

S. Atlantic Halibut by Jon Brodziak

1.0 Background

The Atlantic halibut (*Hippoglossus hippoglossus*) is distributed from Labrador to southern New England in the northwest Atlantic (Bigelow and Schroeder 1953). The Atlantic halibut stock within Gulf of Maine and Georges Bank waters (NAFO Subarea 5) has been exploited since the 1830s. This resource is currently depleted and is not expected to rebuild in the near future (NEFMC 1998). This working paper updates fishery and survey information to evaluate stock status.

2.0 Fishery

Records of Atlantic halibut landings from the Gulf of Maine and Georges Bank begin in 1893 (Table S1). Substantial landings occurred prior to this, however, as the halibut fishery declined in the late 1800s (Hennemuth and Rockwell 1987). Landings have decreased since the 1890s as components of the resource have been sequentially depleted. Annual landings averaged 662 mt during 1893-1940 and declined to an average of 144 mt during 1941-1976. Since 1977, landings have averaged 95 mt·yr⁻¹. Reported landings in 1999 were 20 mt. Of these, 12 mt were landed by domestic fishermen (60%) with the remainder landed by Canadian fishermen (Division 5Zc).

3.0 Survey Indices

The Northeast Fisheries Science Center spring and autumn bottom trawl surveys provide measures of the relative abundance of Atlantic halibut within the Gulf of Maine and Georges Bank (Offshore survey strata 13-30 and 36-40, Table S2). Both indices have high inter-annual variability since relatively few halibut are captured during these surveys; in some years, no halibut are caught. The survey indices suggest that relative abundance increased during the 1970s to early 1980s and subsequently declined in the 1990s. It is unknown whether abundance trends in the Gulf of Maine and Georges Bank have been influenced by changes in the seasonal distribution and availability of Atlantic halibut, however.

4.0 Status Update

Based on updated spring and autumn survey data, Atlantic halibut biomass within the Gulf of Maine and Georges Bank remains very low. Swept-area biomass indices in spring 2000 and autumn 1999 were both less than 100 mt (Figure S1). Thus, even if survey catchability was as low as 25%, current stock biomass, as indexed by the 5-year moving average of swept-area biomass, would be below the biomass threshold of 2,700 mt (Figure S2). Although no estimates of fishing mortality are available, exploitation rate indices (annual landings/5-year moving average of survey index) suggest that exploitation rates have probably been stable since the 1970s, and may have declined during the 1990s (Figure S3). Thus, the Atlantic halibut stock in the Gulf of Maine and Georges Bank remains depleted and exploitation rates do not appear to have increased since the 1970s.

5.0 Harvest Control Rule

In the 1998 report on overfishing definitions and its Supplement (NEFMC 1998), the overfishing review panel recommended proxies for the stock biomass (B_{MSY}) and fishing mortality rate (F_{MSY}) that would produce the largest long-term potential yield. Based on yield-per-recruit and biomass-per-recruit calculations, the panel concluded that B_{MSY} was roughly 5,400 mt and that F_{MSY} was about 0.06 per year with an associated long-term potential yield of 300 mt per year. Accordingly, the panel recommended that the biomass threshold ($B_{THRESHOLD}$) be set to $\frac{1}{2}$ of B_{MSY} so that $B_{THRESHOLD}=2,700$ mt and that the target fishing mortality rate (F_{TARGET}) be set to 60% of F_{MSY} so that $F_{TARGET}=0.04$ per year. The panel also recommended that an appropriate harvest control rule would be to keep fishing mortality as close to zero as practicable until the Gulf of Maine and Georges Bank stock was rebuilt. To evaluate the harvest control rule, the review panel compared swept-area biomass estimates from the NEFSC spring and autumn surveys with the threshold. The panel concluded that the stock was depleted because, on average, the swept-area biomass index was far below $B_{THRESHOLD}$, given an implicit assumption that survey catchability was probably on the order of 25-50%.

6.0 Sources of Uncertainty

Fishery-dependent information on the size and age composition of Atlantic halibut landings is very limited. The magnitude of discards and unreported landings is uncertain. Fishery-dependent data needs to be collected to accurately quantify the impacts of harvests.

Life history information is limited for this species. In particular, research on growth is needed for age-structured population assessment.

Stock structure of Atlantic halibut within the Gulf of Maine and Georges Bank is uncertain. Wise and Jensen (1959) documented movements of tagged Atlantic halibut between Georges Bank and Browns Bank, but it is difficult to draw any definite conclusions about movement rates from their study.

The current harvest control rule, as proposed by the review panel, should be expressed in terms of relative biomass indices (weight in kg per tow) so that uncertainties about survey catchability do not affect the interpretation of biomass status.

The portion of the Atlantic halibut population within Gulf of Maine and Georges Bank waters is a transboundary stock. Conservation measures for both USA and Canadian fisheries may be needed to rebuild this stock.

7.0 References

- Bigelow, H.B, and Schroeder, W.C. 1953. Fishes of the Gulf of Maine. Fishery Bulletin of the Fish and Wildlife Service, No. 74, 577 pp.
- Hennemuth, R.C., and Rockwell, S. 1987. History of fisheries conservation and management. *In* Georges Bank. *Edited by* R. Backus, R. Price, and D. Bourne. MIT Press, Cambridge, MA. pp. 431-446.
- New England Fishery Management Council [NEFMC]. 1998. Evaluation of existing overfishing definitions and recommendations for new overfishing definitions to comply with the Sustainable Fisheries Act. NEFMC, 50 Water Street, Mill 2 Newburyport, MA 01950.
- Wise, J.P., and Jensen, A.C. 1959. Movement of tagged halibut off New England. *Trans. Amer. Fish. Soc.* 88:357-358.

Table S1. Reported landings of Atlantic halibut from the Gulf of Maine and Georges Bank, 1893-1999.

Year	USA	Canada	Other	Total	Year	USA	Canada	Other	Total
1893	634	0	0	634	1947	196	0	0	196
1894	843	0	0	843	1948	156	0	0	156
1895	4200	0	0	4200	1949	157	0	0	157
1896	4908	0	0	4908	1950	116	0	0	116
1897	733	0	0	733	1951	154	0	0	154
1898	564	0	0	564	1952	123	0	0	123
1899	407	0	0	407	1953	104	0	0	104
1900	311	0	0	311	1954	125	0	0	125
1901	287	0	0	287	1955	74	0	0	74
1902	367	0	0	367	1956	62	0	0	62
1903	502	0	0	502	1957	80	0	0	80
1904	332	0	0	332	1958	73	0	0	73
1905	580	0	0	580	1959	59	0	0	59
1906	542	0	0	542	1960	63	0	0	63
1907	447	0	0	447	1961	79	5	0	84
1908	891	0	0	891	1962	86	35	25	146
1909	193	0	0	193	1963	94	88	1	183
1910	329	0	0	329	1964	115	120	1	236
1911	389	0	0	389	1965	128	153	18	299
1912	460	0	0	460	1966	110	110	62	282
1913	402	0	0	402	1967	102	386	26	514
1914	329	0	0	329	1968	74	193	3	270
1915	336	0	0	336	1969	63	96	9	168
1916	478	0	0	478	1970	52	67	19	138
1917	293	0	0	293	1971	81	38	0	119
1918	375	0	0	375	1972	63	37	8	108
1919	496	0	0	496	1973	51	38	0	89
1920	896	0	0	896	1974	46	29	1	76
1921	689	0	0	689	1975	70	36	0	106
1922	694	0	0	694	1976	58	33	0	91
1923	508	0	0	508	1977	50	31	0	81
1924	616	0	0	616	1978	84	50	0	134
1925	843	0	0	125	1979	125	29	0	154
1926	944	0	0	944	1980	80	88	0	168
1927	831	0	0	831	1981	80	118	0	198
1928	781	0	0	781	1982	85	116	0	201
1929	570	0	0	570	1983	72	131	0	203
1930	716	0	0	716	1984	75	62	0	137
1931	511	0	0	511	1985	61	57	0	118
1932	443	0	0	443	1986	44	32	0	76
1933	279	0	0	279	1987	27	23	0	50
1934	192	0	0	192	1988	47	81	0	128
1935	292	0	0	292	1989	13	65	0	78

Table S1 (continued.)

1936	374	0	0	374	1990	16	58	0	74
1937	187	0	0	187	1991	30	58	0	88
1938	146	0	0	146	1992	22	47	0	69
1939	124	0	0	124	1993	15	50	0	65
1940	497	0	0	497	1994	22	24	0	46
1941	145	0	0	145	1995	11	8	0	19
1942	250	0	0	250	1996	13	12	0	25
1943	76	0	0	76	1997	14	14	0	28
1944	77	0	0	77	1998	8	9	0	17
1945	55	0	0	55	1999	12	8	0	20
1946	124	0	0	124					

Table S2. Stratified mean weight (kg) per tow of Atlantic Halibut from NEFSC spring¹ and autumn surveys (offshore strata 13-30, 36-40) and exploitation rate indices calculated as annual landings divided by the 5-year moving average of swept area biomass indices.

Year	Spring Survey Index	Autumn Survey Index	Spring Exploitation Index	Autumn Exploitation Index
1963		0.085		
1964		0.067		
1965		0.032		
1966		0.004		
1967		0.009		3.93
1968	0.129	0.000		3.63
1969	0.236	0.494		0.47
1970	0.105	0.000		0.41
1971	0.033	0.091		0.30
1972	0.005	0.018	0.32	0.27
1973	0.113	0.131	0.27	0.18
1974	0.112	0.014	0.31	0.45
1975	0.000	0.095	0.61	0.46
1976	0.644	0.378	0.16	0.22
1977	0.142	0.059	0.12	0.18
1978	0.163	0.294	0.19	0.24
1979	0.357	0.040	0.18	0.27
1980	0.563	0.010	0.14	0.32
1981	0.066	0.321	0.23	0.41
1982	0.082	0.115	0.25	0.39
1983	0.611	0.000	0.18	0.63
1984	0.022	0.124	0.15	0.36
1985	0.063	0.106	0.21	0.27
1986	0.000	0.313	0.15	0.17
1987	0.287	0.033	0.08	0.13
1988	0.023	0.004	0.49	0.33
1989	0.000	0.066	0.32	0.23
1990	0.064	0.060	0.30	0.23
1991	0.062	0.243	0.30	0.33
1992	0.037	0.201	0.56	0.18
1993	0.006	0.046	0.58	0.16
1994	0.017	0.000	0.37	0.13
1995	0.005	0.066	0.23	0.05
1996	0.013	0.053	0.48	0.10
1997	0.063	0.174	0.41	0.12
1998	0.017	0.103	0.22	0.06
1999	0.239	0.015	0.09	0.07
2000	0.000			

1. Spring surveys during 1973-1981 were conducted using a modified 'Yankee 41' trawl; in all other years spring surveys were conducted using a 'Yankee 36' trawl. No adjustment have been made to survey catches for these differences.

Figure S1. Trends in swept-area biomass indices (mt) of Atlantic halibut from NEFSC spring and autumn bottom trawl surveys.

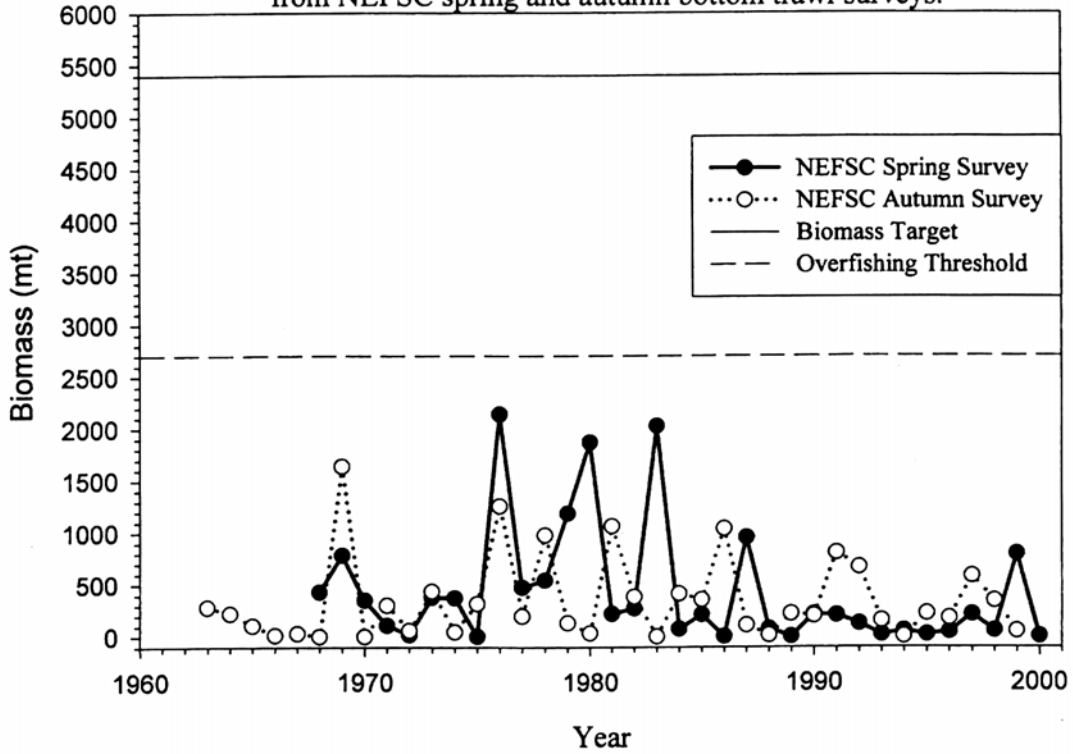


Figure S2. Trends in Atlantic halibut landings from the Gulf of Maine and Georges Bank in comparison to 5-year moving averages of spring and autumn survey indices, 1967-2000.

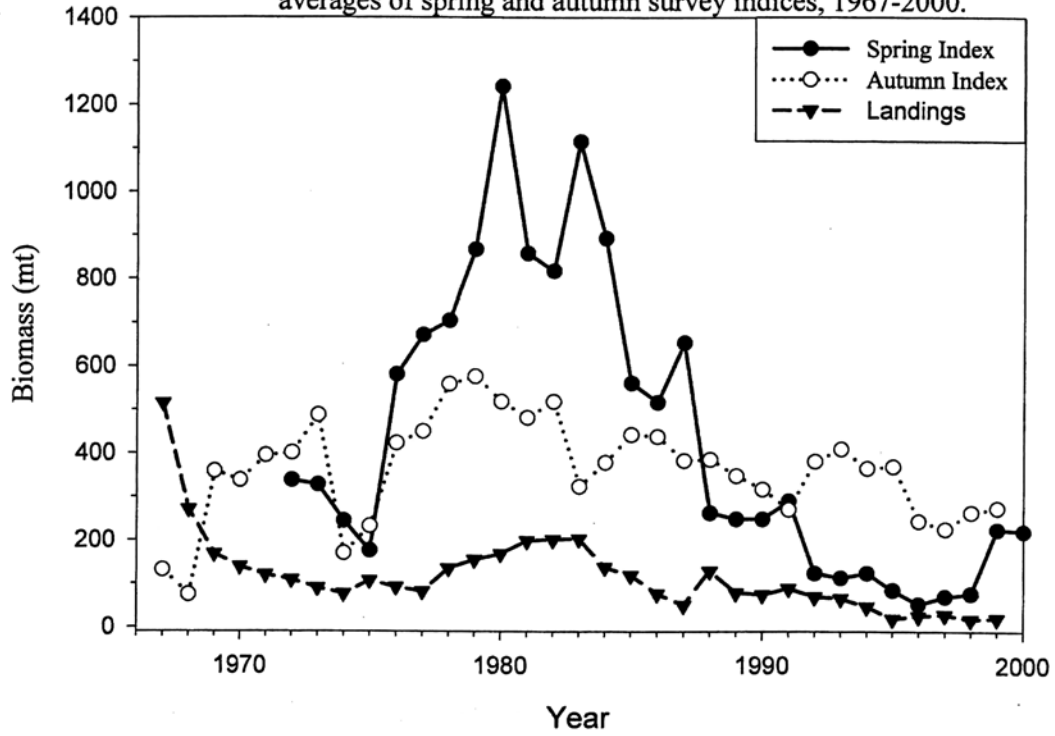


Figure S3. Trends in exploitation rate indices for Atlantic halibut from the Gulf of Maine and Georges Bank based on 5-year moving averages of NEFSC spring and autumn survey indices, 1967-1999

