

Atlantic Mackerel Update for 2014 Specifications

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Population Dynamics Branch

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The following information addresses the request by Dr. Chris Moore, Executive Director of the Mid-Atlantic Fisheries Management Council (MAFMC), in his letter to Dr. Bill Karp on 3 January 2013. The MAFMC requested updated time series of Northeast Fisheries Science Center (NEFSC) spring survey indices and length compositions for Atlantic mackerel, and the implications of the most recent Atlantic mackerel assessment published by the Canada Division of Fisheries and Oceans (DFO) in July 2012.

NEFSC spring survey indices and length compositions

Relative abundance (arithmetic stratified mean number-per-tow) and biomass (arithmetic stratified mean kg-per-tow) indices were derived using data from the NEFSC spring bottom trawl survey conducted during 1968-2012. Indices were not yet available for the ongoing 2013 spring survey. In 2009, the survey changed primary research vessels from the *Albatross IV* to the *Henry B. Bigelow*. Indices for 2009 onward were converted from *Bigelow* units to *Albatross IV* equivalents using conversion factors for relative abundance (1.188) and biomass (0.868) (Miller et al. 2010). Estimated 2012 indices of relative abundance and biomass were 43.77 mackerel-per-tow (standard error = 14.65) and 4.36 kg-per-tow (standard error = 1.78), respectively (Table 1). Estimated 2012 relative abundance was greater than the time series median of 24.28 mackerel-per-tow; estimated 2012 relative biomass was equal to the median of 4.36 kg-per-tow (Figure 1).

Mackerel lengths from the spring survey ranged from 7 cm to 48 cm during 1968-2012. Length compositions varied over time, with some years exhibiting unimodal distributions and other years exhibiting bimodal or trimodal distributions (Table 2, Figure 2). Annual stratified mean proportions-at-length were averaged over nine-year intervals (resulting in five intervals of equal length) to further examine changes in length composition over time. Mackerel length structure expanded between the first (1968-1976) and second (1977-1985) time intervals, but contracted thereafter (Figure 3). During the most recent time interval (2004-2012), mackerel size composition range was the smallest of the time series, with 95% of individuals between 18 cm and 31cm fork length. Average length structure was trimodal during the first 27 years of the time series, but then became bimodal (modes = 20 cm and 27 cm) from 1995 onward. In 2011, the length composition was unimodal (mode = 20 cm), with less than 4% of individuals greater than 24 cm (Figure 2). Updated age-composition data were not available.

Canadian mackerel assessment

In 2012, the DFO assessed the Canadian contingent of Atlantic mackerel in NAFO Subareas 3 and 4 (DFO 2012). A sequential population analysis was conducted using time series of

Canadian landings-at-age (1968-2011) and spawning stock biomass indices from the southern Gulf of St. Lawrence egg survey (1996-2011). Catches from bait and recreational fisheries were not recorded, and commercial discards did not appear to be available for the analysis. Canadian landings increased in the early 2000's, reaching a historic high in 2005. Landings were variable but generally decreased beginning in 2006, reaching a low in 2011. Spawning stock indices from egg surveys exhibited a decline between 1993-1998, subsequently increased due to a strong-1999 year class, and then declined to historical lows since 2005. A 2009 egg survey on the Scotian Shelf and southern Newfoundland coast also exhibited low egg densities.

The assessment document noted that a slight retrospective pattern was apparent for predicted abundance and fishing mortality, but not for spawning stock biomass, and further noted that the diagnostics did not suggest any major adjustment problems. However, the model diagnostics were not presented in the document. The assessment indicated a decline in estimated mackerel spawning stock biomass since approximately 2006 (Figure 4). This decline was attributed to low recruitment and high fishing mortality rates (Figure 5). However, biomass and fishing mortality estimates from the assessment model were not provided in the document text or tables. The assessment recommended a reduction in fishing mortality compared to the 2011 estimate.

An Icelandic project is currently underway to investigate Atlantic mackerel stock structure in the North Atlantic and both the U.S. and Canada have contributed samples for this project. However, at this time no additional information is available regarding Atlantic mackerel stock structure in the northwest Atlantic and in particular whether the U.S. and Canadian contingents should be classified as two distinct mackerel stocks or one unit stock.

References

- DFO. 2012. Assessment of the Atlantic Mackerel Stock for the Northwest Atlantic (Subareas 3 and 4) in 2011. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/031.
- Miller T.J., C. Das, P.J. Politis, A.S. Miller, S.M. Lucey, C.M. Legault, R.W. Brown, and P.J. Rago. 2010. Estimation of Albatross IV to Henry B. Bigelow calibration factors. Northeast Fish Sci Cent Ref Doc. 10-05; 233 p.

Table 1: Atlantic mackerel stratified mean number-per-tow and weight (kg)-per-tow derived from the NEFSC spring bottom trawl survey for 1968-2012.

Year	Number-per-tow		Weight-per-tow	
	Mean	Standard error	Mean	Standard error
1968	70.87	26.38	5.60	2.61
1969	0.48	0.25	0.06	0.03
1970	9.41	2.96	2.21	0.68
1971	12.62	5.28	3.18	1.46
1972	8.49	3.39	1.54	0.76
1973	68.09	62.03	21.90	20.56
1974	7.27	2.68	2.13	1.05
1975	6.79	4.75	0.43	0.21
1976	5.85	2.68	0.82	0.37
1977	0.93	0.36	0.26	0.08
1978	3.15	0.72	1.12	0.24
1979	0.56	0.19	0.29	0.10
1980	1.82	0.63	0.66	0.21
1981	19.07	9.18	8.02	4.45
1982	5.19	3.51	0.85	0.43
1983	0.90	0.30	0.14	0.06
1984	16.23	8.02	2.61	1.21
1985	8.24	2.54	2.23	0.75
1986	4.18	2.58	1.26	0.81
1987	35.23	13.79	7.49	2.35
1988	16.79	6.11	4.13	1.12
1989	12.27	4.41	1.10	0.41
1990	10.75	4.69	1.55	0.68
1991	23.26	10.60	5.60	2.80
1992	24.28	8.38	4.71	2.02
1993	26.09	10.92	5.58	1.63
1994	38.64	10.80	5.99	1.66
1995	24.39	7.56	5.10	1.66
1996	40.89	17.81	11.10	7.58
1997	22.05	8.55	2.49	0.78
1998	25.11	9.31	3.38	1.41
1999	50.62	16.27	7.11	1.79
2000	70.36	18.68	6.93	1.86
2001	116.45	44.30	15.72	6.03
2002	35.20	12.44	7.65	2.79
2003	60.49	16.47	11.08	3.85
2004	110.68	32.85	8.09	2.46
2005	32.32	15.29	4.27	1.85
2006	69.51	24.07	10.16	3.04
2007	30.14	12.52	5.60	2.41
2008	72.31	35.71	11.62	6.86
2009	105.07	30.20	14.70	6.98
2010	32.66	9.43	6.49	2.81
2011	94.62	22.74	9.47	3.15
2012	43.77	14.65	4.36	1.78

Figure 1: Atlantic mackerel relative abundance (stratified mean number-per-tow) and biomass (stratified mean kg-per-tow) indices derived from the NEFSC spring bottom trawl survey for 1968-2012. The median number- and weight-per-tow values represent the median indices over 1968-2012.

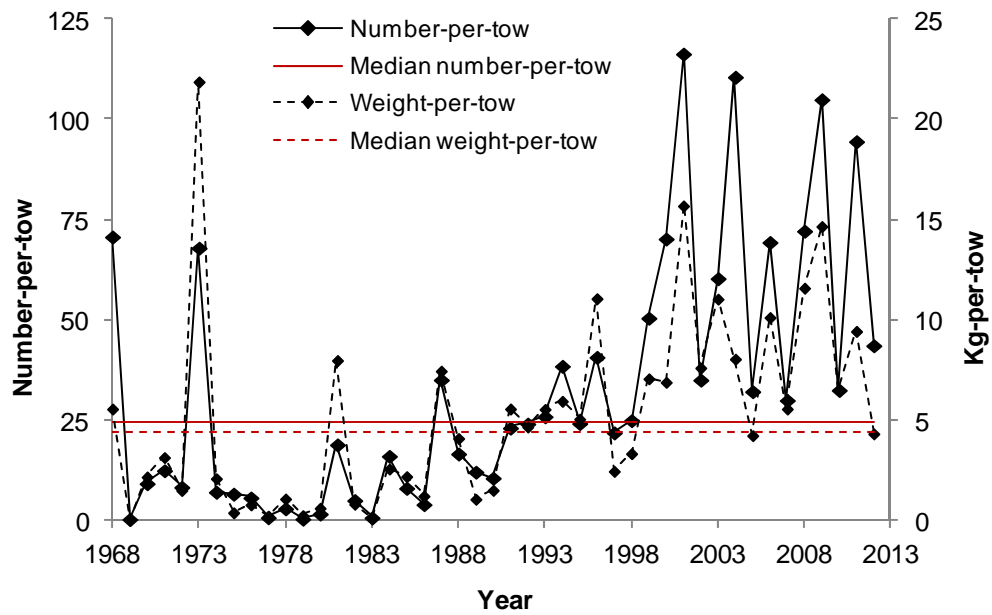


Figure 2: Annual mackerel length compositions from the NEFSC spring bottom trawl survey, 1968-2012.

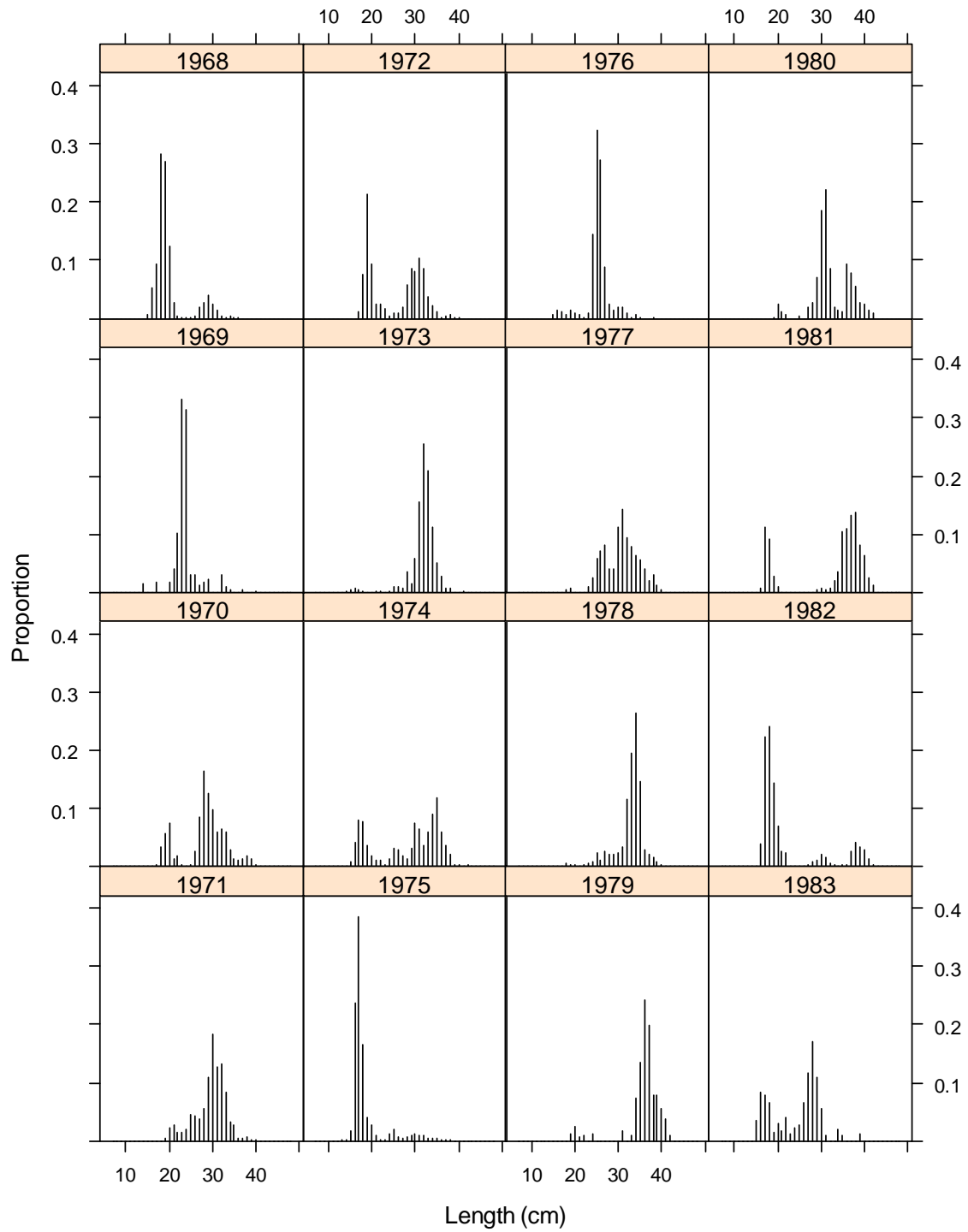


Figure 2, continued

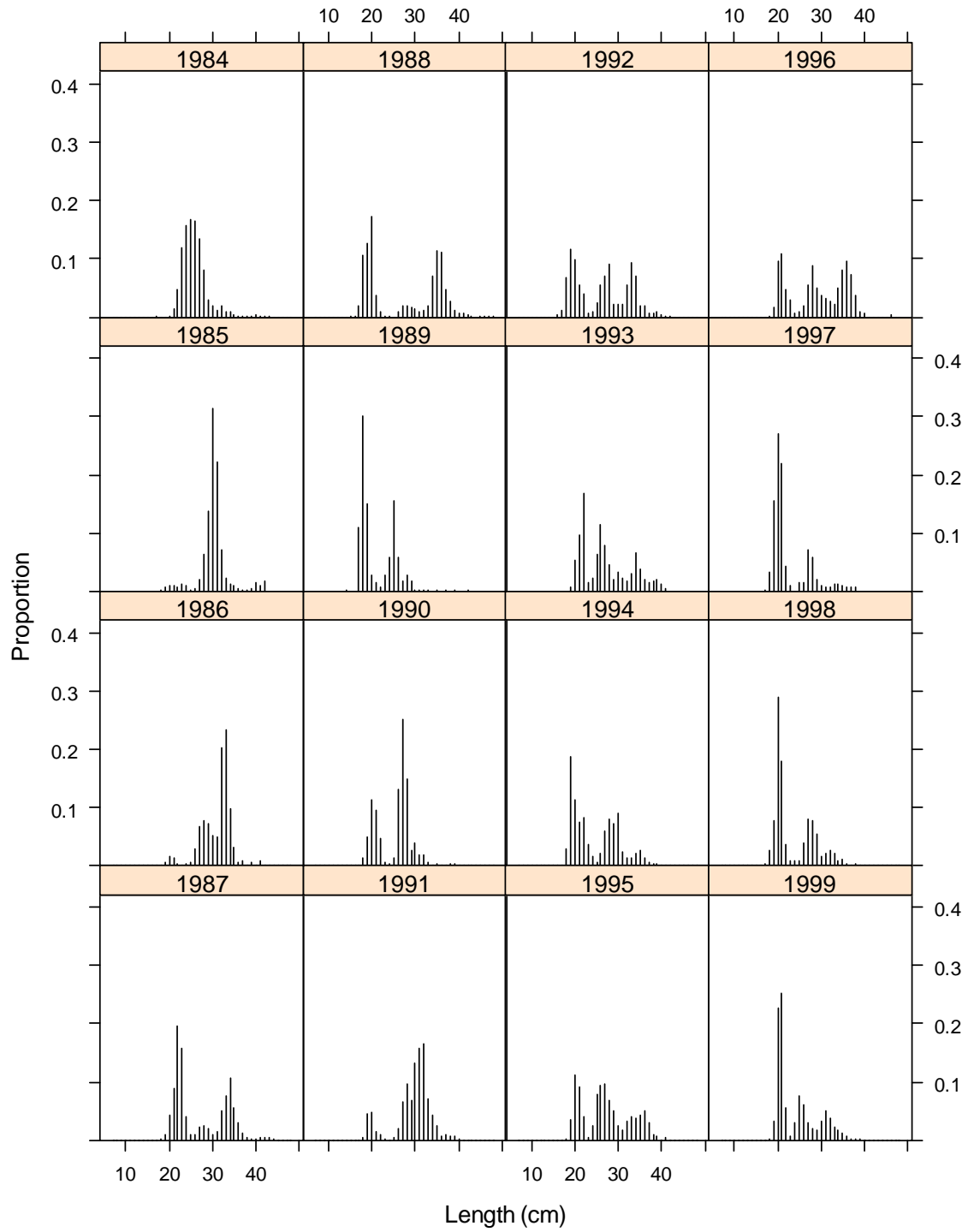


Figure 2, continued

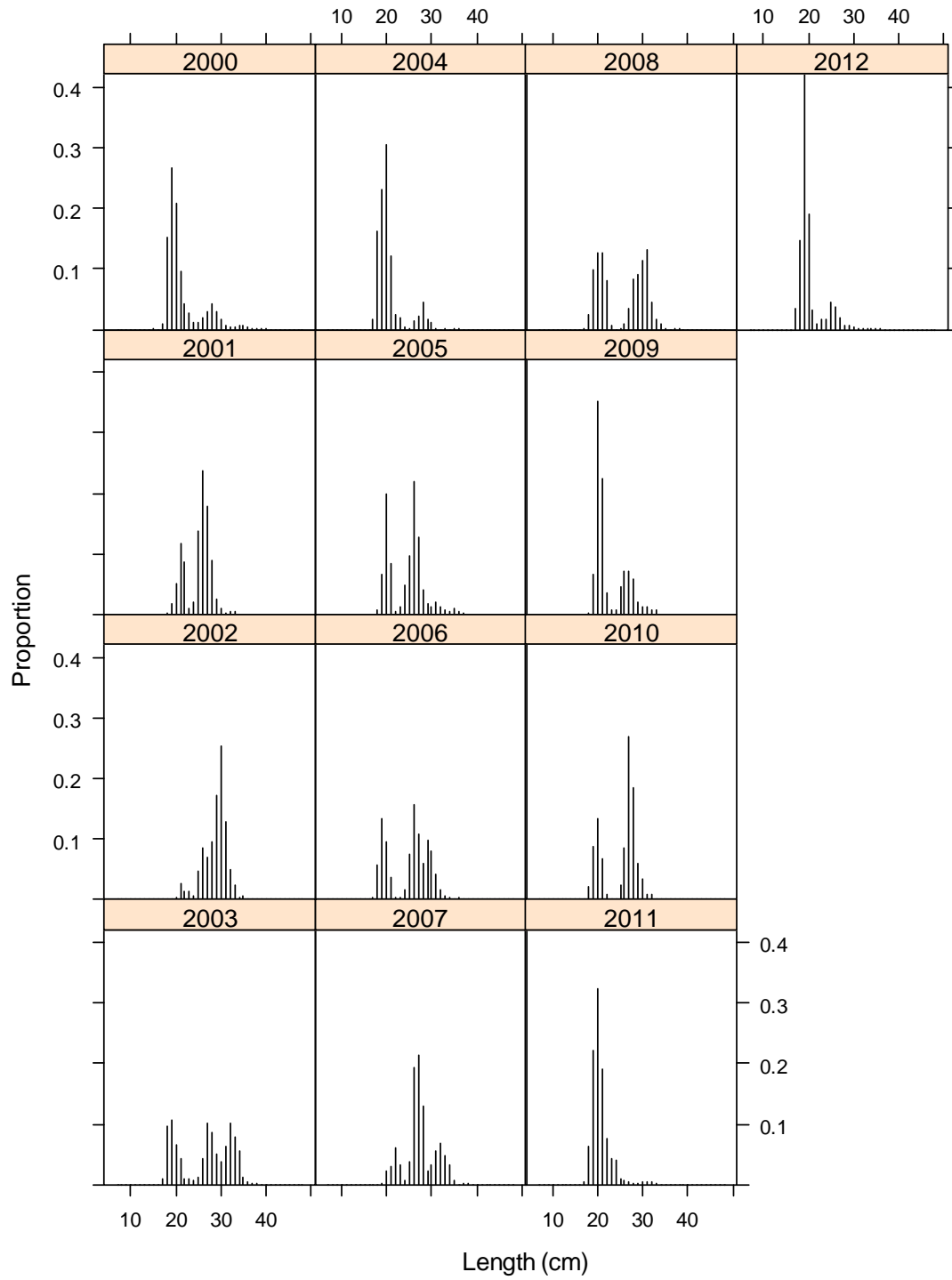


Figure 3: Annual mackerel length compositions (stratified mean numbers-at-length), averaged over nine-year time intervals, from the NEFSC spring bottom trawl survey for 1968-2012.

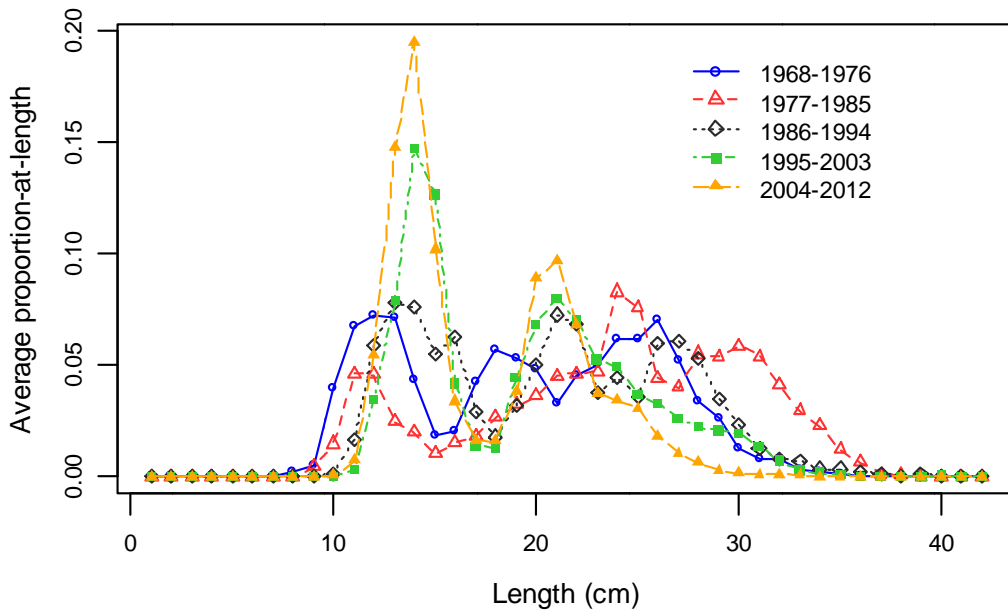


Figure 4: Atlantic mackerel total and spawning stock biomass (tons) in NAFO Subareas 3 and 4 from 1968 to 2011, estimated from a sequential population analysis of the Canadian contingent of mackerel (Reprinted from the 2012 Canadian assessment (DFO 2012, Figure 14).

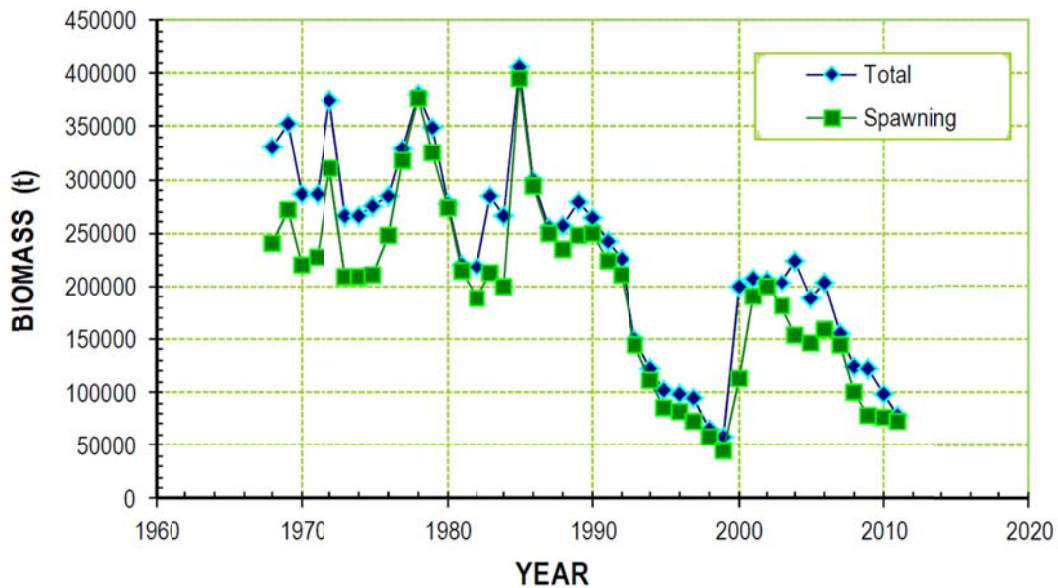


Figure 5: Atlantic mackerel fishing mortality in NAFO Subareas 3 and 4 from 1968 to 2011, estimated from a sequential population analysis of the Canadian contingent of mackerel (Reprinted from the 2012 Canadian assessment (DFO 2012, Figure 13).

