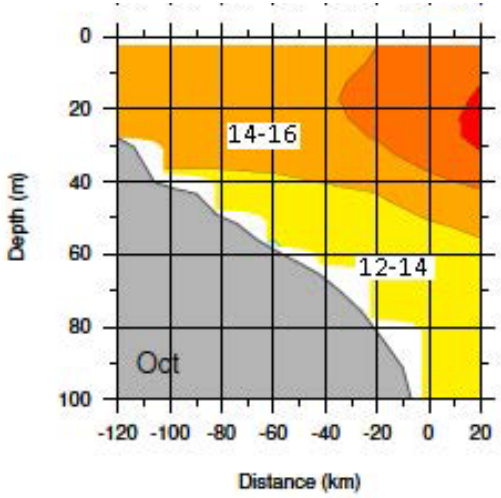
Genetic evidence of inshore/offshore connectivity

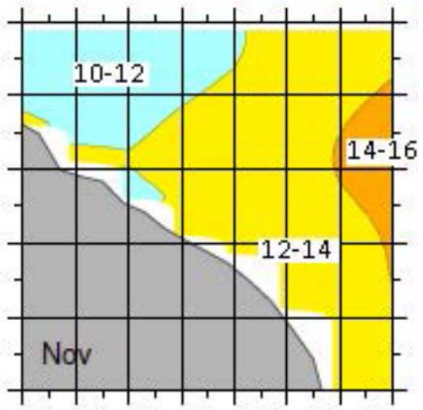
- Only one recent study exists that covers SNE
  - Adults Eastern LIS and Hudson Canyon are genetically similar
  - Larvae from Eastern LIS genetically similar to Hudson Canyon females
  - Lobster from Western LIS appear to be genetically distinct

Viability of Offshore Habitat for Lobster Settlement

- Most productive nursery habitat occurs inshore
  - Temperature conditions – 12 to 18 C°
  - Complex substrate – cobble, boulder, eel grass
  - Light Penetration/Primary Productivity
  - Food availability
- Offshore habitat
  - Temperature – is suitable and exceeds 12 C° in Oct and Nov
  - However settlement is most likely to peak in July and August
  - Productivity of offshore habitats are not likely as high

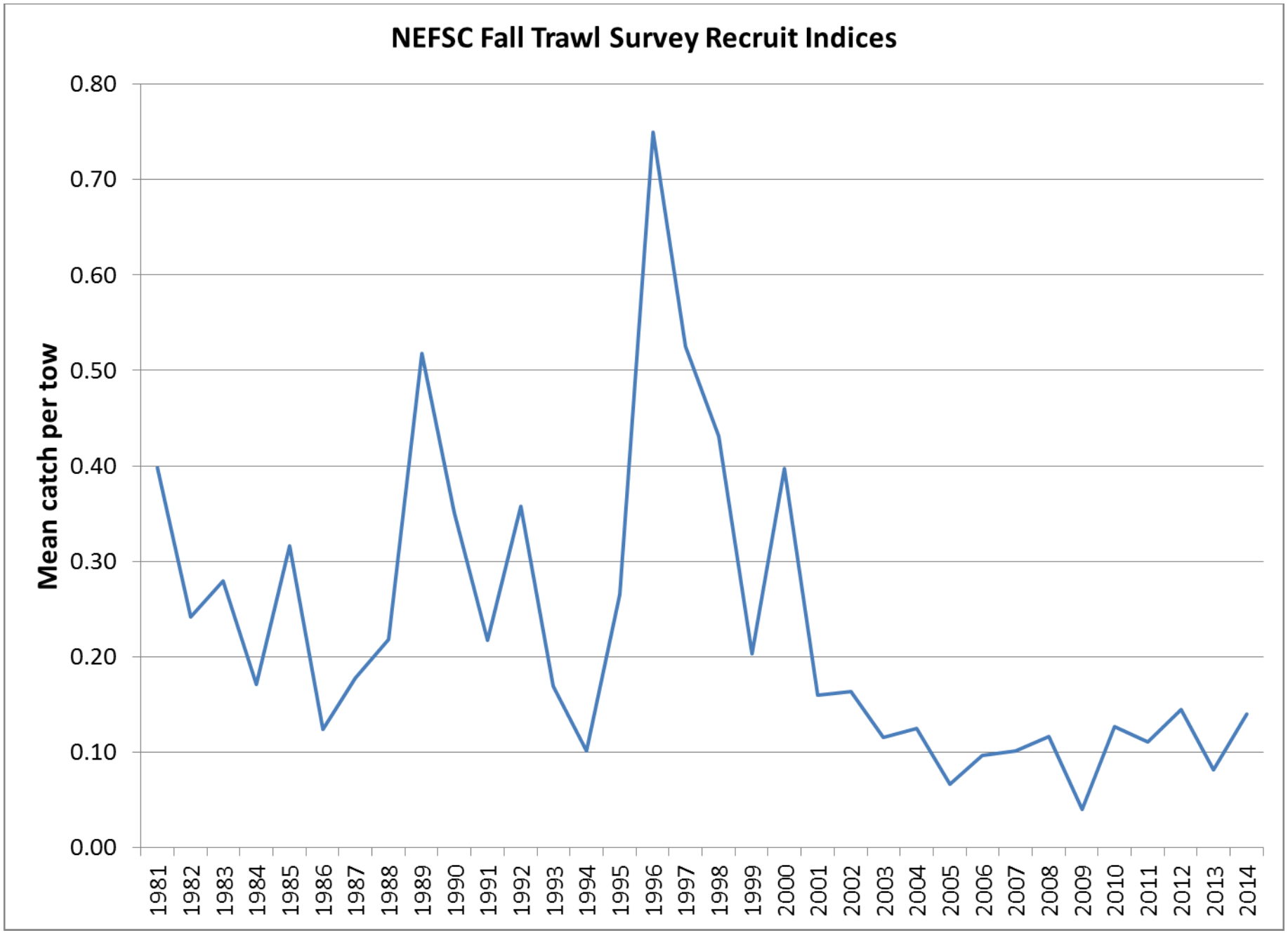




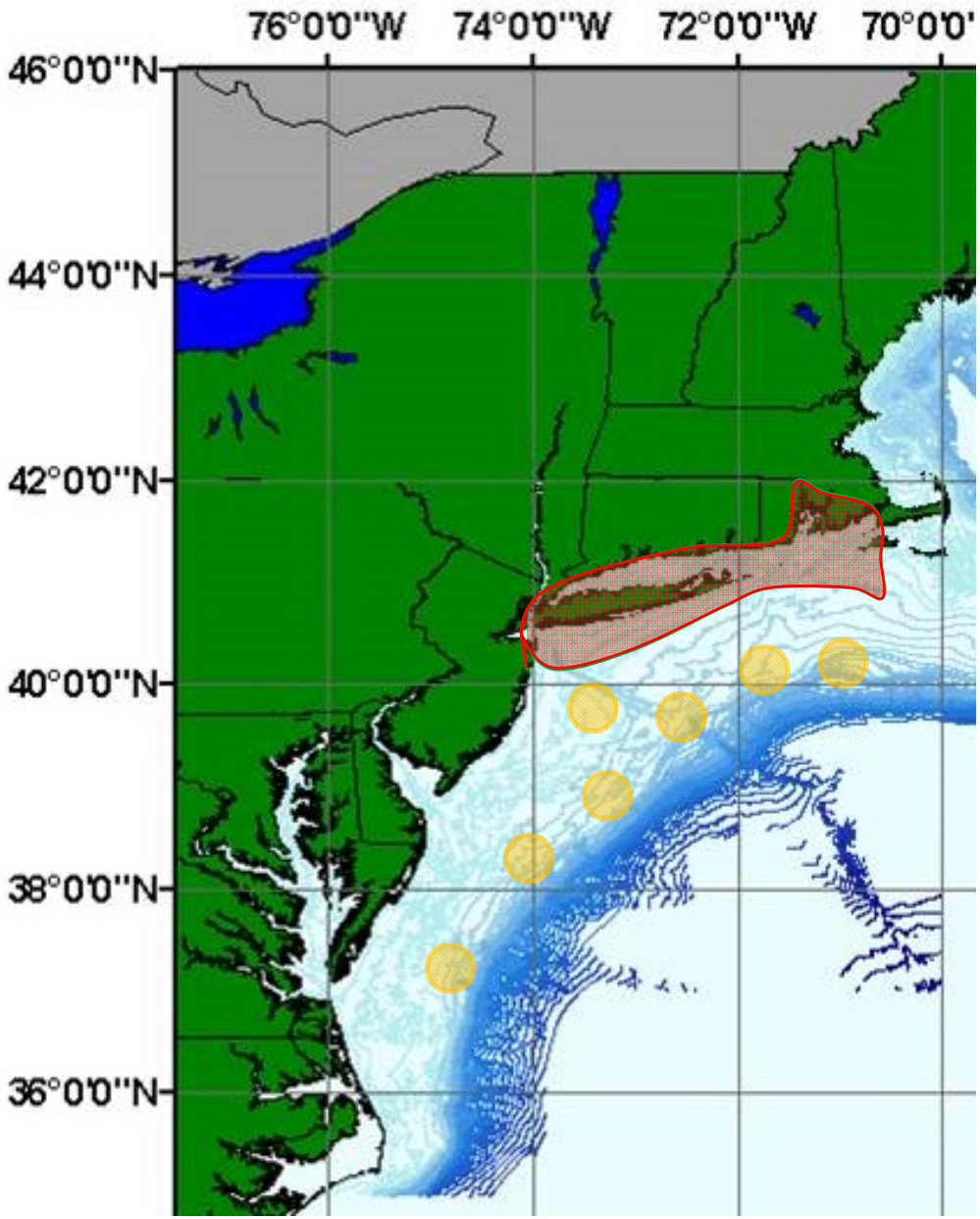


Viability of Offshore Habitat for Lobster Settlement

- No offshore settlement indices exist
  - We know some settlement does occur offshore
    - Juvenile lobster from 30 to 50 mm CL are found their
      - Trawl survey
      - Commercial trap sampling
      - CFRF study fleet
      - Anecdotal reports from fishermen
- Survival and growth rates offshore are not known
- Quality/quantity of offshore habitat is questionable
- Contribution to recruitment from offshore areas is highly uncertain
- Largest portion of highest quality nursery in shallow inshore waters is no longer productive in many years


NEFSC Fall Trawl Survey Recruit Indices
Mean catch per tow
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014

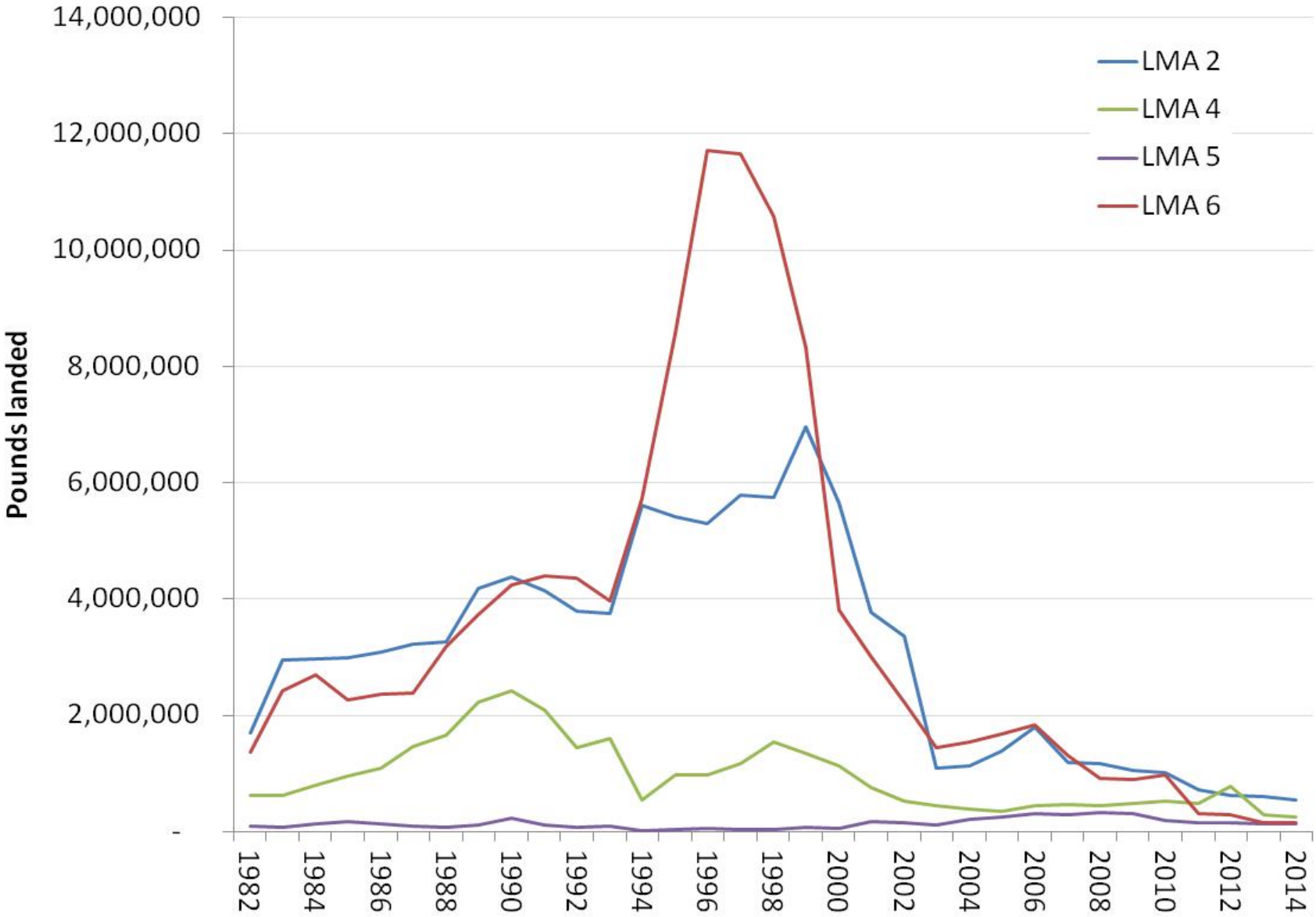
Viabilitv of Offshore Habitat for Lobster Settlement



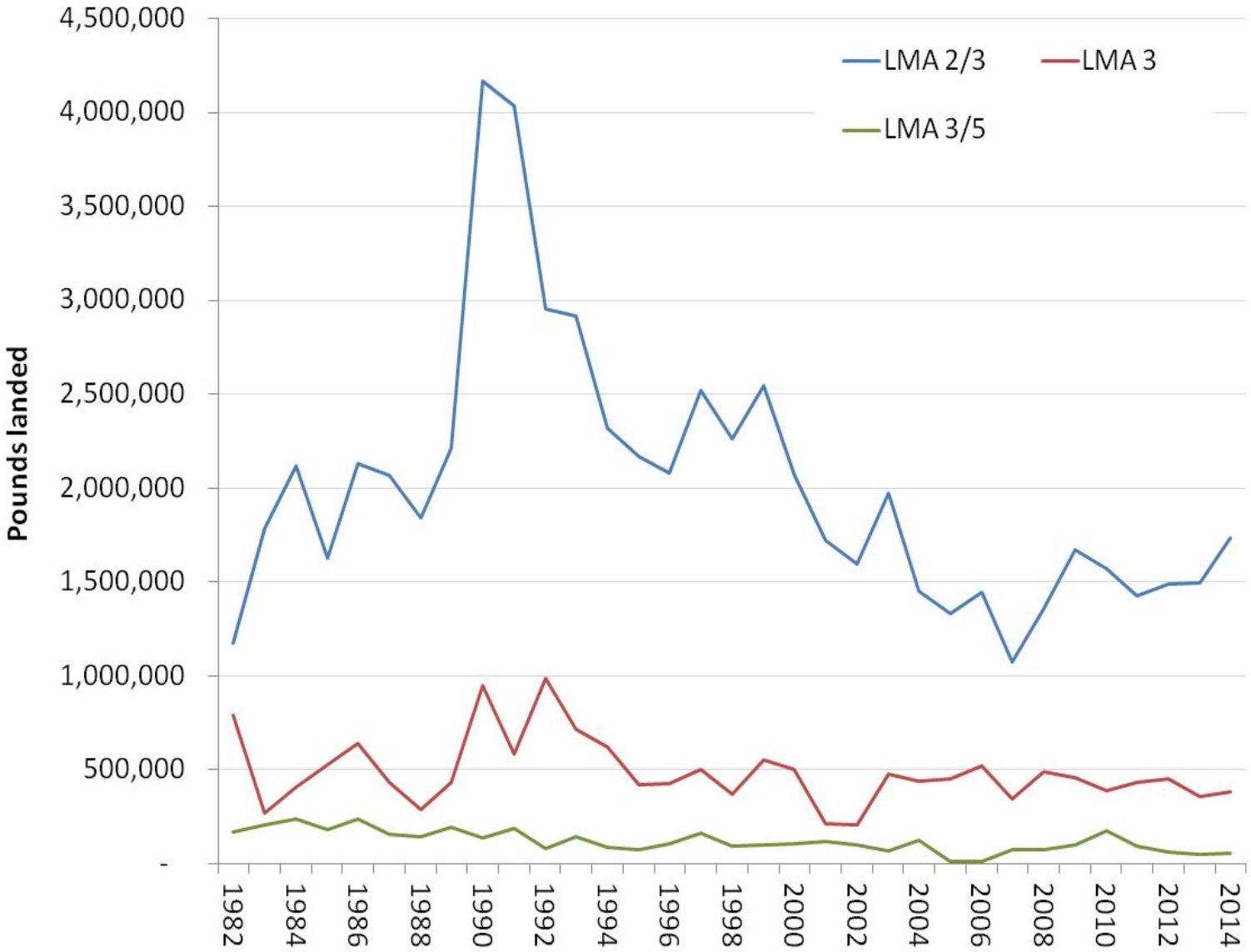
Inshore/Offshore Summary

- Strong evidence of connectivity from adult migrations
- Strong evidence of connectivity from larval circulation
- Strong evidence of connectivity from genetics
- Recruitment indices in dramatic decline both inshore and offshore
- Preponderance of the evidence support that SNE is one stock with inshore and offshore portions directly linked and dependent on each other

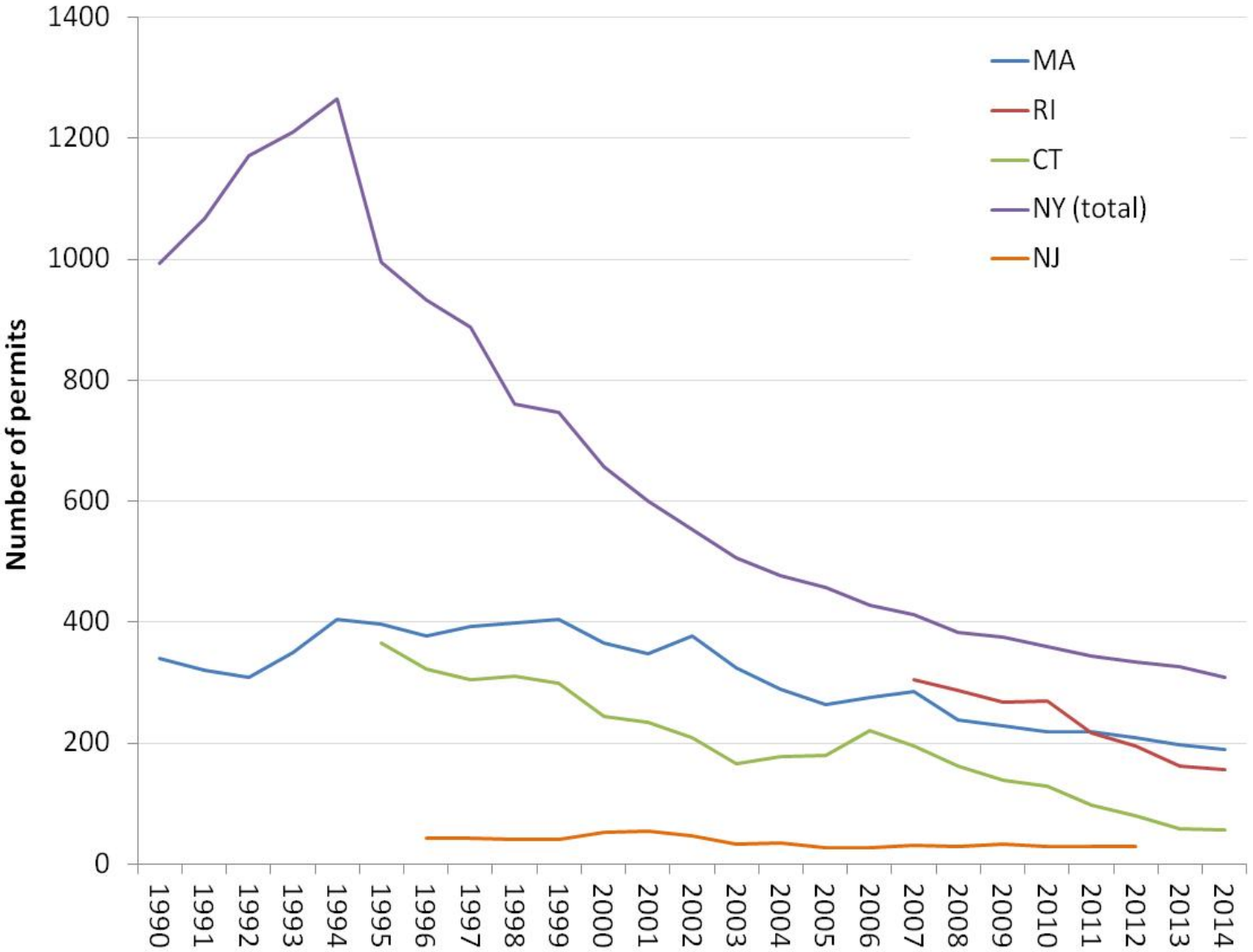
SNE Landings - Inshore



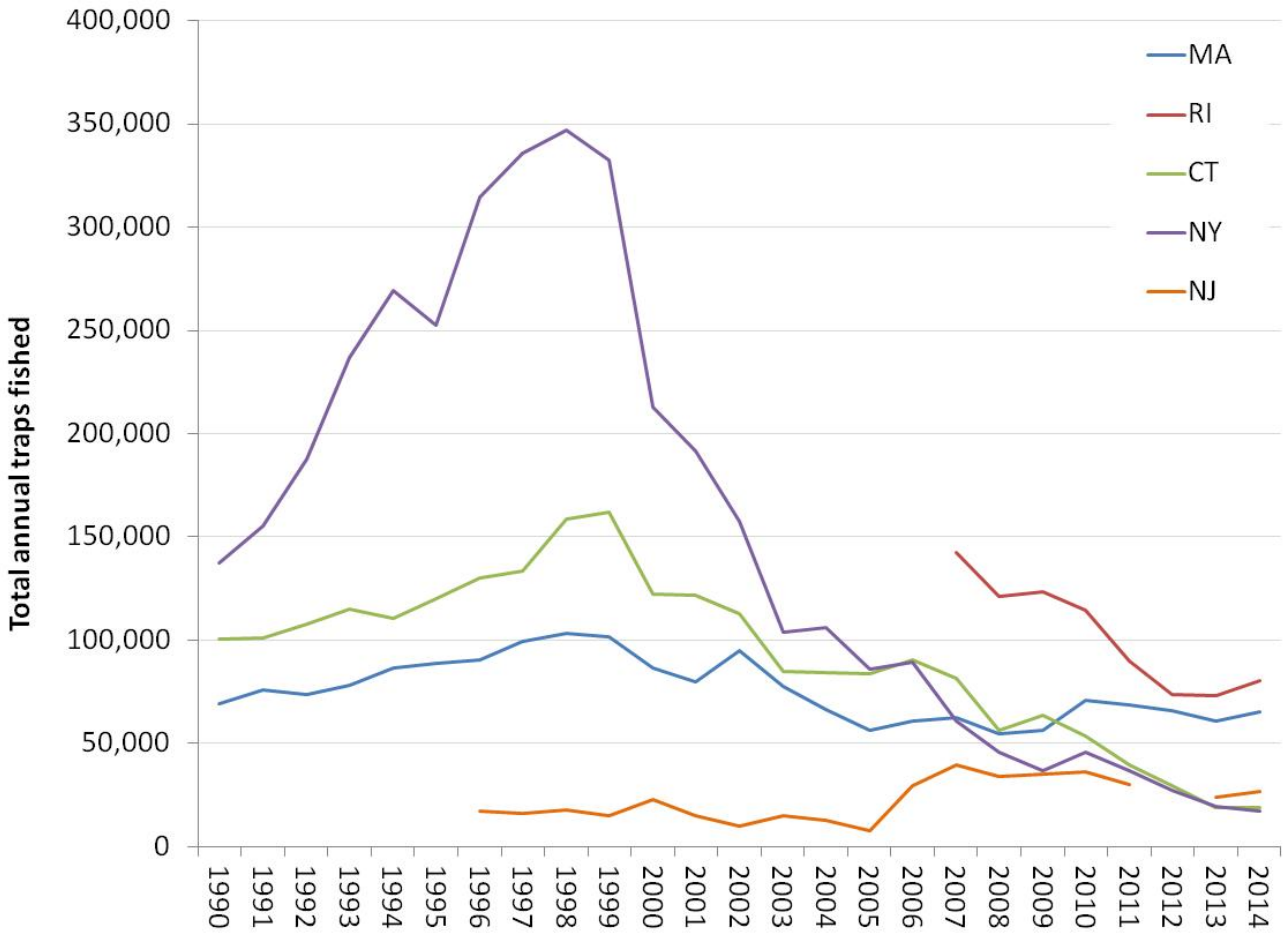
SNE Landings – Offshore



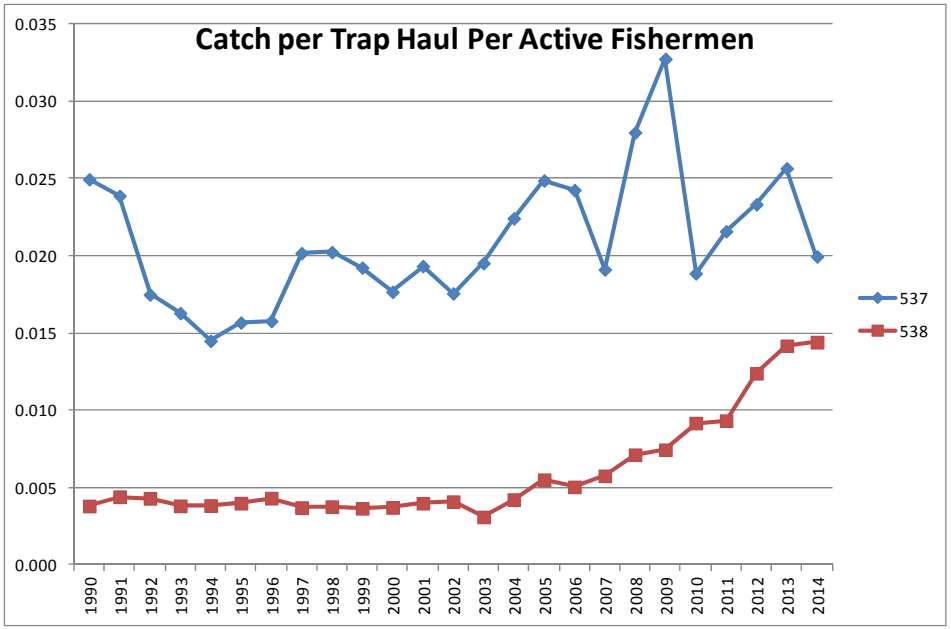
Total Number of Permits

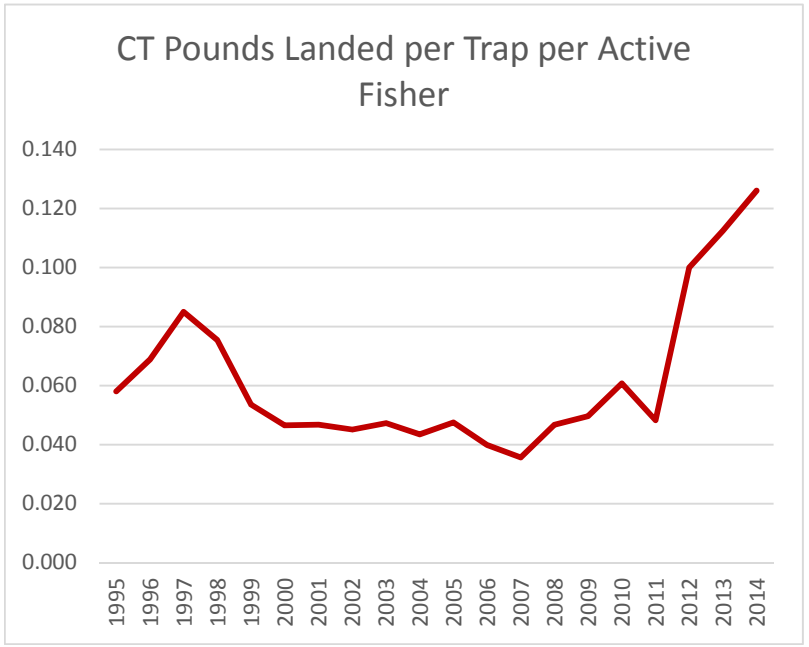


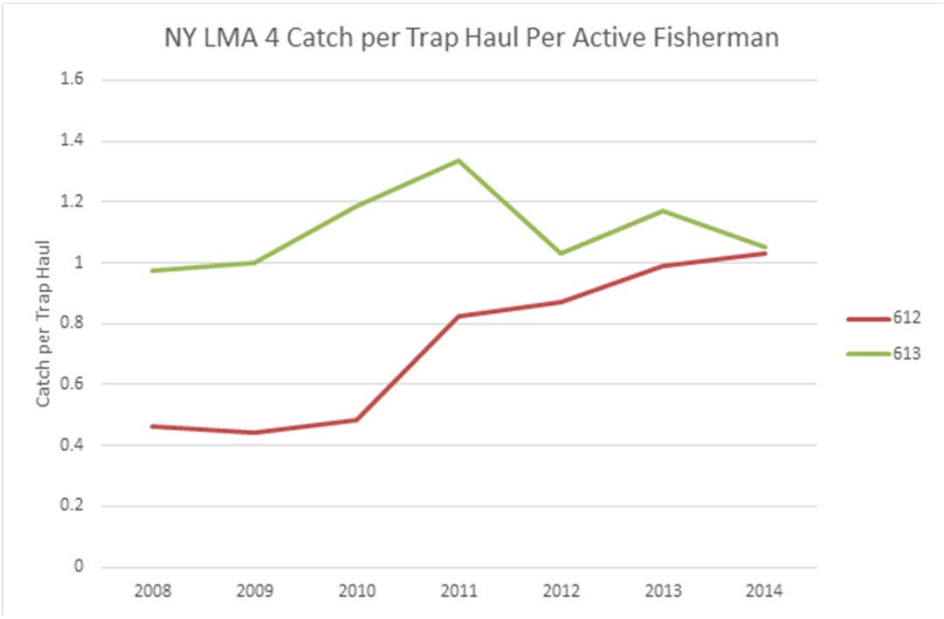
Traps Reported Fished

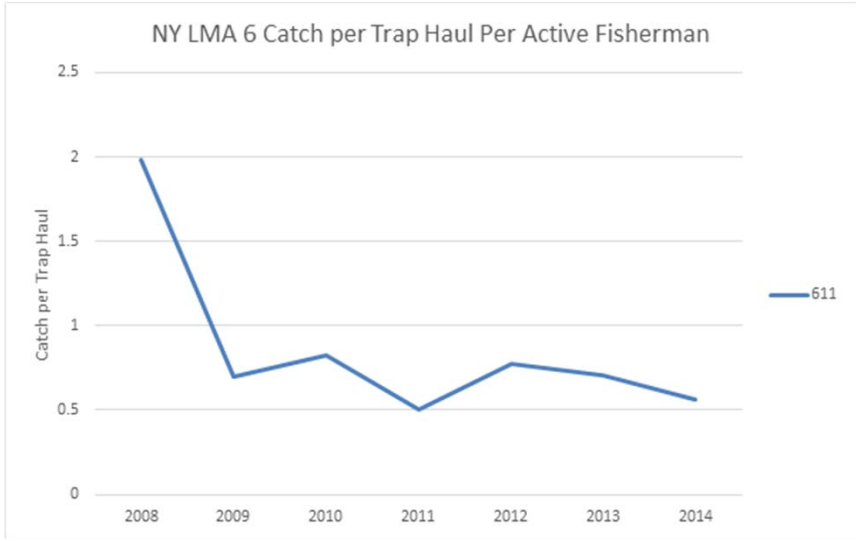


CPUE per Active Fishermen by State









Model Free 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

Model Free Indicators

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

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

Model Free Indicators

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

SNE Summary

- Updated fishery independent data show no improvement
  - Full recruit abundance and survey encounter rate are lowest inshore
  - Recruit abundance is extremely low both inshore and offshore
- Settlement indices are historically low
  - Catch from last 5 years derived from moderate year classes from early 2000's
  - We have never experienced this many successively poor year classes
  - SNE stock is likely to get worse
- SNE shows signs of depensation and continued recruitment failure
- Projections
  - 75% to 90% reduction in catch necessary to stabilize the stock
  - Under current levels of M only modest improvement likely in the absence of F
- Catch, participation, and effort are at or near all time lows
  - CPUE for remaining fishers is very high – disconnect for fishermen

GOM

SPAWNING STOCK ABUNDANCE Mean weight (g) per tow of mature females						
Survey	NESFC		ME/NH		MA 514	
	fall	spring	fall	spring	fall	spring
1981	127.57	303.66			342.80	251.36
1982	20.19	78.56			404.26	90.43
1983	118.43	176.40			537.29	32.40
1984	159.77	347.71			336.33	78.90
1985	311.91	2189.79			563.45	32.32
1986	155.64	375.38			135.10	50.24
1987	29.47	356.77			146.15	82.80
1988	106.70	173.52			94.55	42.74
1989	205.15	169.48			123.19	114.57
1990	116.49	368.43			538.08	100.27
1991	131.02	301.70			142.51	101.77
1992	115.27	304.54			262.54	110.74
1993	167.68	337.77			53.48	117.58
1994	233.02	521.60			376.55	132.17
1995	284.29	252.38			222.57	91.04
1996	422.24	601.51			262.89	72.61
1997	354.21	757.88			87.30	49.64
1998	216.98	832.32			113.80	81.44
1999	931.76	572.69			178.35	194.17
2000	318.65	875.14	3425.58		287.35	133.73
2001	312.96	1058.84	1858.63	462.60	105.26	151.41
2002	1247.40	1450.71	3707.47	967.67	163.87	105.74
2003	675.87	1688.03	3988.26	847.68	101.81	45.15
2004	411.40	1988.81	3497.55	682.69	86.24	189.23
2005	288.34	1163.74	4062.27	1505.13	167.88	358.32
2006	457.21	1298.00	2909.52	885.80	118.39	290.44
2007	291.48	1094.86	3010.80	735.09	138.01	91.86
2008	497.90	1357.83	3423.42	712.51	354.40	222.36
2009	1111.88	1332.23	5525.54	1138.18	396.60	135.71
2010	1796.57	1720.01	3879.74	1322.90	1176.34	157.93
2011	1334.21	1387.80	4446.97	868.71	782.58	151.85
2012	1964.23	2372.91	2964.59	1190.50	524.55	68.82
2013	2010.87	1672.97	4144.70	671.93	761.16	187.97
2014	2997.61	2037.40	3985.00	1326.88	569.74	300.09
2015	NA	2313.49	NA	881.35	1443.63	269.89
2011 - 2015 ave.	2076.73	1956.91	3885.32	987.87	816.33	195.72
25th	121.58	302.41	3033.84	655.14	116.15	55.84
median	211.06	371.91	3566.52	847.68	171.11	90.73
75th	317.23	813.71	3777.66	907.67	324.09	113.62

FULL RECRUIT ABUNDANCE (SURVEY) Abundance of lobsters > 82 mm CL (sexes combined)						
Survey	NEFSC		ME/NH		MA 514	
	fall	spring	fall	spring	fall	spring
1981	0.24	0.36			1.91	1.83
1982	0.05	0.21			2.80	0.57
1983	0.21	0.20			3.08	0.51
1984	0.29	0.34			4.09	0.49
1985	0.55	1.81			3.94	0.50
1986	0.45	0.55			1.71	0.54
1987	0.15	0.44			0.53	0.56
1988	0.14	0.27			1.51	0.56
1989	0.38	0.28			2.27	0.79
1990	0.25	0.44			4.92	0.97
1991	0.35	0.46			3.18	0.69
1992	0.22	0.36			2.35	0.87
1993	0.40	0.47			0.63	1.00
1994	0.50	0.70			3.15	0.76
1995	0.98	0.47			2.50	0.58
1996	0.89	0.99			2.50	0.33
1997	0.70	1.02			1.69	0.62
1998	0.45	0.96			0.88	0.49
1999	1.55	0.51			1.93	0.72
2000	0.61	1.35	14.22		2.20	0.97
2001	0.62	1.50	9.83	2.25	0.72	0.53
2002	1.89	1.81	12.57	3.40	1.02	0.43
2003	1.14	2.38	16.65	3.08	0.42	0.22
2004	1.18	2.55	16.18	3.14	0.33	0.78
2005	0.62	1.64	21.09	6.53	0.56	0.95
2006	0.83	1.67	14.85	5.33	1.03	0.68
2007	0.51	1.50	14.13	4.19	0.48	0.32
2008	0.90	1.94	20.72	3.06	1.55	0.67
2009	1.82	1.66	30.48	6.32	1.70	0.54
2010	3.06	2.61	21.42	6.29	2.30	0.40
2011	3.15	2.14	23.83	5.14	3.80	0.55
2012	3.35	3.38	16.51	5.94	3.18	0.31
2013	3.29	2.43	21.45	4.50	3.74	0.87
2014	5.77	2.74	26.38	9.33	2.91	0.77
2015	NA	3.98	NA	6.48	5.69	1.26
2011 - 2015 ave.	3.89	2.93	22.04	6.28	3.86	0.75
25th	0.26	0.38	11.88	2.67	1.14	0.50
median	0.45	0.49	13.39	3.08	2.24	0.56
75th	0.68	1.01	14.83	3.24	3.01	0.75

GOM

RECRUIT ABUNDANCE (SURVEY)						
Abundance of lobsters 71 - 80 mm CL (sexes combined)						
Survey	NEFSC		ME/NH		MA 514	
	fall	spring	fall	spring	fall	spring
1981	0.03	0.06			4.84	6.38
1982	0.17	0.13			3.85	2.74
1983	0.42	0.14			9.76	1.76
1984	0.13	0.10			6.13	2.15
1985	0.65	0.10			9.60	4.48
1986	0.53	0.11			3.80	3.01
1987	0.28	0.23			1.16	2.47
1988	0.51	0.25			4.12	2.52
1989	0.62	0.00			7.51	4.48
1990	0.90	0.21			15.40	6.11
1991	0.74	0.28			7.55	2.73
1992	0.57	0.25			8.95	4.31
1993	0.49	0.11			3.19	5.12
1994	1.15	0.09			13.80	7.59
1995	0.77	0.77			12.10	4.54
1996	2.05	0.33			12.10	3.09
1997	0.86	0.95			6.41	4.57
1998	1.00	0.76			7.47	4.50
1999	1.34	0.60			8.73	4.26
2000	1.26	1.73	23.82		8.86	4.24
2001	0.66	0.58	17.53	9.16	1.58	4.30
2002	0.75	0.74	22.12	22.63	5.00	3.43
2003	0.20	0.60	23.78	13.71	0.66	1.96
2004	1.06	0.39	15.96	9.69	1.30	2.46
2005	0.39	0.30	30.88	23.85	2.11	4.35
2006	0.58	1.14	23.27	23.15	5.30	6.09
2007	0.39	0.71	21.62	20.24	1.61	0.75
2008	1.05	0.49	40.45	22.90	6.12	2.54
2009	1.17	0.97	41.84	31.77	8.88	3.18
2010	1.51	0.71	46.24	22.40	9.39	2.22
2011	2.70	1.96	58.53	47.39	15.00	5.24
2012	1.61	2.32	47.28	44.81	11.30	3.03
2013	3.21	1.97	48.24	39.71	12.20	4.83
2014	4.19	1.88	53.06	78.58	7.06	3.35
2015	NA	2.82	NA	45.20	17.91	7.05
2011 - 2015 ave.	2.93	2.19	51.78	51.14	12.69	4.70
25th	0.50	0.12	20.97	11.43	3.92	2.73
median	0.66	0.25	22.95	13.71	7.49	4.25
75th	0.89	0.60	23.79	18.17	9.44	4.50

YOUNG-OF-YEAR INDICES					
	YOY	YOY	YOY	YOY	YOY
Survey	ME	ME	ME	ME	MA
	511	512	513 East	513 West	514
1981					
1982					
1983					
1984					
1985					
1986					
1987					
1988					
1989			1.64		
1990			0.77		
1991			1.54		
1992			1.30		
1993			0.45		
1994			1.61		
1995		0.02	0.66		0.56
1996		0.05	0.47		0.00
1997		0.05	0.46		0.17
1998		0.00	0.14		0.02
1999		0.04	0.65		0.36
2000		0.10	0.13	0.17	0.19
2001		0.43	2.08	1.17	0.38
2002	0.13	0.29	1.38	0.85	0.89
2003	0.22	0.27	1.75	1.22	0.68
2004	0.18	0.36	1.75	0.67	1.20
2005	1.59	1.36	1.77	0.82	0.82
2006	0.58	1.13	0.84	0.82	0.32
2007	0.84	1.34	2.01	1.27	1.22
2008	0.42	0.83	1.08	0.97	0.24
2009	0.69	0.48	1.25	0.45	0.13
2010	0.28	0.72	0.80	0.47	0.45
2011	0.41	1.10	2.33	0.67	0.63
2012	0.53	0.73	1.06	0.22	0.21
2013	0.10	0.20	0.48	0.12	0.09
2014	0.16	0.43	0.83	0.33	0.09
2015*	0.11	0.22	0.43	0.05	0.00
2011 - 2015 ave.	0.26	0.54	1.03	0.28	0.20
25th	0.15	0.04	0.47	0.68	0.17
median	0.17	0.05	0.77	1.01	0.36
75th	0.19	0.27	1.57	1.18	0.56

* 2015 Maine data are preliminary

Jonah Crab FMP

Effort Controls, Bycatch, and Claw Harvest

February 2, 2016

Overview

1. Jonah Crab Only Trap Fishermen

Task: Review catch and landings records

Result: Only in Rhode Island

2. Incidental Bycatch Limit

Task: Draft Addendum I

Result: Addendum drafted, PDT recommends bycatch limit for non-lobster traps

3. Jonah Crab Claw Provision

Task: Review catch and landings records

Result: Trip level data minimal, good biological data

Overview

Non-Trap Gear VS. **Non-Lobster Trap Gear**

- Otter Trawl
- Gillnet
- Longline

- Whelk pot
- Crab pot
- Fish pot

Jonah Crab Only Trap Fishermen

Background

Issue:

- Board agreed to set effort controls

Nov. Board Meeting:

- Fishermen in RI, NY, MD
- Approx. 15 fishermen in total
- Tasked to examine catch and landings records to characterize participants

Regulation

"Participation in the directed trap fishery is limited to only those vessels and permit holders that already hold a lobster permit; **or can prove prior participation in the crab fishery before the control date of June 2, 2015.** All traps must conform to the specifications of the lobster management plan."

1. No lobster permit
2. Traps meet specifications of Lobster FMP

Maryland

What we found:

- 6 fishermen landing Jonah crabs w/out a lobster permit
- Otter trawl, gill net, whelk pots

1. No lobster permit ✓
2. Traps meet specifications of Lobster FMP **X**

→No Jonah crab only trap fishermen in MD

New York

What we found:

- 3 fishermen landing Jonah crabs w/out a lobster permit
- Fish pots, hand line, dredges

1. No lobster permit ✓
2. Traps meet specifications of Lobster FMP **X**

→No Jonah crab only trap fishermen in NY

Rhode Island

What we found:

- 4 fishermen landing Jonah crabs w/out a lobster permit
- Lobster traps

1. No lobster license ✓
2. Traps meet specifications of Lobster FMP ✓

→There are Jonah crab only trap fishermen in RI

Conclusions

- **This has become a single state issue**
  - ASMFC work with RI
  - Still need to define directed fishing

- **Fishermen are landing Jonah crabs with NON-LOBSTER TRAPS**
  - Loophole: could obtain incidental permit and fish Jonah crabs with no catch limit

Draft Addendum I for Public Comment

Background

- Concern that 200/500 crab bycatch limit on **NON-TRAP GEAR** does not include all current participants in fishery
- Initiate addendum to increase or remove bycatch limit

Timeline

November 2015-January 2016	Draft Addendum Developed by PDT
	↓
February 2016	Board Reviews Draft Addendum & Makes Any Necessary Changes
	↓
March – April 2016	Public Comment Period Including Hearings
	↓
May 2016	Board Review, Selection of Management Measures and Final Approval

Current Regulation

"There is a 200 crabs per calendar day, 500 crabs per trip incidental bycatch limit for ***non-trap gear****"*

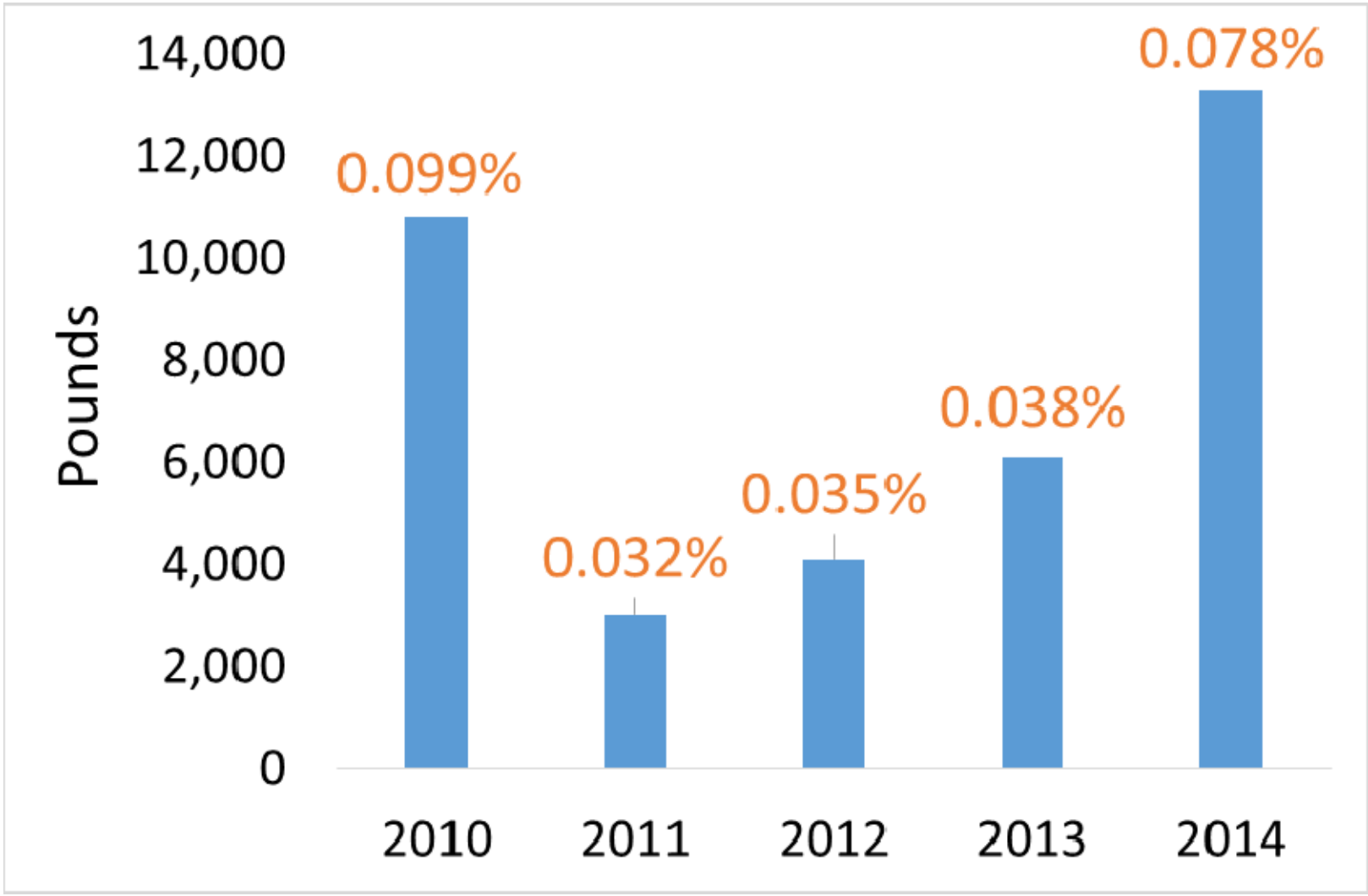
Data from NEFMC & NOAA

NON-TRAP GEAR

- January 1, 2010 - December 31, 2014
  - 97-99% of trips were within current bycatch limit
  - 23 trips over 200/500 crab limit
- May 1, 2013 - August 31, 2015
  - 7 of 372 trips exceeded bycatch limit
  - 3 trips landed over 900 crabs

Data from NEFMC

Total Pounds Landed by NON-TRAP GEAR



Proposed Mgmt. Options

Option 1: Status Quo

200 crabs per calendar day, 500 crabs per trip for non-trap gear

Option 2: 1000 Crab Limit

1000 crab trip limit for non-trap gear for a trip of any length

Option 3: No Bycatch Limit

Remove incidental bycatch limit for non-trap gear

LEC Comments

- Count is still preferable although volume workable too
  - Officers already handling crabs to inspect size and presence of egg-bearing females
- Regardless, increased time and effort required to check catch
- Concern that increased bycatch limit could result in directed efforts and gear conflicts

PDT Comments

- Draft Addendum I only applies to **non-trap gear**
- Incidental catch from **non-lobster traps**
- <u>Concerns:</u>
  - Fishermen could obtain incidental permit and fish with no catch limit
  - Trap proliferation

NOAA Data

NON-LOBSTER TRAPS

From May 1, 2013 to August 31, 2015:

- 194 trips
- 60% of trips landed 200 crabs or fewer
- 20% trips landed between 200 and 500 crabs
- 20% trips landed more than 450 crabs
- Highest trip landings from whelk pots

Maryland Data

NON-LOBSTER TRAPS

- Fish Pots
  - 33 reported trips between 2012-2015
  - All trips under 200 lbs
  - 867 lbs total
- Whelk Pots
  - 36 reported trips between 2014-2015
  - Average < 500 lbs per trip between 2014-2015
  - 15,350 lbs total
  - PDT concerned landings could be rock crabs

PDT Proposes Issue 2

Issue 2: Incidental Bycatch Limit for Non-Lobster Trap Gear

Applies to all traps which do not have a valid lobster tag, including fish pots, whelk pots, and crab pots.

Option 1: Status Quo

- No incidental bycatch limit for non-lobster trap gear
- Obtain incidental permit to fish

Option 2: Incidental Bycatch Limit of 200/500 Crabs

- 200 crabs per day up to 500 crabs per trip for trips 3 days or longer
- 1 day = 24 hours

Jonah Crab Claw Fishermen

Background

FMP Establishes:

- Whole crab fishery
- Exception: fishermen in NJ-VA who can prove a history of claw landings

Nov. Board Meeting:

- Approx. 46 claw fishermen
- Fishermen in NY too
- Task: investigate catch and landings records

Goal & Questions

Goal: Understand size of fishery in order to set appropriate harvest standards

1. How many fishermen are landing claws?
2. Are fishermen landing whole crabs and then selling claws or just landing claws?
3. What is the poundage landed?
4. Are they fishing in state or federal waters?
5. Do fishermen take one or two claws?
6. Is there a market preference for a specific claw size?

Maine

- Number of claw fishermen is confidential
- Personal consumption not reflected in dealer reports so landings likely an underestimate

Year	Total lbs	Total Value
2013	5,048	$2981.85
2014	7,965	$5934

New York

- Land whole crabs and then sell claws
- Lobster pots and fish pots
- Federal and state waters
- Mix of 1 and 2 claws harvested per crab

Year	# Selling Claws	Max Landings
2008	11	144,980
2009	6	150,843
2010	9	213,876
2011	15	227,709
2012	12	244,134
2013	19	293,376
2014	10	130,851

New Jersey

- Unknowns: number of claw fishermen, claw poundage, location of harvest
- Possible for harvesters to fish and not report

Number of NJ Vessels Landing Jonah Crab

	2012		2013		2014		2015	
	Vessels	Lob	Vessels	Lob	Vessels	Lob	Vessels	Lob
Gillnet	3	0	2	0	5	0		0
Trawl	7	3	2	0	2	2		4
Trap	16	16	14	14	18	18		16
TOTAL	**26**	**19**	**18**	**14**	**25**	**20**		**20**

Delaware

- 2 fishermen landing claws
- Land claws and whole crabs depending on market
- Poundage confidential
- Federal waters
- Harvest both claws
- Preference to harvest crabs over 4”

Maryland

- 18 fishermen total (2000-2015)
- Total landings: 30,665 lbs (2014) and 21,232 lbs (2015)
  - -Landings per trip all under 4,500 lbs
  - -50% of fishermen averaged < than 50 lbs per trip each year
  - -80% of fishermen averaged < than 200 lbs per trip each year
  - - 60% of fishermen landed < than 500 lbs yearly
- Lobster pot, fish pot, gillnet, whelk pot, otter trawl
- State and federal waters
- Harvest both claws

Maryland

Claw Landings (All Gears Combined)

Year	# of Fishermen	Trips	Pounds Landed	Pounds/ Trips
2010	4	43	5,545	129
2011	3	19	4,175	220
2012	9	53	7,507	142
2013	*	Confidential		*
2014	7	54	30,665	568
2015	8	70	21,232	303

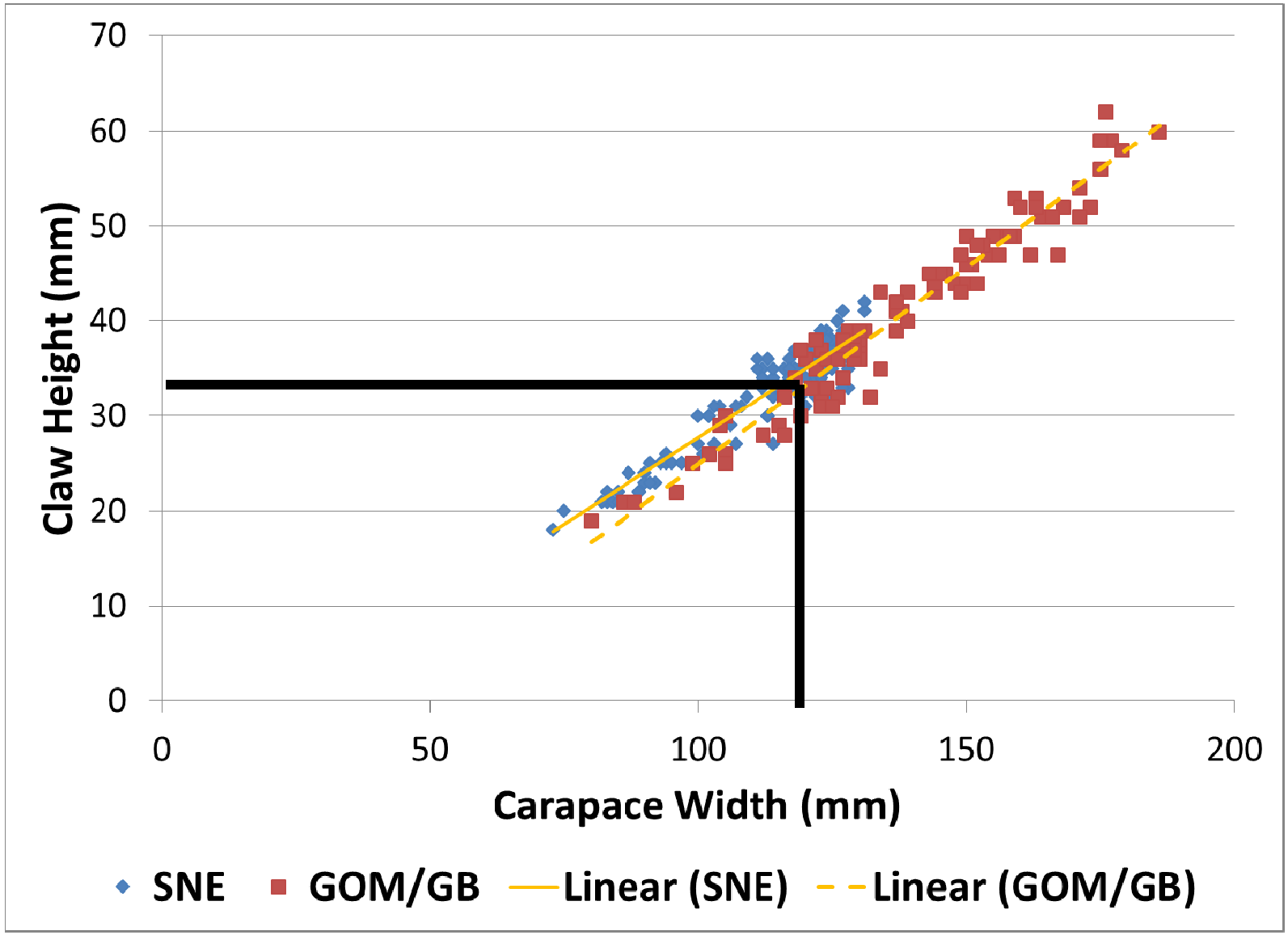
Maryland

Claw Landings by Gear (2000-2015)

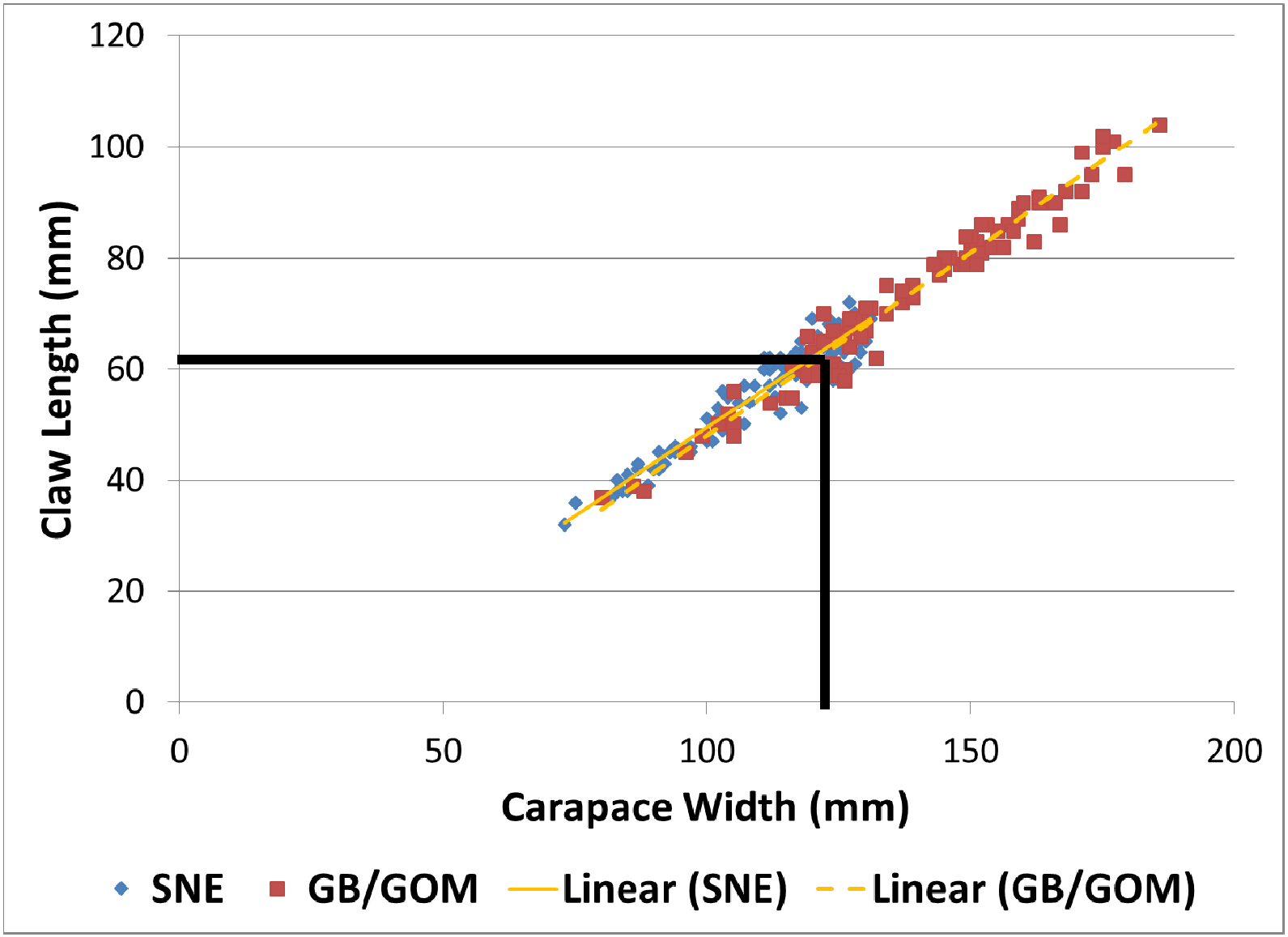
	Lobster Trap	Fish Pot	Gillnet	Whelk Pot	Otter Trawl
Total Trips	481	227	30	31	7
Total lbs	110,894	6,212	35,554	15,410	650

Jonah Crab Biological Data

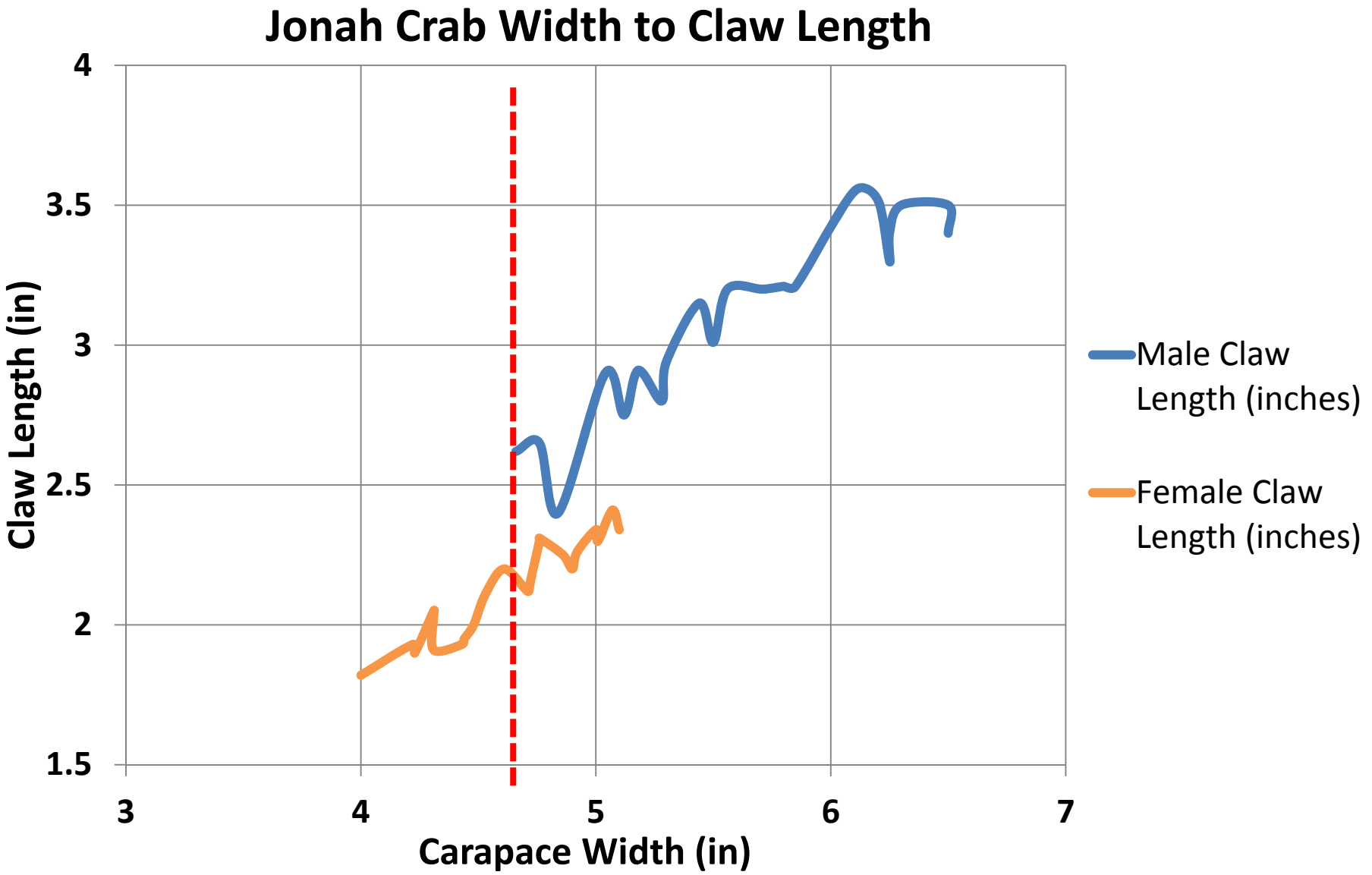
Carapace Width: Claw Height



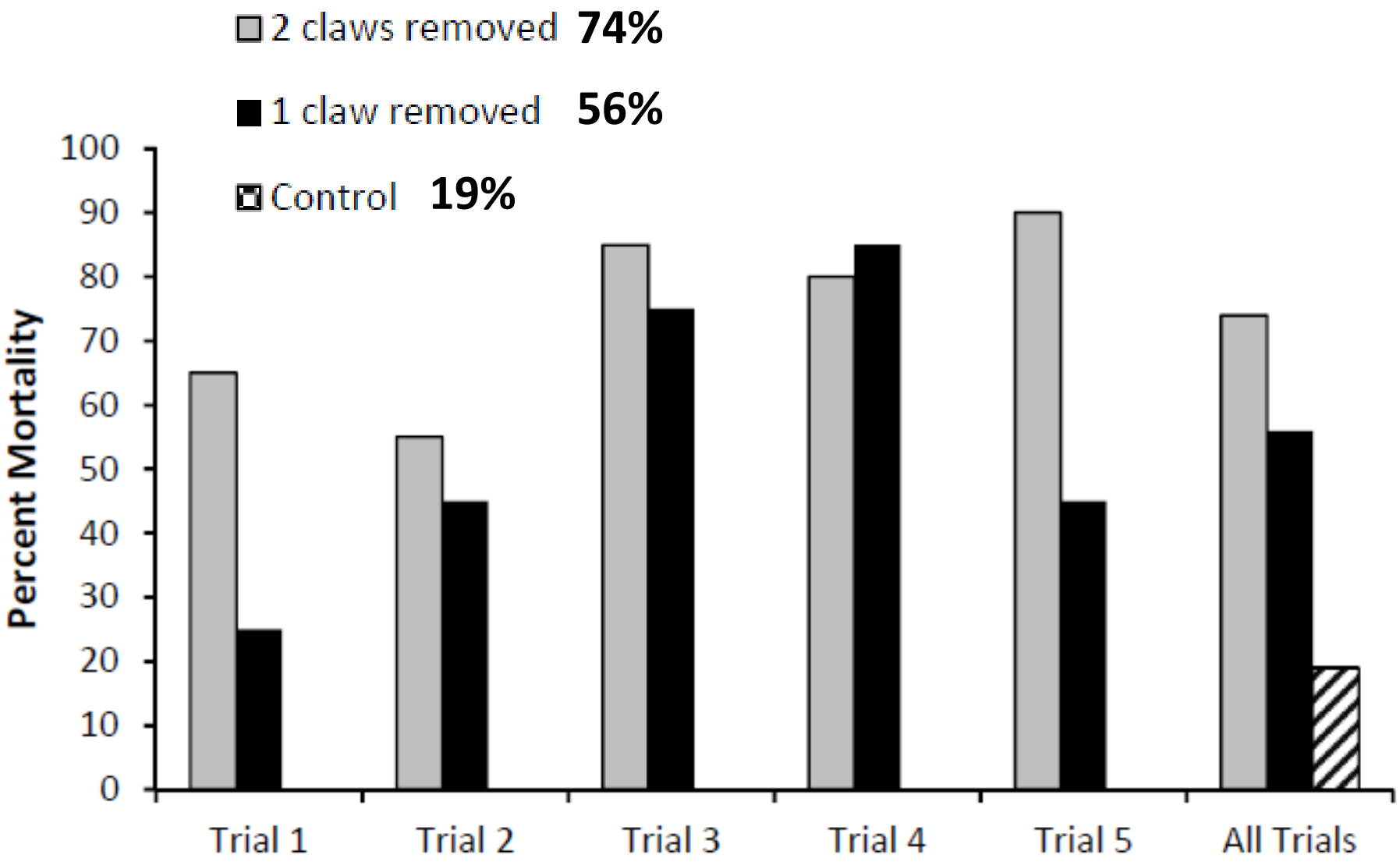
Carapace Width: Claw Length



Carapace Width: Claw Length



Claw Mortality



Claw Mortality

	INITIAL FEEDING		SECONDARY FEEDING	
Treatment	**Ate Something**	**Ate Shucked & Shelled**	**Ate Something**	**Ate Shucked & Shelled**
Control	87%	63%	96%	96%
1 Claw Removed	55%	19%	74%	46%
2 Claws Removed	32%	0%	47%	12%

Conclusions & Questions

Conclusions:

- Claws harvested in 6 states w/ a variety of gears
- Poor trip level data
- Biological data may prove useful

Questions:

- Does the Board want a claw fishery?
- If yes, what standard would be best to manage the claw fishery?
- Who can land claws?