

Herring Assessment in ICNAF Div. 4WX

by

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Catch Statistics and Age Composition

The total catch from the Div. 4WX stock during the 1976 fishery (November 1, 1975 to October 31, 1976) was 114342 tons. An additional 29858 tons was taken in the New Brunswick juvenile fishery (Div. 4Xb) and gillnet catches from local inshore stocks (Table 1). The catch figures for the entire 1976-77 Div. 4Wa fishery were not available. The Canadian provisional catch from November, 1976, to mid-April, 1977, was 19620 tons; this fishery commenced again in May, but no information on catch levels was available to adjust the analysis.

The 1970 year class posed ageing difficulties since only a very small increment occurred on the otolith during 1976. This was also true of Div. 5Y and Div. 5Z and Stat. Area 6 (V. Anthony, pers. comm.). The majority of otoliths had either no opaque zone outside the hyaline ring, or an extremely small one. Consequently, a large proportion of the fish were initially aged as 1971 year class and when the catch was weighted by this age composition, the contribution from the 1971 year class was greater than that of the 1970 year class. The contribution of the 1971 year class to the fishery during the period 1973-75 has been extremely low and from all indications is a poor year class. There was insufficient time to re-age the suspect otoliths in the 1976 samples, but considering the acknowledged ageing problem and the previous contributions of the two year classes, it was decided to adjust the age composition. All fish aged 5 and 6 in the 1976 age composition were combined, then apportioned into the 1970 and 1971 year classes on the basis of the proportions of the two year classes in the 1975 catch adjusted for partial recruitment.

### Year-class Size and Estimates of Fishing Mortality

The starting values of  $F$  used in the cohort analysis were set at 0.75 for the 1965 and earlier year classes (i.e. age group 11+). This starting  $F$  was obtained by averaging the fishing mortality on age groups 10 for the period 1965 to 1974 obtained from a preliminary cohort run. A starting  $F$  of 0.35 was used for fully recruited age groups (ages 6-10). This is the same value as that used in projecting the 1975-76 TAC of 129,600 tons for Div. 4WX and this value should be reasonable since the catch, mainly due to additional domestic regulations, was only 114433 tons. Partial recruitment values (Redbook, 1976, p. 40) were then applied to  $F = 0.35$  to obtain starting  $F$  values for age groups 3-5.

In 1976, the Div. 4XWb fishery was managed by means of daily, weekly, and annual boat quotas in order to regulate supply to processing capability. The catch-effort information obtained from log records had previously been used to obtain a first estimate of incoming year class size. The new regulating measures would be expected to affect catch-per-effort values, thus the decline in the 1976 catch-per-effort value from previous years could not be interpreted as meaningful in terms of stock abundance. Lacking any independent estimates of year class size, the size of the 1974 year class was set at the conventional level of 750 million fish at age 2. The catch in numbers and the calculated fishing mortalities and stock sizes at age from cohort analysis are given in Table 2.

### Catch Projection for the 1976-77 Season

In the Div. 4WX fishery, the fisheries occur in the early months of the year in Div. 4Wa (November-May) and in summer in Div. 4XWb (June-October). Since the mean weights differ significantly in these two fisheries, the projection is run in two parts.

Total allowable catches for the 1976-77 season have already been established, and the 1976-77 Div. 4Wa fishery is essentially complete. Consequently, in order to obtain stock sizes for the beginning of the 1977-78 season, the following procedure was employed. Using actual 1976-77 catch numbers from Div. 4Wa and assuming  $M = 0.1$  for this fishery, the status of the stock was determined to the end of the 1976-77 Div. 4Wa fishery. A 1977 TAC of 84000 tons for Div. 4XWb was agreed at the 1976 ICNAF Annual Meeting, thus assuming this catch and an  $M = 0.1$  for this fishery, a projection for the last half of the 1976-77 season was run to determine stock sizes at the beginning of the 1977-78 season. The weighted mean  $F$  for fish aged 3 and older for the 4WX stock in the 1976-77 fishery (combined 4Wa and 4XWb fisheries) was 0.244.

### Catch Projection for the 1977-78 Season

The 1977-78 projection is based on applying a management strategy to the Div. 4WX stock on an annual basis. The mean weights from the Div. 4XWb fishery were used in these calculations. Catch in 1978 resulting stock size at the beginning of 1979 are shown in Fig. 1. Fishing the stock at  $F_{0.1} = 0.30$  during the 1977-78 season would produce a catch of 97500 tons, with a resulting stock size (age 4+) of  $362.5 \times 10^{-3}$  tons.

If advice on partitioning of the catch between Div. 4Wa and 4XWb is desired, and the traditional proportions are to be maintained, then 20500 tons (21%) should be taken in Div. 4Wa with the remaining 77025 tons (79%) being taken in Div. 4XWb. Due to the smaller mean weights of fish caught in Div. 4Wa, probably because these are post-spawning fish, the fishing mortality on fully recruited age groups was 0.328, somewhat higher than  $F_{0.1} = 0.3$ . The weighted mean  $F$  on fish age 3 and older for the entire Div. 4WX in 1977-78 would be 0.252. It should be noted that this Div. 4XWb TAC includes the inshore catch and some amount should set aside for this fishery; in the past assessments, this estimated catch has been between 11000-15000 tons.

This assessment was hampered by the lack of any independent estimates of stock abundance. Since these herring fisheries are largely dependent on young fish and projections are required for two fishing seasons hence, the size of incoming year classes are very important. Lacking any independent estimates of incoming year-class size severely limits any assessment. Although there are juvenile fisheries in the Bay of Fundy, no relationships clear with year-class size have yet been established. Catch-effort data is no longer useful because of present management initiatives. Herring fisheries in general should be assessed closer to the fishing season and independent estimation of stock status is essential.

Table 1.

1976 Fishing Season Catches - 4WX Herring

	1975		1976											Total		
	<u>Nov.</u>	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>		<u>Dec.</u>	
<u>4kb-X</u> Purse Seine						94	354	5328	13297	19785	16937	2258	329	14	55395	
Weir							905	1945	2222	728	48	103	3		5959	
Trap							29	109	65	98	123	3			427	
Gill Net					1	12	105	1743	601	2822	3011	27			8322	
<u>4ka</u> Purse Seine	45	11718	19802	5631											37195	
<u>4WX</u> Bulgaria										9					9	
Cuba									18	1		9	1	1	30	
France					25										25	
FRG									4	50	140	86			280	
USSR			15	32	789	846	983	947	89			15	23	50	3769	
															<u>Total</u>	114433

Table 2. Cohort analysis - 4WX herring.

Year	Age (years)										Age 2 and older		Age 4 and older	
	2	3	4	5	6	7	8	9	10	10+	Number(x10 <sup>-6</sup> )	Weight(x10 <sup>-3</sup> )	Number(x10 <sup>-6</sup> )	Weight(x10 <sup>-3</sup> )
<b>Stock size</b>														
1967	1248130	1174743	1316709	584070	437102	147897	36425	9467	2145	187	4957	717	2534	531
1968	2361339	978497	899880	862332	378832	213816	68654	25753	7381	1488	5798	753	2458	513
1969	639703	1253129	728799	677848	457616	244265	93064	27275	7113	915	4130	679	2237	511
1970	793544	459921	678095	489051	409547	274361	143429	55750	16590	3387	3324	574	2070	439
1971	859995	553039	323920	296972	218441	226527	123366	80099	26397	7214	2716	428	1303	329
1972	5084470	573568	295654	169137	140386	110445	100753	55742	32446	14793	6577	509	919	230
1973	781954	3575343	404611	107678	68618	46728	46029	38424	22062	14085	5106	607	748	170
1974	1261590	613384	2418167	232161	57013	33050	20739	21756	13511	9321	4681	645	2808	522
1975	1880572	925860	460936	1422261	141941	32876	19712	12172	7895	5825	4910	637	2164	454
1976	750000	1326593	614214	293815	816407	70427	18450	13209	6816	3890	3914	607	1837	419
<b>Catch</b>														
1967	47948	68430	238394	109814	159203	57948	4497	409	296	148	687	135	571	126
1968	751706	79933	65107	274518	72827	90617	31977	15441	5668	1175	1389	177	557	135
1969	70536	384467	118960	160723	110852	62506	22595	6345	2693	722	940	161	425	114
1970	105916	58165	235361	201097	120223	111911	41257	21271	7039	2674	956	195	791	164
1971	144167	173562	106170	113561	75593	93620	50022	36618	7536	5695	807	152	429	126
1972	649254	71934	148516	77207	75384	49065	48700	26055	13792	11679	1172	148	450	113
1973	29656	562616	109530	34422	25562	19361	17604	19836	9661	11120	839	125	247	60
1974	118301	45500	616206	53199	15254	8120	5313	10964	5787	7359	886	147	722	137
1975	235590	158941	92356	384646	50599	9357	3238	3481	2842	4599	946	149	551	121
1976	19922	161637	130597	72334	219788	18960	4967	3556	1835	3071	637	125	455	105
<b>Fishing mortality</b>														
1967	.043	.067	.223	.233	.515	.567	.147	.049	.165	.750			F1	.211
1968	.434	.095	.083	.434	.239	.632	.723	1.087	1.888	.750				.229
1969	.130	.414	.199	.304	.312	.332	.312	.297	.542	.750				.322
1970	.161	.151	.625	.605	.392	.599	.383	.548	.633	.750				.454
1971	.205	.426	.450	.549	.482	.610	.594	.704	.379	.750				.503
1972	.152	.149	.810	.702	.900	.675	.764	.727	.634	.750				.491
1973	.043	.191	.355	.436	.531	.612	.549	.845	.662	.750				.232
1974	.109	.086	.331	.292	.351	.317	.333	.814	.641	.750				.285
1975	.149	.210	.250	.355	.501	.378	.200	.380	.507	.750				.300
1976	.105	.144	.266	.315	.350	.350	.350	.350	.350	.750				.242

Mean F (age 3 and older) weighted by stock size.

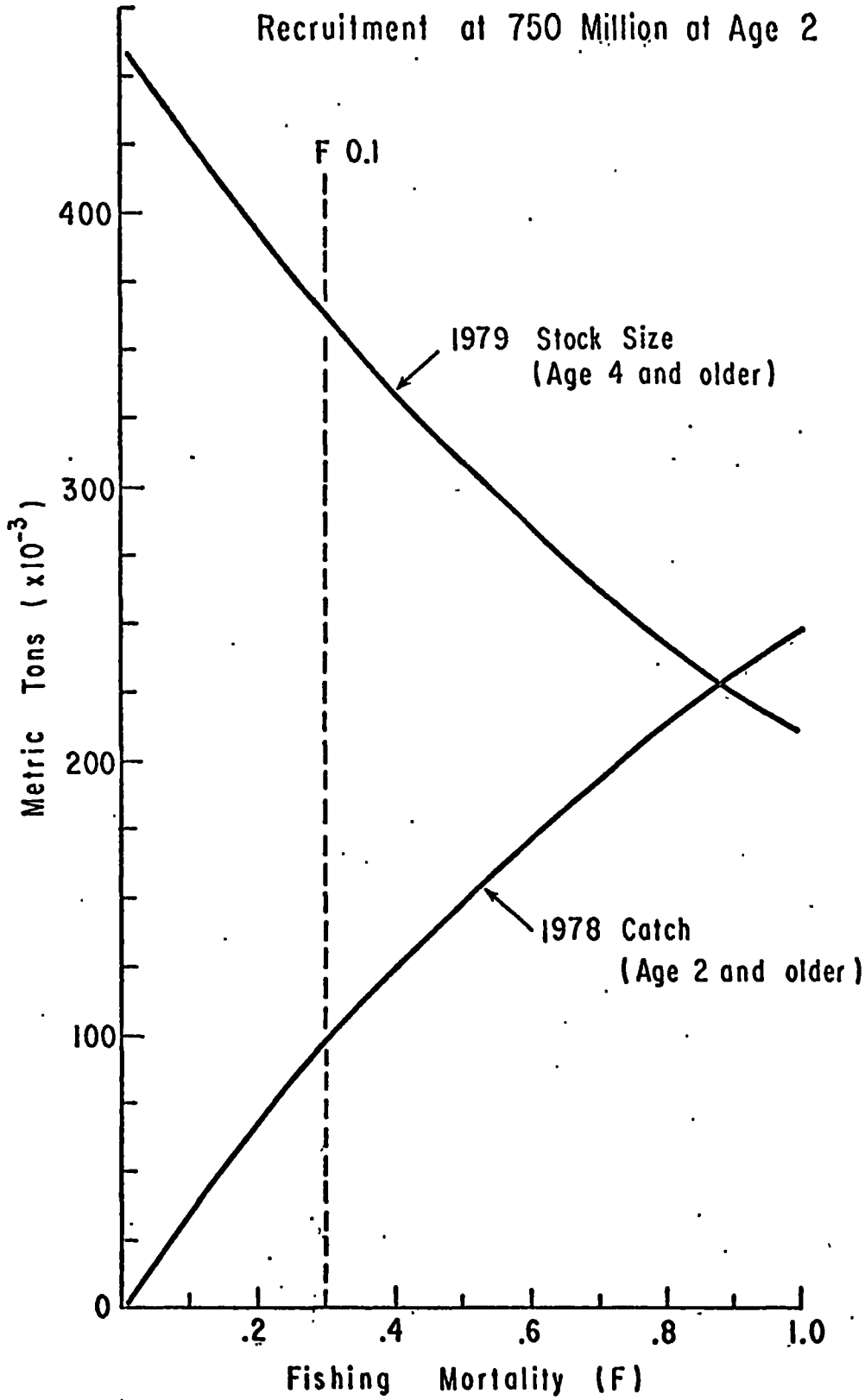


Fig. 1. 4WX Herring - 1978 catch and 1979 stock size.