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An Analysis of Sea Herring Fisheries of the Northwest Atlantic from Cape Hatteras to Southwest Nova Scotia

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INTRODUCTION

The fisheries for sea herring along the coast of the State of Maine and the Province of New Brunswick have been prosecuted throughout the 20th century (Figure 1). These fisheries primarily catch young herring (age 1-3) which are canned as sardines. Since the 1960's, fisheries for older herring (ages 3+) have developed in the Gulf of Maine (ICNAF SA 5Y), southwest Nova Scotia (SA 4WX), on Georges Bank (SA 5Ze), in Block Island Sound (SA 5Zw), and in offshore waters of the Mid-Atlantic area (SA 6).

Past analyses of herring fisheries have been limited by two factors. First, the interdependence between herring populations which are fished throughout the range is unknown. Second, research vessel survey data has not been demonstrated to be an adequate basis for estimating the strength of the recruiting year classes and/or the current fishing mortality rate as has been the practice for other fish stocks of the region (see Clark 1979). In this paper, the first of these limitations is eliminated by applying a holistic approach to the fisheries of the region. Furthermore, since precise estimation of the current condition of the resource is difficult given the current research vessel survey data base, the framework is provided for assessing the resource probabilistically.

ANALYSIS OF CATCH DATA

Catch at age data for all herring fisheries between southwest Nova Scotia and Cape Hatteras were pooled for the period 1965-1977. Virtual population analysis (VPA, see Ricker 1975 for description of the method) was applied to the pooled catch data. Arbitrary but realistic values of fishing mortality were assumed for the terminal year of exploitation of each year class. The mean weights at age used to calculate the biomass of the population in each year were 0.012, 0.042, 0.101, 0.172, 0.202, 0.235, 0.258, 0.291, 0.312, 0.333, and 0.345 kg for ages 1-11, respectively (Anthony 1977, unpublished). Based on the preliminary VPA described above, the geometric mean fishing mortality rate by age for the period 1965-1973 was calculated. Estimates of fishing mortality between 1974-1977 were not included in these averages, because they were assumed to be too sensitive to the arbitrarily selected values of fishing mortality used in the terminal year of the analysis (starting F's). In order to verify that estimates of fishing mortality prior to 1974 were relatively insensitive to the assumptions of starting F's, three additional sets of VPA were conducted using starting F's by age corresponding to the mean values for 1965-1973 (as indicated in the preliminary analysis above), starting F values equal to 50% of these, and starting F values equal to 150% of these. The resulting three sets of VPA are given in Tables 1-3.

The annual fishing mortality rates (1970-1977) for the 1968-1972 year classes for the 50% and 150% VPA's relative to the 100% VPA were calculated and are reported in Table 4. Note that by 1973, fishing mortality rates have converged to within about 20%. In fact, for the older year classes convergence is even much closer than this. Thus, the assumption of 1965-1973 as a base

period that is relatively insensitive to the starting F's in the analysis appears valid.

The mean F's at age for 1965-1973 were recalculated based on Table 2. They are 0.038, 0.351, 0.206, 0.260, 0.365, 0.403, and 0.580 for ages 1-7+. Note that fishing mortality rates for ages 9-11 were not included in this analyses because they too were deemed to be overly sensitive to the assumed values of starting F. Then, the relative F's (F at age i in year j divided by the mean F for age i) were calculated for ages 1-8 and years 1965-1973. The geometric means of the relative F's for ages 3-8 were calculated for each year from 1965-1973. These values are given in Table 5 along with the relative F's at age 1 and 2 for each year.

Based on the values given in Table 5, the cumulative frequency distributions of relative F's for ages 1, 2, and 3-8 were plotted in Figures 2-4. Based on the short history of information available, the probability of a relative F exceeding the value corresponding to a cumulative frequency of α is equal to $1-\alpha$. Thus Figures 2-4 can be used to judge the risk associated with various assumptions of starting F used in virtual population analysis when assessing the current status of the fishery. The application of Figures 2-4 will be demonstrated below.

PROBABILISTIC ASSESSMENT OF CURRENT STATUS OF THE FISHERY

In order to assess the current status of the fishery, the current fishing mortality rates must be either estimated or assumed. In the case of the sea herring fishery from southwest Nova Scotia to Cape Hatteras, a reliable method for estimating current fishing mortality rates has not yet been demonstrated. Therefore, these values must be assumed.

Figures 2-4 may be used to evaluate the relative risks associated with a particular set of assumed current fishing mortality rates. For example, if an optimistic evaluation of the current status of the fishery is desired, then values of relative F for ages 1, 2, and 3+ that correspond to a low cumulative frequency should be considered. These values of relative F would then be multiplied by the mean values of F for each age for the base period of 1965-1973. Then VPA using these estimates of fishing mortality as starting values would be applied. The procedure would be the same for a more conservative analysis, except that relative F values would be selected which correspond to a higher cumulative frequency. As a rough approximation, there would be about an 80% probability of overestimating the current size of the resource based on relative F's corresponding to a 20% cumulative frequency, for example.

In this document, six different VPA's ranging from optimistic to conservative are presented. The most conservative VPA corresponds to a cumulative frequency of 90%. The most optimistic VPA corresponds to a cumulative frequency of 20%. VPA's corresponding to a cumulative frequency of 50% and 80% are also presented. The fifth VPA corresponds to a cumulative frequency of 90% for fish of age 1 and 2 and a cumulative frequency of 80% for older fish (thus more conservative for recruiting year classes than for the spawning stock). The sixth corresponds to a cumulative frequency of 90% and 50% for age 1 and 2 and age 3+, respectively. The results of these six VPA's* are given in Tables 6-11.

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*These VPA's will be referred to as the 20%, 50%, 80%, 90/80%, and 90% VPA depending on the particular cumulative frequency on which they were based.

Each of the VPA's were started in 1977 (the most recent year for which complete catch data was available). Thus, the starting F's corresponding to the values of cumulative frequency noted above, were applied in 1977. Estimates of the size of each year class in the beginning of 1978 were obtained by projecting ahead from 1977 by applying the assumed of fishing mortality rate in that year and a natural mortality rate of 0.2 (using Baranov's catch equation, see Ricker 1975).

In order to project ahead to the beginning of 1979, estimates of the total catch at age during 1978 were necessary. USA catch statistics were used as reported. The 1978 catch in the New Brunswick juvenile fishery was assumed to be 25,000 tons (about the same as in 1977). The age composition of this catch was assumed to correspond to the 1978 age composition of the catch in the eastern section of Maine (east of Mt. Desert Island). The southwest Nova Scotia adult fishery was assumed to catch 95,000 tons in 1978. The age composition of this catch was estimated by applying partial recruitment values calculated for the southwest Nova Scotia adult fishery for 1965-1973 to the age composition of the population at the beginning of 1978 as indicated by the VPA's reported in Tables 6-11. Thus, estimates of 1978 age composition for the catch from southwest Nova Scotia are dependent on a particular VPA under consideration. Thus, with estimates of the 1978 catch at age determined as described above, the size of each year class was projected to the beginning of 1979 by applying the catch equation. These results are also given in Tables 6-10.

PROJECTIONS FOR 1979

For each of the VPA's, the size of the spawning stock (age 4+) at the beginning of 1980 and the catch during 1979 was calculated for various values of fishing mortality in 1979. The pattern of partial recruitment in 1979 was assumed to be as indicated by earlier VPA's for the period 1965-1973. The results are summarized in Figures 5-10 and Tables 11-16.

DISCUSSION

The results reported in Tables 6-16 and Figures 5-10 exemplify the degree of uncertainty in the current condition of the resource. Thus, the determination of optimum yield must not only reflect biological, economic, and social objectives, but must also reflect the degree of optimism or conservatism of the decision makers.

According to the most optimistic analysis considered (20% VPA), the spawning stock size (age 4+) at the beginning of 1979 is 1.1 million metric tons. This is similar to the average spawning stock size during the period 1965-1973 which was 1.2 million metric tons. On the other hand, the most conservative analysis considered (90% assessment) indicates a spawning stock size in the beginning of 1979 of 196,000 metric tons. This is smaller than the size of the spawning population in 1973 just prior to recruitment of the strong 1970 year class. Given the failure of the Georges Bank autumn spawning grounds fishery in 1977, and the relative low catches of herring by research vessels in offshore areas in recent years, and the low abundance of larval herring in offshore waters in recent years, the conservative analysis is probably more realistic than the optimistic analysis.

Surplus production in 1979 is heavily dependent on the strength of the 1976 year class. In 1977, 698 million fish of the 1976 year class were caught. The catches at age 1 for the 1966 and 1969 year classes were 765 and 624 million fish. The catch at age 1 for all other year classes has not exceeded 50% of the 1977 catch. Thus, since the current assessment is based on catch at age data for 1977, even the most conservative analysis considered in this paper indicates that the 1976 year class is large in size at age 3. For the 90% VPA, the 1976 year class is estimated to be 4.7 million fish at age 3 in 1979, or about 65% of the size of the 1970 year class. For slightly less conservative analysis (80% VPA) the size of the 1976 year class at age 3 is estimated to be 6.9 million fish, or about the same size as the 1970 year class. Thus, unless the fishing mortality rate at age 1 in 1977 was extremely high (as it was in 1970), the 1976 year class is large (comparable to the 1963, 1966, and 1970 year classes) and will provide a greatly increased surplus yield in 1979 compared to recent years. The most optimistic analysis considered indicates that the 1976 year class at age 3 is four times larger than the 1970 year class, the largest year class previously observed.

The effect of fishing in 1979 is illustrated by Figures 5-10. For the VPA's considered in this document, estimates of surplus production range from about 500,000 tons to about 3.5 million tons. In each case, unrealistically high fishing mortality rates would be required in 1979 in order to catch the surplus production. This occurs because of the contrast between the large size of the recruiting 1976 year class and the small size of the spawning stock at the beginning of 1979. This implies that in order to prevent spawning stock size from increasing during 1979, almost all of the

1976 year class must be caught during that year, obviously requiring an exceedingly high fishing mortality rate.

Once a particular VPA has been selected (based on the level of risk which is acceptable) and the desired catch, fishing mortality rate and percent increase or decrease in spawning stock size has been determined, it is then necessary to allocate the total allowable catch between regions. In theory, the allocation between regions should be based on the size of the population within each region. Unfortunately, this is unknown. Therefore, in Tables 17-20, information on the catch by area, year, and month is provided. It may be adequate to allocate between regions based on historical distribution of catch between regions during periods when all regions were heavily exploited (pre 1977). Of course some modification of the historical pattern of exploitation between regions is possible, but it is unrealistic and dangerous to establish regulations which encourage a large catch from a single region based on an assessment of the status of the resource of the whole region unless sea herring populations are homogenous throughout (totally mixed).

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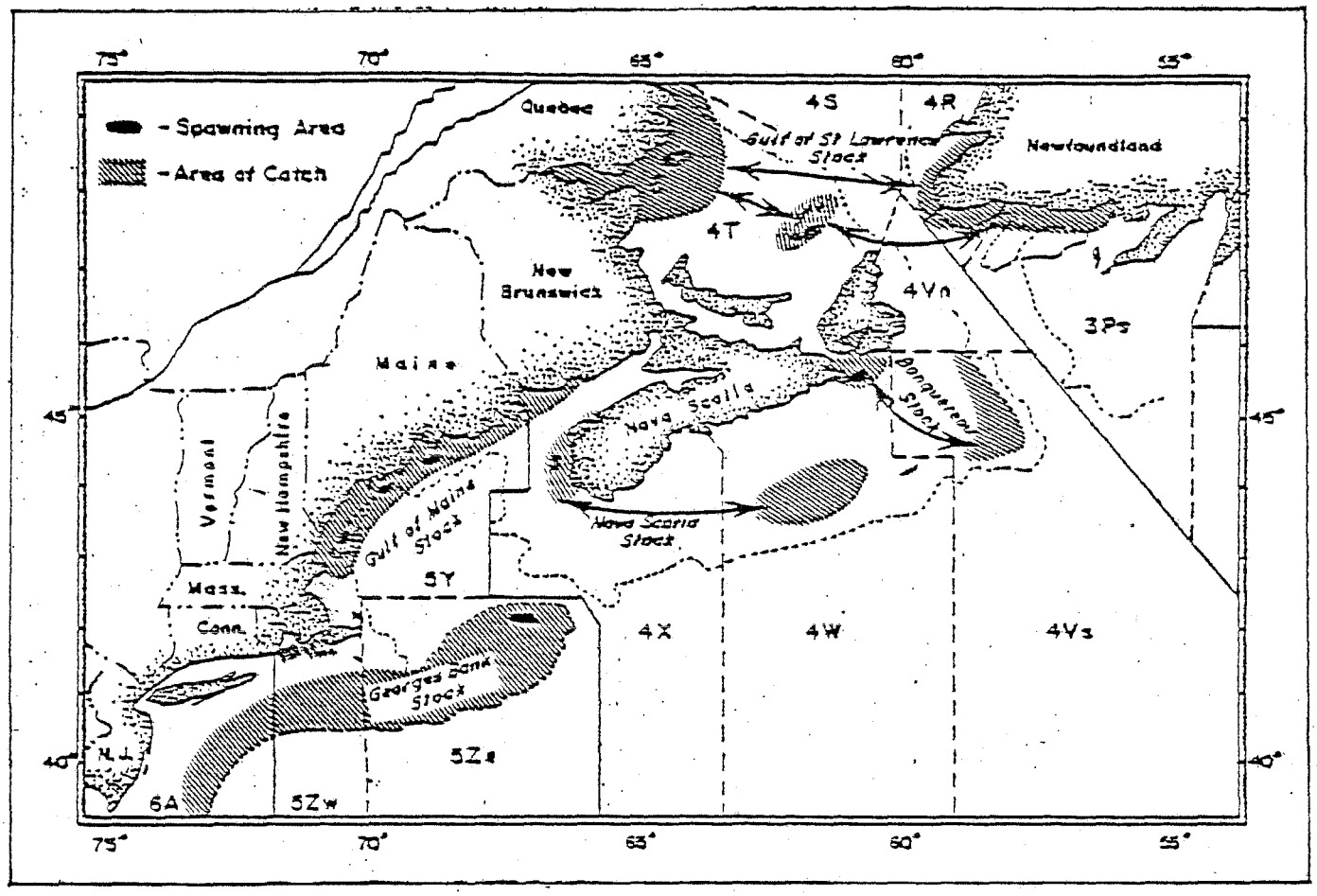

Figure 1. Location of adult herring stocks in the Northwest Atlantic.

Table 1. VPA with starting F's equal to 50% of the 1965-1973 average.

C VTHFO

YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	AGE 1+	
	STOCK SIZE (MILLIONS)											NUMBERS	WEIGHT
1965	6593.2	9139.9	3074.6	3972.8	2622.5	427.0	110.9	49.0	1.6	.0	.0	25991.3	2130.3
1966	6169.4	5147.3	5068.7	2371.2	2963.8	1999.9	316.8	77.7	31.2	1.2	.0	24147.3	2393.2
1967	11433.1	4998.9	3099.2	3197.5	1801.2	1942.9	1342.0	188.0	44.3	22.2	.8	27970.0	2448.8
1968	3816.9	9671.5	3105.1	2241.2	2198.0	1245.0	1203.3	698.5	104.9	24.1	8.6	23317.1	2403.1
1969	3710.9	2979.6	3692.3	2109.5	1597.9	1184.4	714.6	490.0	226.9	49.7	6.7	16762.6	1923.2
1970	3499.7	2889.5	1689.0	2148.3	1399.0	896.1	592.7	330.8	190.3	72.1	15.0	13722.5	1534.4
1971	15573.1	2304.1	1442.2	1145.6	1049.7	694.0	485.8	274.4	164.6	84.8	24.8	23243.1	1294.8
1972	2703.7	12515.7	1336.8	652.8	550.2	462.8	307.3	194.9	119.3	79.2	37.0	18959.6	1237.6
1973	3537.0	2199.2	8486.3	965.5	253.7	148.5	120.7	84.8	57.4	42.7	31.4	15927.2	1342.9
1974	5931.7	2859.8	1420.5	5133.1	430.0	108.8	56.7	48.4	36.2	24.6	21.4	16121.2	1386.3
1975	2799.8	4658.1	1843.6	988.7	3001.5	234.3	59.0	30.5	29.0	16.6	14.2	13865.2	1298.7
1976	5346.4	2237.9	3179.3	1246.6	626.1	1587.6	108.7	24.3	14.0	14.9	10.3	14396.3	1241.3
1977	38903.0	4310.5	1331.0	2222.6	860.9	402.0	913.3	62.1	12.2	5.4	10.0	49038.1	1695.8
	CATCH AT AGE (MILLIONS)											TOTAL	
1965	278.9	2690.1	162.1	320.3	163.5	36.3	14.5	9.9	.1	.0	.0	3675.6	
1966	168.0	1240.9	1059.1	155.4	537.4	328.0	79.5	21.5	3.7	.2	.0	3593.6	
1967	764.8	1007.0	328.7	466.1	255.0	430.9	446.4	54.6	13.6	10.7	.3	3778.1	
1968	161.7	3812.9	480.5	263.1	685.7	339.4	554.5	387.7	40.4	14.7	3.1	6743.7	
1969	165.1	835.9	973.9	364.5	459.1	420.8	284.1	236.3	127.8	28.9	2.4	3898.8	
1970	623.6	1030.8	263.5	791.8	503.9	276.3	235.6	118.6	79.4	38.5	5.4	3967.4	
1971	266.7	612.0	590.2	433.1	443.6	291.7	227.2	117.9	62.1	36.3	8.9	3089.7	
1972	16.0	1955.6	143.1	314.7	340.3	291.2	188.0	115.0	61.7	37.4	13.3	3476.3	
1973	40.4	422.4	2019.4	403.1	110.6	72.7	56.5	37.2	25.1	15.1	11.3	3213.8	
1974	46.7	553.3	193.5	1337.2	131.3	33.6	17.8	11.8	14.5	6.6	7.7	2354.0	
1975	51.3	886.9	291.8	203.9	969.9	92.9	26.8	12.2	9.8	3.7	5.1	2554.3	
1976	76.6	557.9	422.2	177.4	123.0	430.4	29.9	8.6	6.8	2.5	3.7	1839.0	
1977	698.5	645.5	115.0	263.8	128.9	75.1	203.1	15.5	3.3	1.6	3.6	2153.9	
	FISHING MORTALITY											MEAN	
1965	.048	.300	.060	.093	.071	.098	.155	.251	.070	.000	.000	.180	
1966	.030	.307	.261	.075	.222	.199	.322	.362	.140	.195	.000	.185	
1967	.077	.256	.124	.175	.169	.279	.453	.383	.410	.746	.500	.166	
1968	.048	.654	.187	.138	.418	.355	.698	.924	.547	1.083	.500	.415	
1969	.050	.368	.342	.211	.378	.492	.570	.746	.946	.997	.500	.311	
1970	.218	.495	.188	.516	.501	.412	.570	.498	.608	.869	.500	.302	
1971	.019	.344	.693	.533	.619	.615	.713	.633	.532	.630	.500	.185	
1972	.007	.189	.125	.745	1.110	1.144	1.088	1.022	.828	.724	.500	.257	
1973	.013	.237	.303	.609	.646	.762	.715	.652	.649	.490	.500	.265	
1974	.009	.239	.162	.337	.407	.413	.421	.312	.577	.349	.500	.186	
1975	.020	.224	.191	.257	.437	.568	.685	.575	.462	.280	.500	.237	
1976	.016	.320	.158	.170	.243	.353	.359	.489	.750	.203	.500	.160	
1977	.020	.180	.100	.140	.180	.230	.280	.320	.350	.390	.500	.052	

Table 2. VPA with starting F's equal to 1965-1973 average.

C YTHFO

YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	AGE 1+
					STOCK SIZE (MILLIONS)							NUMBERS WEIGHT
1965	6551.1	9087.7	3013.1	3913.4	2589.1	410.8	105.0	42.9	.6	.0	.0	25713.7 2097.0
1966	6137.6	5112.9	5026.2	2320.8	2914.9	1972.6	303.6	72.9	26.2	.4	.0	23888.2 2355.4
1967	11404.4	4873.6	3071.0	3162.6	1760.1	1903.0	1319.8	177.2	40.4	18.1	.2	27730.3 2409.2
1968	3803.0	8647.2	3084.4	2218.0	2169.7	1211.4	1170.7	680.4	96.1	20.9	5.3	23107.0 2363.6
1969	3684.5	2968.0	3672.5	2092.6	1578.9	1161.3	687.1	463.5	212.3	42.5	4.1	16567.4 1885.6
1970	3392.3	2868.0	1679.5	2132.0	1385.2	880.7	573.9	308.4	168.9	60.3	9.3	13458.6 1498.1
1971	14276.2	2216.2	1424.6	1137.8	1036.5	682.8	473.2	259.1	146.4	67.4	15.3	21735.4 1244.7
1972	2223.5	11447.5	1264.9	638.5	543.8	452.0	298.2	184.7	106.8	64.3	22.8	17247.2 1154.4
1973	2660.7	1807.9	7612.1	906.7	242.1	143.4	112.1	77.5	49.2	32.6	19.4	13663.7 1199.6
1974	4160.3	2141.0	1100.5	4418.6	382.2	99.4	52.6	41.4	30.2	17.9	13.2	12457.2 1157.1
1975	1842.2	3366.2	1255.9	726.9	2417.8	195.2	51.3	27.1	23.3	11.8	8.8	9926.4 985.0
1976	3012.7	1462.2	1959.4	765.9	412.0	1111.7	76.9	18.1	11.3	10.3	6.4	8846.9 805.9
1977	19641.7	2397.7	697.6	1224.6	467.6	227.0	524.9	36.2	7.1	3.2	6.2	25233.9 916.7
					CATCH AT AGE (MILLIONS)							TOTAL
1965	278.9	2690.1	162.0	320.3	163.5	36.3	14.5	9.9	.1	.0	.0	3675.6
1966	168.0	1240.8	1059.1	155.4	537.4	328.0	79.5	21.5	3.7	.2	.0	3593.6
1967	764.8	1007.0	328.7	466.1	255.0	430.9	446.4	54.6	13.6	10.7	.1	3777.9
1968	161.7	3812.9	480.5	263.1	685.7	339.4	554.5	387.7	40.4	14.7	3.1	6743.7
1969	165.1	835.9	973.9	364.5	459.0	420.8	284.1	236.3	127.8	28.9	2.4	3898.7
1970	623.6	1030.8	263.5	791.8	503.9	276.3	235.6	118.6	79.4	38.5	5.4	3967.4
1971	266.7	612.0	590.2	433.1	443.6	291.7	227.2	117.9	62.1	36.3	8.9	3089.7
1972	16.0	1955.6	143.1	314.7	340.3	291.2	188.0	115.0	61.7	37.4	13.3	3476.3
1973	40.4	422.4	2019.4	403.1	110.6	72.7	56.5	37.2	25.1	15.1	11.3	3213.8
1974	46.7	553.3	193.5	1337.2	131.3	33.6	17.8	11.8	14.5	6.6	7.7	2354.0
1975	51.3	886.9	291.8	203.9	969.9	92.9	26.8	12.2	9.8	3.7	5.1	2554.3
1976	76.6	557.9	422.2	177.4	123.0	430.4	29.9	8.6	6.8	2.5	3.7	1839.0
1977	698.5	645.5	115.0	263.8	128.9	75.1	203.1	15.5	3.3	1.6	3.6	2153.9
					FISHING MORTALITY							MEAN
1965	.048	.392	.061	.094	.072	.102	.165	.293	.191	.000	.000	.182
1966	.031	.310	.263	.077	.226	.202	.339	.390	.169	.713	.000	.187
1967	.077	.257	.125	.177	.174	.286	.463	.412	.460	1.024	1.000	.168
1968	.048	.656	.188	.140	.425	.367	.726	.965	.615	1.423	1.000	.420
1969	.051	.369	.344	.213	.384	.505	.601	.810	1.058	1.323	1.000	.317
1970	.226	.500	.189	.521	.507	.421	.595	.546	.719	1.173	1.000	.402
1971	.021	.361	.603	.538	.630	.628	.741	.686	.622	.882	1.000	.200
1972	.008	.208	.133	.770	1.133	1.195	1.148	1.123	.986	.998	1.000	.287
1973	.017	.296	.344	.664	.690	.803	.796	.741	.810	.703	1.000	.316
1974	.012	.333	.215	.403	.472	.462	.463	.375	.740	.516	1.000	.248
1976	.031	.341	.295	.368	.577	.731	.841	.675	.616	.420	1.000	.350
1978	.028	.540	.270	.293	.396	.650	.663	.729	1.057	.310	1.000	.281
1977	.040	.350	.200	.270	.360	.450	.550	.630	.700	.780	1.000	.107

Table 3. VPA with starting F's equal to 150% of 1965-1973 average.

C VTHFO

YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	AGE 1+	
	STOCK SIZE (MILLIONS)											NUMBERS	WEIGHT
1965	6538.3	9071.5	2994.0	3894.5	2579.1	405.7	103.2	41.0	1.0	.0	.0	25628.3	2086.9
1966	6129.9	5102.4	5013.0	2305.1	2899.7	1964.1	299.5	71.4	24.6	.7	.0	23810.4	2343.0
1967	11394.4	4865.7	3062.5	3151.9	1747.1	1090.6	1312.8	173.8	39.2	16.8	.4	27655.1	2397.0
1968	3793.3	6639.4	3078.0	2211.1	2160.8	1200.8	1160.4	674.7	93.3	19.9	4.3	23041.1	2351.2
1969	3676.0	2964.3	3666.2	2087.4	1673.1	1154.1	678.4	455.2	207.7	40.3	3.3	16506.1	1873.8
1970	3355.7	2560.9	1676.5	2126.9	1381.0	875.9	568.0	301.4	162.1	56.7	7.5	13372.5	1486.7
1971	13922.9	2186.3	1418.8	1135.3	1032.2	679.3	469.3	254.3	140.6	61.9	12.3	21213.2	1228.2
1972	2058.9	11879.6	1240.5	633.8	541.8	448.6	295.4	181.5	102.9	59.6	18.4	16660.9	1126.6
1973	2369.9	1671.4	7311.1	886.7	238.3	141.8	109.3	75.2	46.7	29.5	15.7	12894.4	1150.9
1974	5494.7	1903.2	988.9	4172.7	365.9	96.3	51.3	39.2	28.4	15.8	10.7	11167.1	1078.4
1975	1526.1	2819.4	1061.6	635.6	2217.0	181.9	48.7	26.0	21.5	10.3	7.1	8555.2	876.6
1976	2180.2	1203.4	1512.7	607.2	337.5	948.3	66.2	16.1	10.4	8.8	5.1	6895.9	654.7
1977	13220.5	1716.1	487.1	859.5	337.9	166.2	392.0	27.5	5.5	2.5	5.0	17219.8	648.4
	CATCH AT AGE (MILLIONS)											TOTAL	
1965	279.8	2690.1	162.1	320.3	163.5	36.3	14.5	9.9	.1	.0	.0	3675.6	
1966	163.0	1240.8	1059.1	155.4	537.4	328.0	79.5	21.5	3.7	.2	.0	3593.6	
1967	764.8	1007.0	328.7	466.1	255.0	430.9	446.4	54.6	13.6	10.7	.3	3778.1	
1968	161.7	3812.9	480.5	263.1	685.7	339.4	554.5	387.7	40.4	14.7	3.1	6743.7	
1969	165.1	835.9	973.9	364.5	459.1	420.8	284.1	236.3	127.8	28.9	2.4	3898.8	
1970	623.6	1030.8	263.5	791.8	503.9	276.3	235.6	118.6	79.4	38.5	5.4	3967.4	
1971	266.7	612.0	590.2	433.1	443.6	291.7	227.2	117.9	62.1	36.3	8.9	3089.7	
1972	16.0	1955.6	143.1	314.7	340.3	291.2	188.0	115.0	61.7	37.4	13.3	3476.3	
1973	40.4	422.4	2019.4	403.1	110.6	72.7	56.5	37.2	25.1	15.1	11.3	3213.8	
1974	46.7	553.3	193.5	1337.2	131.3	33.6	17.8	11.8	14.5	6.6	7.7	2354.0	
1975	51.3	886.9	291.8	203.9	969.9	92.9	26.8	12.2	9.8	3.7	6.1	2554.3	
1976	76.6	557.9	422.2	177.4	123.8	430.4	29.9	8.6	6.8	2.5	3.7	1839.0	
1977	698.5	645.5	115.0	263.8	128.9	75.1	203.1	15.5	3.3	1.6	3.6	2153.9	
	FISHING MORTALITY											MEAN	
1965	.048	.393	.062	.095	.072	.104	.168	.308	.117	.000	.000	.183	
1966	.031	.311	.264	.077	.228	.203	.344	.400	.181	.359	.000	.188	
1967	.077	.258	.126	.178	.175	.288	.466	.422	.478	1.165	1.500	.168	
1968	.048	.657	.188	.140	.427	.371	.736	.978	.640	1.587	1.500	.422	
1969	.051	.378	.344	.213	.386	.509	.611	.832	1.099	1.483	1.500	.319	
1970	.228	.501	.190	.523	.510	.424	.604	.562	.763	1.324	1.500	.406	
1971	.022	.367	.606	.540	.633	.633	.750	.704	.658	1.011	1.500	.206	
1972	.009	.216	.136	.778	1.141	1.212	1.168	1.159	1.050	1.137	1.500	.300	
1973	.019	.325	.361	.685	.706	.817	.827	.774	.880	.816	1.500	.338	
1974	.015	.384	.242	.432	.499	.481	.478	.401	.812	.607	1.500	.282	
1975	.038	.423	.359	.433	.649	.812	.910	.716	.680	.498	1.500	.419	
1976	.046	.704	.365	.386	.509	.683	.679	.873	1.223	.372	1.500	.380	
1977	.060	.530	.300	.410	.540	.680	.830	.050	1.050	1.170	1.500	.166	

Table 4. F's from VPA tables 1 and 3 relative to F's from VPA Table 2 for 1970-1977 and for the 1968-1972 year-classes.

Year	Year-class									
	1968		1969		1970		1971		1972	
	Table 3	Table 1	Table 3	Table 1	Table 3	Table 1	Table 3	Table 1	Table 3	Table 1
1977	1.5	.5	1.5	.50	1.5	.5	1.5	.5	1.5	.5
1976	1.19	.67	1.23	.65	1.24	.64	1.29	.61	1.32	.58
1975	1.08	.81	1.11	.78	1.13	.76	1.18	.70	1.22	.65
1974	1.04	.89	1.05	.86	1.07	.84	1.13	.75	1.15	.72
1973	1.02	.94	1.03	.92	1.05	.88	1.09	.80		
1972	1.01	.97	1.02	.94	1.04	.91				
1971	1.01	.98	1.02	.95						
1970	1.00	.99								

Table 5. Relative F's for age 1, age 2 and age 3+

Year	Age 1	Age 2	Age 3+
1965	1.26	1.12	1.19
1966	0.82	0.88	0.85
1967	2.03	0.73	1.22
1968	1.26	1.87	1.54
1969	1.34	1.05	1.19
1970	5.95	1.42	2.91
1971	0.55	1.03	0.75
1972	0.21	0.59	0.35
1973	0.45	0.84	0.61

Table 6. VPA based on 20% cumulative frequency.

IC VTME

YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	AGE 4+
	STOCK SIZE (MILLIONS)											NUMBERS WEIGHT
1965	6672.4	9236.7	3189.6	4084.6	2684.5	457.2	121.9	60.4	2.5	.0	.0	7411.1 1402.1
1966	8225.7	5212.0	5147.9	2465.5	3055.4	2050.6	341.6	86.7	40.6	2.0	.0	8042.2 1649.8
1967	11489.6	4946.6	3152.0	3262.2	1878.5	2017.7	1383.5	208.2	51.7	29.9	1.4	8833.1 1858.8
1968	3831.8	8717.9	3143.4	2284.3	2261.0	1308.3	1264.5	732.4	121.4	30.1	14.9	8006.8 1747.4
1969	3729.7	2991.7	3730.0	2140.9	1633.2	1227.8	766.2	539.7	254.3	63.2	11.5	6636.8 1445.8
1970	3549.9	2904.8	1698.9	2179.1	1424.8	925.0	628.0	372.9	230.7	94.2	25.9	5880.6 1262.8
1971	15778.1	2345.2	1454.6	1153.7	1074.8	715.0	509.4	303.2	198.9	117.7	42.7	4115.4 919.2
1972	2851.3	12680.3	1370.3	663.0	556.7	483.2	324.4	214.0	142.7	107.2	63.8	2555.1 588.3
1973	3745.5	2322.7	8620.6	992.9	261.9	153.8	137.1	98.5	72.8	61.7	54.2	1833.0 385.8
1974	6613.9	3032.5	1521.6	5242.9	452.3	115.5	61.0	61.7	47.3	37.1	36.9	6054.9 1093.9
1975	2987.7	5373.3	1984.9	1071.4	3091.3	252.5	64.4	34.0	39.9	25.8	24.5	4603.7 924.0
1976	4281.6	2400.2	3600.9	1362.4	693.7	1660.9	123.5	28.8	16.9	23.8	17.8	3927.8 824.3
1977	55658.9	3437.8	1463.6	2567.6	955.6	457.3	973.2	74.3	15.8	7.7	17.3	5068.8 1028.3
1978		44958.5	2233.8	1094.6	1864.4	666.3	306.8	614.1	46.9	10.0	4.9	4607.9 998.9
	CATCH AT AGE (MILLIONS)											TOTAL
1965	278.8	2690.1	162.1	320.3	163.5	36.3	14.5	9.9	.1	.0	.0	544.6
1966	168.0	1240.8	1069.1	155.4	537.4	328.0	79.5	21.5	3.7	.2	.0	1125.7
1967	764.8	1007.0	328.7	466.1	256.0	430.9	446.4	54.6	13.6	10.7	.3	1677.6
1968	161.7	3812.9	480.5	263.1	685.7	339.4	554.5	387.7	40.4	14.7	3.1	2288.6
1969	165.1	835.9	973.9	364.6	459.1	420.8	284.1	236.3	127.8	28.9	2.4	1923.9
1970	623.6	1030.8	263.6	791.8	503.9	276.3	235.6	118.6	79.4	38.5	5.4	2049.5
1971	266.7	612.0	590.2	433.1	443.6	291.7	227.2	117.9	62.1	36.3	8.9	1620.8
1972	16.0	1955.6	143.1	314.7	340.3	291.2	188.0	115.0	61.7	37.4	13.3	1361.6
1973	40.4	422.4	2019.4	403.1	110.6	72.7	56.5	37.2	25.1	15.1	11.3	731.6
1974	46.7	553.3	193.5	1337.2	131.3	33.6	17.8	11.8	14.5	6.6	7.7	1560.5
1975	51.3	886.9	291.8	203.9	969.9	92.9	26.8	12.2	9.8	3.7	5.1	1324.3
1976	76.6	557.9	422.2	177.4	123.0	430.4	29.9	8.6	6.8	2.5	3.7	782.3
1977	698.5	645.5	115.0	263.8	128.9	76.1	203.1	15.5	3.3	1.6	3.6	694.9
1978	136.0	1638.0	343.0	69.0	141.0	42.0	26.0	68.0	5.0	2.0	.2	353.2
	FISHING MORTALITY											MEAN
1965	.047	.385	.058	.090	.069	.092	.140	.199	.045	.000	.000	.085
1966	.030	.383	.256	.072	.215	.193	.295	.318	.166	.118	.000	.170
1967	.076	.253	.122	.171	.162	.267	.436	.339	.341	.497	.260	.239
1968	.048	.649	.184	.136	.406	.335	.651	.868	.463	.760	.260	.399
1969	.050	.366	.338	.207	.369	.470	.520	.650	.793	.691	.260	.396
1970	.215	.492	.187	.587	.496	.397	.528	.428	.473	.591	.260	.482
1971	.010	.337	.586	.520	.599	.590	.667	.564	.419	.412	.260	.565
1972	.006	.186	.128	.720	1.086	1.060	.992	.872	.639	.481	.260	.888
1973	.012	.223	.297	.606	.818	.724	.598	.533	.474	.313	.260	.577
1974	.008	.224	.151	.328	.383	.384	.386	.238	.400	.217	.260	.333
1975	.010	.200	.176	.235	.421	.515	.606	.499	.314	.172	.260	.383
1976	.020	.295	.138	.155	.217	.335	.300	.397	.604	.123	.260	.250
1977	.014	.231	.091	.120	.161	.199	.260	.260	.260	.257	.260	.165
1978	.078	.041	.185	.072	.087	.072	.098	.130	.125	.248	.048	.088

Table 7. VPA based on 50% cumulative frequency.

TC VTME

YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	AGE 4+ NUMBERS	AGE 4+ WEIGHT
	STOCK SIZE (MILLIONS)												
1965	6574.4	9115.7	3046.4	3945.3	2607.3	419.4	108.1	46.1	1.4	.0	.0	7127.7	1345.6
1966	6153.5	5131.5	5049.0	2347.9	2941.0	1987.2	310.7	75.5	28.9	1.1	.0	7692.2	1576.4
1967	11420.2	4866.9	3086.3	3181.3	1782.1	1924.3	1331.7	183.0	42.5	20.3	.7	8465.8	1776.4
1968	3306.1	8660.3	3095.4	2230.5	2184.8	1229.4	1188.1	690.1	100.8	22.6	7.1	7653.3	1662.6
1969	5686.6	2970.5	3683.1	2101.6	1589.1	1173.7	701.8	477.7	220.1	46.4	5.5	6315.8	1364.4
1970	3389.5	2869.5	1681.6	2140.8	1392.6	888.9	583.9	320.4	180.3	66.6	12.3	5586.9	1186.0
1971	14068.8	2213.3	1425.9	1139.5	1043.6	688.7	479.9	267.3	156.1	76.7	20.3	3872.2	851.6
1972	2223.5	11277.9	1262.6	639.6	545.2	457.8	303.1	190.1	113.5	72.2	30.4	2351.9	531.2
1973	2564.4	1807.6	7473.5	904.8	242.9	144.5	116.7	81.4	53.6	38.0	25.8	1607.7	330.7
1974	3955.2	2063.7	1100.3	4305.3	380.6	100.1	53.5	46.1	33.4	21.5	17.6	4957.1	891.5
1975	1738.5	3197.1	1192.7	726.7	2325.3	194.0	51.8	27.9	26.3	14.4	11.6	3378.0	678.8
1976	2637.5	1377.4	1821.2	714.3	411.9	1036.4	75.9	18.6	11.9	12.8	8.5	2290.2	485.5
1977	22299.9	2090.7	628.6	1111.5	425.4	226.8	463.6	35.4	7.5	3.7	8.2	2282.2	466.7
1978		17627.8	1132.6	411.1	673.0	232.6	118.4	198.1	15.1	3.2	1.6	1653.1	355.8
	CATCH AT AGE (MILLIONS)											TOTAL	
1965	278.8	2690.1	162.1	320.3	163.5	36.3	14.5	9.9	.1	.0	.0	544.6	
1966	168.0	1240.8	1059.1	155.4	537.4	328.0	79.5	21.5	3.7	.2	.0	1125.7	
1967	764.8	1007.8	328.7	466.1	256.0	430.9	446.4	54.6	13.6	10.7	.3	1677.6	
1968	161.7	3812.9	480.6	263.1	685.7	339.4	554.5	387.7	40.4	14.7	3.1	2288.6	
1969	165.1	836.9	973.9	364.5	459.1	420.8	284.1	236.3	127.8	28.9	2.4	1923.9	
1970	623.6	1030.8	263.5	791.8	503.9	276.3	235.6	118.6	79.4	38.5	5.4	2049.5	
1971	266.7	612.0	590.2	433.1	443.6	291.7	227.2	117.9	62.1	36.3	8.9	1620.8	
1972	16.0	1056.6	143.1	314.7	340.3	291.2	188.0	115.0	61.7	37.4	13.3	1361.6	
1973	40.4	422.4	2019.4	403.1	110.6	72.7	56.5	37.2	26.1	16.1	11.3	731.6	
1974	46.7	553.3	193.5	1337.2	131.3	33.6	17.8	11.8	14.5	6.6	7.7	1560.5	
1975	51.3	886.9	291.8	203.9	969.9	92.9	26.8	12.2	9.8	3.7	5.1	1324.3	
1976	76.6	557.9	422.2	177.4	123.0	430.4	29.9	8.6	6.8	2.5	3.7	782.3	
1977	698.5	645.5	115.0	263.8	128.9	75.1	203.1	15.5	3.3	1.6	3.6	694.9	
1978	136.0	1696.0	362.0	60.0	136.0	38.0	26.0	62.0	4.0	2.0	.2	336.2	
	FISHING MORTALITY											MEAN	
1965	.048	.391	.060	.094	.072	.100	.160	.260	.082	.000	.000	.088	
1966	.031	.308	.262	.076	.224	.200	.330	.374	.152	.233	.000	.178	
1967	.077	.257	.125	.176	.171	.282	.457	.396	.432	.853	.650	.251	
1968	.048	.655	.187	.130	.421	.361	.711	.943	.676	1.217	.650	.426	
1969	.061	.360	.343	.212	.381	.498	.684	.774	.995	1.124	.650	.426	
1970	.226	.499	.189	.619	.604	.416	.581	.519	.655	.987	.650	.516	
1971	.021	.361	.602	.637	.624	.621	.726	.657	.671	.726	.650	.613	
1972	.008	.212	.133	.768	1.128	1.167	1.115	1.067	.894	.829	.650	1.004	
1973	.018	.296	.362	.666	.687	.794	.750	.691	.715	.570	.650	.687	
1974	.013	.348	.215	.418	.474	.458	.453	.338	.642	.411	.650	.423	
1975	.033	.363	.313	.368	.608	.738	.827	.650	.522	.332	.650	.566	
1976	.033	.584	.294	.318	.398	.604	.563	.704	.068	.242	.650	.477	
1977	.035	.413	.225	.302	.404	.450	.650	.651	.653	.639	.650	.415	
1978	.078	.112	.431	.204	.240	.198	.278	.420	.343	1.131	.148	.258	

85 %

Table 8. VPA based on 80% cumulative frequency.

!C YTME

YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	AGE 4+	
	STOCK SIZE (MILLIONS)											NUMBERS	WEIGHT
1965	6559.6	9098.2	3026.0	3925.3	2596.1	414.1	106.2	44.1	1.2	.0	.0	7086.9	1337.5
1966	6143.6	6120.0	5034.8	2331.3	2926.0	1978.1	306.3	73.9	27.2	.9	.0	7642.6	1566.0
1967	11410.1	4878.7	3076.8	3169.7	1768.4	1911.1	1324.3	179.4	41.2	18.9	.6	8413.5	1764.7
1968	3902.2	8652.1	3088.6	2222.9	2175.3	1218.2	1177.2	684.0	97.9	21.5	6.0	7603.0	1650.6
1969	3660.9	2967.3	3676.5	2098.1	1582.8	1166.0	692.6	468.8	215.2	44.0	4.6	6270.2	1362.8
1970	3366.3	2864.8	1678.9	2135.3	1388.0	883.8	577.6	312.9	173.2	62.7	10.4	5544.0	1174.0
1971	13822.8	2194.9	1422.0	1137.3	1030.1	685.0	475.8	262.2	150.0	70.9	17.2	3837.5	841.9
1972	2078.1	11079.6	1247.5	636.4	543.4	454.2	300.1	186.7	109.3	67.3	25.7	2323.1	523.1
1973	2402.7	1687.8	7311.1	892.4	240.4	143.1	113.8	78.9	50.9	34.6	21.8	1575.9	322.9
1974	3561.4	1931.3	1002.4	4172.6	370.5	98.0	52.4	42.8	31.4	19.2	14.9	4801.8	862.9
1975	1548.2	2874.1	1084.5	646.6	2216.9	185.7	50.1	26.9	24.4	12.8	9.8	3173.3	638.7
1976	2244.3	1221.5	1557.6	625.9	346.6	948.3	69.2	17.2	11.1	11.2	7.1	2036.5	433.0
1977	13203.5	1768.5	501.8	896.0	353.1	173.5	391.9	29.9	6.4	3.1	6.9	1860.9	381.5
1978		10181.0	869.7	307.4	496.8	173.7	74.9	139.9	10.7	2.3	1.1	1206.8	258.6
	CATCH AT AGE (MILLIONS)											TOTAL	
1965	278.8	2690.1	162.1	320.3	163.5	36.3	14.5	9.9	.1	.0	.0	544.6	
1966	168.0	1240.8	1059.1	155.4	537.4	328.0	79.5	21.5	3.7	.2	.0	1125.7	
1967	764.8	1007.0	328.7	466.1	255.0	430.9	446.4	54.6	13.6	10.7	.3	1677.6	
1968	161.7	3812.9	480.6	263.1	685.7	339.4	554.5	387.7	40.4	14.7	3.1	2288.6	
1969	165.1	835.9	973.9	364.5	459.1	420.8	284.1	236.3	127.8	28.9	2.4	1923.9	
1970	623.6	1030.8	263.5	791.8	503.9	276.3	235.6	118.6	79.4	38.5	5.4	2049.5	
1971	266.7	612.8	590.2	433.1	443.6	291.7	227.2	117.9	62.1	36.3	8.9	1620.8	
1972	16.0	1955.6	143.1	314.7	340.3	291.2	188.8	115.0	61.7	37.4	13.3	1361.6	
1973	40.4	422.4	2019.4	403.1	110.6	72.7	56.5	37.2	25.1	15.1	11.3	731.6	
1974	46.7	553.3	193.5	1337.2	131.3	33.6	17.8	11.8	14.5	6.6	7.7	1560.5	
1975	51.3	886.9	291.8	203.9	969.9	92.9	26.8	12.2	9.8	3.7	5.1	1324.3	
1976	76.6	557.9	422.2	177.4	123.0	430.4	29.9	8.6	6.8	2.5	3.7	782.3	
1977	698.5	645.5	115.0	263.8	128.9	75.1	203.1	16.5	3.3	1.6	3.6	694.9	
1978	136.0	1571.0	374.0	73.0	142.0	41.0	25.0	63.0	4.0	2.0	.2	350.2	
	FISHING MORTALITY											MEAN	
1965	.048	.392	.061	.094	.072	.102	.163	.283	.093	.000	.000	.089	
1966	.031	.309	.263	.076	.226	.201	.335	.384	.162	.271	.000	.179	
1967	.077	.257	.125	.176	.173	.284	.461	.406	.449	.952	.830	.253	
1968	.048	.656	.188	.140	.424	.365	.721	.956	.600	1.337	.830	.430	
1969	.051	.369	.343	.212	.383	.502	.504	.796	1.033	1.240	.830	.431	
1970	.228	.500	.189	.520	.506	.419	.500	.635	.693	1.005	.830	.621	
1971	.022	.366	.604	.539	.628	.625	.735	.676	.602	.816	.830	.621	
1972	.009	.216	.136	.774	1.134	1.184	1.135	1.101	.950	.927	.830	1.025	
1973	.010	.321	.361	.679	.697	.805	.779	.721	.772	.648	.830	.707	
1974	.015	.377	.238	.432	.491	.476	.465	.360	.700	.471	.830	.441	
1975	.037	.413	.350	.424	.649	.787	.871	.682	.677	.382	.830	.614	
1976	.038	.600	.363	.378	.492	.684	.638	.788	1.084	.280	.830	.655	
1977	.060	.610	.290	.390	.610	.640	.830	.829	.824	.831	.830	.540	
1978	.078	.186	.634	.302	.376	.304	.466	.678	.620	8.568	.223	.391	

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Table 9. VPA based on 90% and 50% cumulative frequency for ages 1-2 and age 3+, respectively.

VTG

YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	AGE 4+ NUMBERS	AGE 4+ WEIGHT
	STOCK SIZE (MILLIONS)												
1965	6574.4	9115.7	3046.4	3945.3	2607.3	419.4	108.1	46.1	1.4	.0	.0	7127.7	1345.6
1966	6153.5	5131.5	5049.0	2347.9	2941.0	1987.2	310.7	75.5	28.9	1.1	.0	7692.2	1576.4
1967	11420.2	4886.9	3086.3	3181.3	1782.1	1924.3	1331.7	183.0	42.5	20.3	.7	8465.8	1776.4
1968	3806.1	8660.3	3095.4	2230.5	2184.8	1229.4	1188.1	690.1	100.8	22.6	7.1	7653.3	1662.6
1969	3686.6	2970.5	3683.1	2101.6	1589.1	1173.7	701.8	477.7	220.1	46.4	5.5	6315.8	1364.4
1970	3388.8	2869.5	1681.6	2140.8	1392.6	888.9	583.9	320.4	180.3	66.6	12.3	5585.9	1185.0
1971	14068.8	2213.3	1425.9	1139.5	1043.6	688.7	479.9	267.3	156.1	76.7	20.3	3872.2	851.5
1972	2223.5	11277.9	1262.6	639.6	545.2	457.8	303.1	190.1	113.5	72.2	30.4	2351.9	531.2
1973	2564.4	1807.6	7473.5	904.8	242.9	144.5	116.7	81.4	53.6	38.0	25.8	1607.7	330.7
1974	3955.2	2063.7	1100.3	4305.3	380.6	100.1	53.5	45.1	33.4	21.5	17.6	4957.1	891.5
1975	1738.5	3197.1	1192.7	726.7	2325.3	194.0	51.8	27.9	26.3	14.4	11.6	3378.0	678.8
1976	2637.5	1377.4	1821.2	714.3	411.9	1036.4	75.9	18.6	11.9	12.8	8.5	2290.2	485.5
1977	9776.9	2090.7	628.6	1111.5	425.4	226.8	463.6	35.4	7.5	3.7	8.2	2282.2	466.7
1978		7375.3	1132.6	411.1	673.0	232.6	118.4	198.1	15.1	3.2	1.6	1653.1	355.8
	CATCH AT AGE (MILLIONS)											TOTAL	
1965	278.8	2690.1	162.1	320.3	163.5	36.3	14.5	9.9	.1	.0	.0	544.6	
1966	168.0	1240.8	1059.1	155.4	537.4	328.0	79.5	21.5	3.7	.2	.0	1125.7	
1967	764.8	1007.0	328.7	466.1	255.0	430.9	446.4	54.6	13.6	10.7	.3	1677.6	
1968	161.7	3812.9	480.5	263.1	685.7	339.4	554.5	387.7	40.4	14.7	3.1	2288.6	
1969	165.1	835.9	973.9	364.5	459.1	420.8	284.1	236.3	127.8	28.9	2.4	1923.9	
1970	623.6	1030.8	263.5	791.8	503.9	276.3	235.6	118.6	79.4	38.5	5.4	2049.5	
1971	266.7	612.0	590.2	433.1	443.6	291.7	227.2	117.9	62.1	36.3	8.9	1620.8	
1972	16.0	1955.6	143.1	314.7	340.3	291.2	188.0	115.0	61.7	37.4	13.3	1361.6	
1973	40.4	422.4	2019.4	403.1	110.6	72.7	56.5	37.2	25.1	15.1	11.3	731.6	
1974	46.7	553.3	193.5	1337.2	131.3	33.6	17.8	11.8	14.5	6.6	7.7	1560.5	
1975	51.3	886.9	291.8	203.9	969.9	92.9	26.8	12.2	9.8	3.7	5.1	1324.3	
1976	76.6	557.9	422.2	177.4	123.0	430.4	29.9	8.6	6.8	2.5	3.7	782.3	
1977	698.5	645.5	115.0	263.8	128.9	75.1	203.1	15.5	3.3	1.6	3.6	694.9	
1978	136.0	1460.0	362.0	69.0	135.0	38.0	26.0	62.0	4.0	2.0	.2	336.2	
	FISHING MORTALITY											MEAN	
1965	.048	.391	.060	.094	.072	.100	.160	.269	.082	.000	.000	.088	
1966	.031	.308	.262	.076	.224	.200	.330	.374	.152	.233	.000	.178	
1967	.077	.257	.125	.176	.171	.282	.457	.396	.432	.853	.650	.251	
1968	.048	.655	.187	.139	.421	.361	.711	.943	.576	1.217	.650	.426	
1969	.051	.369	.343	.212	.381	.498	.584	.774	.995	1.124	.650	.426	
1970	.226	.499	.189	.519	.504	.416	.581	.519	.655	.987	.650	.516	
1971	.021	.361	.602	.537	.624	.621	.726	.657	.571	.726	.650	.613	
1972	.008	.212	.133	.768	1.128	1.167	1.115	1.067	.894	.829	.650	1.004	
1973	.018	.296	.352	.666	.687	.794	.750	.691	.715	.570	.650	.687	
1974	.013	.348	.215	.416	.474	.458	.463	.338	.642	.411	.650	.423	
1975	.033	.363	.313	.368	.608	.738	.827	.650	.522	.332	.650	.666	
1976	.033	.584	.294	.318	.396	.604	.563	.704	.968	.242	.650	.477	
1977	.082	.413	.225	.342	.404	.450	.650	.651	.653	.639	.650	.415	
1978	.078	.247	.431	.204	.249	.198	.276	.420	.343	1.131	.148	.256	

Table 10. VPA based on 90% and 80% cumulative frequency for ages 1-2 and age 3+, respectively.

'C YTME

YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	AGE 4+ NUMBERS	AGE 4+ WEIGHT
	STOCK SIZE (MILLIONS)												
1965	6559.6	9098.2	3026.0	3925.3	2596.1	414.1	106.2	44.1	1.2	.0	.0	7086.9	1337.5
1966	6143.6	5120.0	5034.8	2331.3	2925.0	1978.1	306.3	73.9	27.2	.9	.0	7642.6	1566.0
1967	11410.1	4878.7	3076.8	3169.7	1768.4	1911.1	1324.3	179.4	41.2	18.9	.6	8413.5	1764.7
1968	3802.2	8652.1	3088.6	2222.9	2175.3	1218.2	1177.2	684.0	97.9	21.5	6.0	7603.0	1660.6
1969	3680.9	2967.3	3676.5	2096.1	1582.8	1166.0	692.6	468.8	215.2	44.0	4.6	6270.2	1362.8
1970	3366.3	2864.8	1678.9	2135.3	1388.0	883.8	577.6	312.9	173.2	62.7	10.4	5544.0	1174.0
1971	13822.8	2194.9	1422.0	1137.3	1039.1	686.0	476.8	262.2	150.0	70.9	17.2	3837.5	841.9
1972	2078.1	11079.6	1247.5	636.4	543.4	454.2	300.1	186.7	109.3	67.3	25.7	2323.1	523.1
1973	2402.7	1687.9	7311.1	892.4	240.4	143.1	113.8	78.9	50.9	34.6	21.8	1575.9	322.9
1974	3561.4	1930.7	1002.4	4172.7	370.5	98.0	52.4	42.8	31.4	19.2	14.9	4801.9	862.9
1975	1548.6	2874.1	1084.1	646.6	2217.0	185.7	50.1	26.9	24.4	12.8	9.8	3173.4	638.7
1976	2280.5	1221.7	1557.5	625.5	346.5	948.3	69.2	17.2	11.1	11.2	7.1	2036.2	433.0
1977	9789.5	1798.0	502.0	896.0	352.9	173.5	392.0	29.9	6.4	3.1	6.9	1860.7	381.4
1978		7385.4	893.8	307.6	496.8	173.4	74.9	139.9	10.7	2.3	1.1	1206.8	258.6
	CATCH AT AGE (MILLIONS)											TOTAL	
1965	278.8	2690.1	162.1	320.3	163.5	36.3	14.5	9.9	.1	.0	.0	544.6	
1966	168.0	1240.8	1059.1	155.4	537.4	328.0	79.5	21.5	3.7	.2	.0	1125.7	
1967	764.8	1007.0	328.7	466.1	255.0	430.9	446.4	54.6	13.6	10.7	.3	1677.6	
1968	161.7	3812.9	480.5	263.1	685.7	339.4	654.5	387.7	40.4	14.7	3.1	2288.6	
1969	165.1	835.9	973.9	364.5	459.1	420.8	284.1	236.3	127.8	28.9	2.4	1923.9	
1970	623.6	1030.8	263.5	791.8	503.9	276.3	235.6	118.6	79.4	38.5	6.4	2049.5	
1971	266.7	612.0	590.2	433.1	443.6	291.7	227.2	117.9	62.1	36.3	8.9	1620.8	
1972	16.0	1955.6	143.1	314.7	340.3	291.2	188.0	115.0	61.7	37.4	13.3	1361.6	
1973	40.4	422.4	2019.4	403.1	110.6	72.7	56.5	37.2	25.1	15.1	11.3	731.6	
1974	46.7	553.3	193.5	1337.2	131.3	33.6	17.8	11.8	14.5	6.6	7.7	1560.5	
1975	51.3	886.9	291.8	203.9	969.9	92.9	26.8	12.2	9.8	3.7	5.1	1324.3	
1976	76.6	557.9	422.2	177.4	123.0	430.4	29.9	8.6	6.8	2.5	3.7	782.3	
1977	698.5	645.5	115.0	263.8	128.9	75.1	203.1	15.5	3.3	1.6	3.6	694.9	
1978	136.0	1418.0	387.0	79.0	154.0	45.0	26.0	66.0	4.0	2.0	.2	376.2	
	FISHING MORTALITY											MEAN	
1965	.048	.392	.061	.094	.072	.102	.163	.283	.093	.000	.000	.089	
1966	.031	.300	.263	.076	.226	.201	.336	.384	.162	.271	.000	.179	
1967	.077	.257	.125	.176	.173	.284	.461	.406	.449	.962	.830	.253	
1968	.048	.656	.188	.140	.424	.365	.721	.966	.600	1.337	.830	.430	
1969	.051	.369	.343	.212	.383	.502	.594	.796	1.033	1.240	.830	.431	
1970	.228	.500	.180	.520	.606	.419	.590	.535	.693	1.095	.830	.621	
1971	.022	.365	.604	.539	.628	.626	.736	.676	.602	.816	.830	.621	
1972	.009	.216	.135	.774	1.134	1.184	1.135	1.101	.960	.927	.830	1.026	
1973	.010	.321	.361	.679	.697	.805	.778	.721	.772	.646	.830	.707	
1974	.015	.377	.238	.432	.491	.470	.465	.360	.700	.471	.830	.441	
1975	.037	.413	.350	.424	.649	.787	.871	.682	.677	.382	.830	.614	
1976	.038	.680	.363	.372	.492	.683	.638	.788	1.084	.280	.830	.555	
1977	.082	.490	.290	.390	.610	.640	.830	.829	.824	.831	.830	.540	
1978	.078	.237	.640	.331	.415	.335	.478	.722	.626	2.568	.223	.427	

Table 11. VPA based on 90% cumulative frequency.

'C VTME

YEAR	AGE 1	2	3	4	5	6	7	8	9	10	11	AGE 4+	
					STOCK SIZE (MILLIONS)							NUMBERS	WEIGHT
1965	6555.6	9091.7	3017.3	3917.3	8591.6	412.0	105.4	43.3	1.2	.0	.0	7070.7	1334.3
1966	6139.6	5115.7	6029.4	2324.3	2018.5	1974.6	304.5	73.2	26.5	.9	.0	7622.5	1661.8
1967	11405.8	4875.2	3073.3	3165.1	1762.9	1045.8	1321.3	177.9	40.7	18.4	.5	8392.7	1760.1
1968	3800.6	8648.9	3085.8	2220.0	2171.6	1213.7	1172.9	681.6	96.7	21.1	5.6	7583.2	1645.8
1969	3673.1	2966.0	3673.8	2093.8	1580.3	1162.9	680.0	465.3	213.3	43.0	4.3	6252.0	1348.2
1970	3356.9	2862.7	1677.9	2133.1	1386.2	881.8	575.2	310.0	170.3	61.2	9.7	5527.4	1169.6
1971	13726.1	2187.1	1420.3	1136.5	1037.4	683.6	474.1	260.2	147.6	68.6	15.9	3823.7	838.1
1972	2073.3	11000.7	1241.2	635.0	542.7	452.7	298.9	185.4	107.7	65.3	23.8	2311.5	519.9
1973	2321.6	1683.3	7246.8	887.3	239.2	142.5	112.7	78.0	49.8	33.3	20.2	1563.0	319.8
1974	3464.6	1864.6	998.7	4120.0	366.4	97.1	51.9	41.9	30.6	18.4	13.8	4740.0	851.5
1975	1463.5	2796.4	1030.1	643.6	2174.0	182.3	49.4	26.5	23.7	12.1	9.1	3120.8	627.7
1976	2280.5	1156.2	1493.2	581.4	344.0	913.3	66.5	16.6	10.8	10.6	6.6	1949.9	415.3
1977	9776.9	1798.1	448.8	843.5	316.8	171.6	363.6	27.7	5.9	2.8	6.4	1738.2	356.3
1978		7375.3	893.9	264.2	453.9	144.1	73.3	117.0	8.9	1.9	.9	1064.1	227.7
					CATCH AT AGE (MILLIONS)							TOTAL	
1965	278.8	2690.1	162.1	320.3	163.5	36.3	14.5	9.9	.1	.0	.0	544.6	
1966	168.0	1240.8	1059.1	155.4	537.4	328.0	79.5	21.5	3.7	.2	.0	1125.7	
1967	764.2	1007.0	328.7	466.1	256.0	430.9	446.4	54.8	13.6	10.7	.3	1677.6	
1968	161.7	3812.9	480.6	263.1	685.7	339.4	654.5	387.7	40.4	14.7	3.1	2288.6	
1969	165.1	835.9	973.9	364.5	459.1	420.8	284.1	236.3	127.8	28.9	2.4	1923.9	
1970	623.6	1030.8	263.5	791.8	503.9	276.3	235.6	118.6	79.4	38.5	5.4	2049.5	
1971	266.7	612.0	590.2	433.1	443.6	291.7	227.2	117.9	62.1	36.3	8.9	1620.8	
1972	16.0	1955.6	143.1	314.7	340.3	291.2	188.0	115.0	61.7	37.4	13.3	1361.6	
1973	40.4	422.4	2019.4	403.1	110.6	72.7	56.5	37.2	25.1	15.1	11.3	731.6	
1974	46.7	553.3	193.5	1337.2	131.3	33.6	17.8	11.8	14.5	6.6	7.7	1560.6	
1975	51.3	886.9	291.8	203.9	969.9	92.9	26.8	12.2	9.8	3.7	5.1	1324.3	
1976	76.6	557.9	422.2	177.4	123.0	430.4	29.9	8.6	6.8	2.5	3.7	782.3	
1977	698.5	645.5	115.0	263.8	128.9	75.1	203.1	15.5	3.3	1.6	3.6	694.9	
1978	136.0	1469.0	394.0	75.0	151.0	41.0	27.0	63.0	4.0	1.5	.2	362.7	
					FISHING MORTALITY							MEAN	
1965	.048	.392	.061	.094	.072	.102	.164	.289	.098	.000	.000	.089	
1966	.031	.310	.263	.077	.226	.202	.337	.388	.167	.289	.000	.188	
1967	.077	.257	.126	.177	.173	.285	.462	.410	.456	.998	.934	.254	
1968	.048	.656	.188	.140	.425	.366	.724	.962	.610	1.392	.934	.432	
1969	.051	.370	.344	.212	.383	.504	.699	.805	1.049	1.293	.934	.433	
1970	.228	.501	.194	.521	.607	.421	.593	.542	.710	1.145	.934	.624	
1971	.028	.307	.646	.539	.629	.627	.739	.682	.615	.868	.934	.624	
1972	.009	.217	.136	.778	1.137	1.101	1.144	1.115	.973	.972	.934	1.033	
1973	.019	.322	.365	.684	.702	.810	.790	.734	.797	.682	.934	.715	
1974	.015	.393	.239	.430	.408	.478	.471	.370	.725	.490	.934	.448	
1975	.039	.427	.372	.426	.667	.809	.892	.696	.602	.486	.934	.629	
1976	.038	.746	.371	.407	.496	.721	.675	.832	1.140	.299	.934	.588	
1977	.082	.499	.330	.420	.588	.650	.934	.938	.934	.940	.934	.593	
1978	.078	.247	.656	.373	.453	.374	.616	.881	.674	1.870	.280	.478	

Table 12. Catch and stock size projections for 1979 for analysis based on 20% cumulative frequency of relative F's. Stock biomass (age 4+) at beginning of 1979- - 1,109 thousand tons.

1979 F Fully Recruited	1979 Catch Age 3+ (Thousands of Tons)	1980 Stock Biomass Age 4+ (Thousands of Tons)
0.2	357	5517
0.4	680	5084
0.6	974	4688
0.8	1241	4327
1.0	1485	3997
1.5	2008	3286
2.0	2429	2710
3.0	3053	1857
4.0	3477	1282
5.0	3771	888
6.0	3979	617

Table 13. Catch and stock size projections for 1979 for analysis based on 50% cumulative frequency of relative F's. Stock biomass (age 4+) at beginning of 1979 - 358 thousand tons.

1979 F Fully Recruited	1979 Catch Age 3+ (Thousands of Tons)	1980 Stock Biomass Age 4+ (Thousands of Tons)
0.2	123	1981
0.4	235	1828
0.6	338	1689
0.8	431	1561
1.0	517	1443
1.5	701	1189
2.0	850	983
3.0	1074	676
4.0	1226	467
5.0	1333	324
6.0	1408	225

Table 14. Catch and stock size projections for 1979 for analysis based on 80% cumulative frequency of relative F's. Stock biomass (age 4+) at beginning of 1979 - 227 thousand tons.

1979 F Fully Recruited	1979 Catch Age 3+ (Thousands of Tons)	1980 Stock Biomass Age 4+ (Thousands of Tons)
0.2	70	1092
0.4	134	1006
0.6	191	928
0.8	144	857
1.0	292	792
1.5	396	651
2.0	479	537
3.0	603	368
4.0	688	254
4.6	726	203

Table 15. Catch and stock size projections for 1979 for analysis based on 90% cumulative frequency of relative F's for age 1 and 2 and 50% for age 3+. Stock biomass (age 4+) at the beginning of 1979 - 358 x 10^{-3} MT.

1979 F fully recruited	1979 catch age 3+ $X10^{-3}$ MT	1980 stock biomass age 4+ $X10^{-3}$MT
0.2	72	907
0.4	136	828
0.6	193	757
0.8	245	693
1.0	291	635
1.5	389	513
2.0	465	417
3.0	574	279
4.0	645	189

Table 16. Catch and stock size projections for 1979 for analysis based on 90% cumulative frequency of relative F's. Stock biomass (age 4+) at beginning of 1979 - 196 thousand tons.

1979 F Fully Recruited	1979 Catch Age 3+ (Thousands of Tons)	1980 Stock Biomass Age 4+ (Thousands of Tons)
0.2	52	778
0.4	99	716
0.6	142	659
0.8	180	608
1.0	216	561
1.6	305	442
2.0	353	378
3.0	442	258
3.6	481	206

Table 17. Catch in thousands of tons of Age 3+.

Year	SA 5 Adult	SA 5 Juvenile	SA 5Z+6*	Pt. Judith**	SA 4WX	SA 4Xb
			AREA			
1967	7.8	21.6	221.9	0.2	133.1	27.9
1968	31.2	9.0	390.5	0.2	136.6	24.1
1969	30.9	17.1	328.0	1.0	111.8	24.2
1970	39.6	8.8	244.0	1.4	143.6	6.6
1971	37.7	7.6	256.5	1.4	71.4	7.7
1972	41.2	2.1	167.1	2.3	91.3	9.9
1973	16.0	8.2	226.1	4.2	111.2	15.9
1974	17.5	9.5	135.9	2.8	179.4	12.1
1975	21.0	4.8	141.1	4.4	180.3	13.2
1976	20.2	16.4	42.9	0.2	69.8	22.4
1977	≈17,800	12.5	0.2	0.3		
% of total catch 1967-1976	6.7	2.7	55.0	0.5	31.4	4.2

*Including Point Judith

**Inshore domestic winter fishery by vessels from Point Judith

Table 18. Gulf of Maine adult herring fishery monthly landings, tons, 1967-78.

	1978	1977	1976	1975	1974	1973	1972	1971	1970	1969	1968	1967
Jan.	2884.0	2640.2	1020.9	35.7	-	1.0	0.1	332	354.0	1561.0	-	355.3
Feb.	4402.2	3419.0	880.7	366.0	544.0	1.0	0.5	-	-	213.4	301.4	90.1
Mar.	3073.1	3055.1	2926.5	3434.3	979.0	1780.4	1.6	1	139	-	-	1192.7
Apr.	189.4	2779.7	3674.2	1469.2	3994.0	3106.4	2243.4	515	144	1075.8	2172.3	990.6
May	443.0	1076.9	226.6	134.1	180.0	1887.4	3611.4	567	540.8	603.9	700.2	284.8
June	495.9	1.9	3.3	71.1	183.0	2132.0	2899.5	1612	367	67.9	2730.2	108.0
July	40.8	146.3	1297.3	2616.9	358.9	427.1	4782.5	2963	3335.3	2327.1	7423.8	290.9
Aug.	240.4	1807.9	2795.3	1727.3	3856.0	1420.1	11007.1	7917	6797.0	5335.0	8299.3	392.1
Sept.	2141.4	1270.2	2895.2	2794.4	2851.0	452.9	6115.8	16694	8213.4	11013.3	7068.4	1410.9
Oct.	1462.4	671.1	2334.5	3165.6	1429.0	4000.7	10472.9	5192	8422.7	4332.3	6138.2	1487.1
Nov.	2442.4	653.5	1956.9	3659.3	1470.0	459.0	1859.4	1410	4812.1	905.5	2856.2	1119.3
Dec.	1002.6	369.2	113.4	1602.1	2253.0	528.0	145.9	1373	7913.7	4555.7	777.8	85.2
Total	18817.6	17891.0	20124.5	21706.4	18097.9	16196.0	42918.2	38576	41039.0	31992.6	32705.0	7308.0

Table 19.

Maine herring landings by months
(metric tons)
1947 to 1975
(Includes lobster bait)

Month	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
Unknown[1]	11,608.9	11,380.0	10,887.0	9,140.0	3,062.0	3,167.0	6,094.0	6,053.0	2,812.0	6,198.0	6,033.0	6,899.0	4,444.0	9,150.0	2,072.7
January	---	---	---	---	5.8	---	---	---	---	---	---	16.4	---	---	0.1
February	---	---	---	---	11.1	---	---	---	---	---	---	33.5	---	---	---
March	565.4	---	---	---	2.8	12.7	---	---	---	100.0	---	---	---	---	11.9
April	---	---	35.6	---	---	---	51.5	158.4	---	---	19.6	17.5	---	1.1	6.8
May	13.6	944.0	2,425.2	5,767.7	599.0	6,305.3	4,088.6	11,461.5	2,334.1	410.6	5,976.4	1,141.2	1,382.0	1,393.4	978.4
June	2,127.1	16,796.1	13,343.1	16,952.8	4,854.9	22,634.7	10,508.4	1,974.4	12,704.3	12,716.7	18,281.9	13,545.6	15,444.8	8,304.7	3,762.3
July	10,139.7	20,230.0	7,551.6	20,408.8	2,661.3	17,655.2	8,231.1	9,239.4	7,586.8	15,812.4	13,089.4	20,261.4	12,122.6	11,787.4	3,971.4
August	13,976.5	11,447.0	7,832.5	19,834.5	4,765.2	10,073.9	6,056.7	5,131.7	6,437.3	15,636.3	9,988.3	19,218.8	11,000.1	10,069.2	3,667.5
September	10,508.9	7,418.5	12,937.3	12,006.7	7,170.6	7,758.2	8,449.2	4,761.0	4,967.2	5,670.6	8,574.8	7,537.8	5,031.9	8,924.4	5,056.0
October	10,819.1	6,022.6	17,731.2	5,486.2	6,974.1	7,948.9	10,954.8	6,065.7	5,015.0	7,605.2	5,071.9	7,723.6	2,271.0	8,109.9	3,782.3
November	4,044.0	1,516.0	2,764.0	1,714.7	3,644.0	3,707.0	3,786.8	1,232.0	1,626.9	2,354.1	1,289.4	4,120.2	1,339.9	706.3	1,315.9
December	386.6	756.3	---	16.8	660.2	70.2	101.2	181.8	---	243.2	298.2	243.9	---	21.3	4.8
Total	66,189.1	76,510.5	75,307.5	91,328.3	34,407.0	79,333.1	58,322.3	63,995.9	43,483.6	66,747.1	68,622.9	80,758.9	53,036.3	59,347.7	24,130.1

[1] Includes estimated lobster bait.

Month	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Unknown[1]	10,364.5	17,386.4	1,465.4	2,387.7	3,245.6	1,898.4	3,478.2	784.8	162.4	3.0	---	---	---	---	---	---	
January	1.8	4.8	---	261.8	494.9	49.3	556.9	431.4	---	---	---	---	564.0	312.3	11.1	---	75.1
February	106.7	---	7.5	1,231.9	393.0	---	39.8	546.3	117.3	---	---	---	---	37.3	---	298.5	577.9
March	641.4	---	167.5	2,365.9	640.3	42.8	1,908.1	1,137.4	---	---	---	5.6	---	---	---	880.5	414.6
April	520.9	---	5.4	566.6	173.6	113.2	1,410.6	152.7	---	5.0	72.7	---	---	---	2.4	---	9.5
May	8,608.9	43.1	106.3	1,924.9	267.7	20.0	399.3	117.3	63.2	54.8	341.8	---	---	5.5	270.4	741.3	107.9
June	9,025.6	10,985.1	3,923.4	4,839.8	2,462.1	1,360.6	1,888.4	2,489.9	948.9	968.0	3,733.9	1,045.8	1,015.6	712.8	7,511.6	3,571.6	1927.7
July	10,108.9	15,820.5	5,869.5	5,466.4	4,779.2	3,437.5	4,831.3	3,776.2	2,860.3	3,159.1	5,108.2	3,469.7	4,285.7	3,621.4	6,532.2	8,847.2	8042.4
August	11,615.1	13,820.6	4,687.6	7,054.9	5,108.6	5,900.3	6,094.5	6,646.4	3,309.8	3,529.0	5,856.0	4,889.7	4,267.4	3,466.9	5,304.2	7,300.7	10791.3
September	12,248.2	5,198.4	4,833.8	3,967.3	3,436.3	7,252.1	4,177.1	4,814.2	3,611.2	2,348.8	2,322.2	2,179.9	2,515.5	2,276.2	4,697.6	4,327.6	4493.4
October	5,440.9	3,438.1	3,027.0	1,590.1	2,948.7	4,106.6	3,595.8	2,511.0	2,586.1	966.8	1,917.7	3,218.4	4,725.3	3,801.0	3,934.8	5,072.1	1834.5
November	605.4	185.2	2,156.2	152.4	753.4	715.8	1,717.1	434.4	982.5	1,277.6	160.1	1,174.4	1,630.5	851.9	1,912.4	800.4	1593.1
December	---	6.4	26.7	---	194.0	47.2	212.9	---	82.3	95.6	---	416.4	138.2	100.6	68.3	356.4	—
Total	69,287.4	66,888.6	26,276.3	31,809.7	24,901.4	24,943.8	30,310.0	23,852.0	14,724.0	12,407.7	19,512.6	16,399.9	19,142.2	15,182.1	30,195.0	32,356.3	23956

[1] Includes estimated lobster bait.

Table 20. Catch of herring in the Georges Bank herring fishery (MT).

ear	January	February	March	April	May	June	July	August	September	October	November	December	Σ
961	29	19	20	23	11	1	2,984	12,611	16,375	15,719	15,318	4,545	67,655
962	54	5,799	2,199	7,118	19,853	24,669	26,142	22,644	28,079	11,182	3,219	1,284	152,242
963	45	217	254	357	283	3,059	28,569	24,560	29,643	9,160	512	1,309	97,968
964	762	114	221	1,562	9,961	15,006	19,583	25,566	47,650	8,721	1,725	567	131,438
965	519	53	1,089	5,796	8,641	7,078	1,311	1,342	11,496	1,999	910	2,648	42,882
966	1,179	1,470	3,089	1,643	8,206	28,498	36,446	20,286	31,136	7,190	403	3,158	142,704
967	56	199	4,869	13,949	27,004	27,182	33,801	26,318	34,016	23,265	12,534	15,550	218,743
968	187	9,712	28,050	37,806	24,374	17,386	33,006	54,543	108,997	38,075	14,355	7,107	373,598
969	6,908	13,143	9,468	27,735	20,859	23,952	30,434	43,649	71,343	39,401	15,945	7,921	310,758
970	7,455	10,811	16,410	10,972	9,849	14,887	14,048	18,280	74,051	39,591	14,752	16,182	247,294
971	4,630	10,357	8,085	10,306	15,956	19,215	22,873	30,155	69,001	54,948	13,402	8,446	267,374
972	1,607	4,262	5,132	5,708	5,603	10,434	9,608	23,940	56,588	37,931	6,325	7,052	174,190
973	5,350	10,313	9,645	12,348	12,700	11,033	9,566	31,103	58,065	38,289	2,468	1,455	203,335
974	1,799	2,314	3,694	4,232	16,154	12,689	10,373	19,840	37,887	32,479	7,137	912	149,510
975	2,546	2,639	2,220	4,914	5,804	5,270	7,316	15,837	52,902	31,046	6,988	8,614	146,096
976	239	250	221	1,127	1,196	1,031	78	5,811	24,248	7,238	1,926	139	43,502
	33,365	71,673	94,666	145,596	186,454	221,390	286,128	376,485	751,478	396,234	117,919	86,898	2,768,289
	2085.3	4479.5	5916.6	9099.8	11653.9	13836.9	17883.0	23530.3	46967.3	24764.6	7369.9	5431.1	173018
	1.21	2.59	3.42	5.26	6.74	8.0	10.4	13.6	27.15	14.32	4.26	3.14	100.0