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Virtual population assessment of cod in ICNAF Divisions 2GH

by

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Introduction

Catches in northern Labrador varied from about 4 thousand metric tons to almost 100 thousand metric tons during the period 1962-71. The average catch over this period was about 36 thousand tons. Some of the effects of the fishery on the cod of this area are assessed.

Materials and Methods

Data pertaining to length and age structure were obtained from the Sampling Yearbooks and supplemented where necessary by data derived from Canada (Nfld.) research vessel surveys. This material was treated in a way similar to that used in previous assessments. No sampling data were available for 1970 and an age composition for this year was derived from trends in catch-per-hour of year-classes in the adjacent years.

Landings were adjusted to catches on the basis of the available discard data.

Values of .2 and .506 were used for natural mortality and $E(1-e^{-Z})$ respectively. Growth rate was derived from data covering the period 1962-71.

Results

Age compositions of the catches

The age compositions of catches in the period 1962-71 are shown in Table 1. The proportion of older fish present in 1962 and 1963 was reduced very quickly in the following years.

Fishing mortalities

Estimates of F for cod at each age are shown in Table 2. Full recruitment took place at age 8. The annual fishing mortality was at a low level in 1962-64 as would be expected from the small catches in those years and for a long period prior (Fig. 1).

Yield per recruit

Yield-per-recruit values were calculated using the partial recruitment shown in Table 2. The maximum yield occurred at $F = 0.7$ but 93% of the maximum was available at $F = 0.3$ (Fig. 2).

Stock sizes

Numbers of cod present at the beginning of the year for the period 1962-71 are shown in Table 3. Total stock size of cod age 3 and older has decreased from a high of about 320 million to a level of less than 150 million after 1968. The numbers of older cod have been much reduced. The year-classes of 1964, 1965 and 1966 appear to be poor.

Maximum catch estimates

No estimate of stock size was derived for 4-year-old cod in 1962 and 1963. The average stock size of cod of age 5 was about 54 million in the period 1962-66 and 24 million in the period 1967-71. The yield per recruit of age 5 cod was .715 Kg. The maximum yield in the period 1962-68 was considered to have depended mostly on the average entry of about 54 million 5-year-olds. This would have allowed a maximum catch of about 39 thousand metric tons. Catches in the early 1970's are considered to depend on the average entry of about 24 million 5-year-olds. The average maximum yield for these years is estimated at about 17 thousand tons.

Effort data reported by Portugal and Spain were used to derive yearly catch-per-hour and total hours fished for the period 1960-71 in order to construct a Schaefer type curve. No significant relationship was found between catch-per-hour and various running averages of effort.

Discussion and Conclusions

The total stock size of cod in this area appears to have decreased by a factor of about one-half. This decrease appears to be largely due to a succession of three poor year-classes. Based on the lower stock size, the maximum sustainable catch in the early 1970's is estimated at about 20 thousand metric tons.

Table 1. Numbers of cod (000's) caught at each age by year during the period 1962-71 in ICNAF Divisions 2Gh.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
2					38			48	9	
3		2	284	95	1,425	89	26	1,756	1,195	27
4		20	411	541	3,621	7,094	2,149	4,473	1,638	3,741
5	79	134	1,469	1,977	4,517	11,546	12,991	4,628	2,376	3,439
6	90	598	765	6,159	4,672	10,625	6,791	9,060	1,746	3,062
7	117	250	2,131	10,322	10,812	5,428	5,010	6,263	3,252	909
8	184	183	445	13,869	9,918	5,002	2,917	4,956	2,132	1,254
9	469	210	341	5,098	12,303	2,260	5,189	1,970	1,647	499
10	362	290	189	1,419	5,464	1,941	1,504	1,766	664	267
11	418	156	293	1,557	2,691	790	2,897	1,097	587	137
12	339	140	124	889	2,001	790	812	1,117	346	96
13	230	140	80	496	2,212	401	543	549	362	-
14	168	61	141	630	1,020	389	530	107	173	31
15	164	82	14	434	1,029	174	480	182	34	
16	136	49	17	119	703	100	274	57	57	
17	134	40	5	154	196	104	132	23	18	
18	60	36	42	42	86	74	201	-	7	
19	7	14	35	41	102	16	72	-		
20	2	1		24	3	16	-	-		
21		4		-	154	-	-	-		
22				-	8	22	-	-		
23				2			27			
No. caught	2,959	2,410	6,786	43,868	62,975	46,861	42,545	38,053	16,242	13,462
Wt. caught	4,938	4,032	9,068	52,465	99,360	57,925	58,153	46,308	17,545	12,791

Table 2. Fishing mortality estimates of cod at each age by year during the period 1962-71 in ICNAF Divisions 2GH.

Age	Year	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	Average F 1965-71	% recruited
3			<.001	.005	.002	.023	.005	.001	.082	.018	.0003	.022	3
4			<.001	.012	.011	.080	.15	.15	.24	.10	.071	.11	16
5	.001	.003	.028	.073	.12	.39	.45	.56	.42	.20	.32	.30	45
6	.003	.009	.019	.16	.25	.45	.42	.66	.40	.43	.42	.40	60
7	.008	.010	.042	.38	.45	.50	.40	.86	.52	.52	.42	.50	75
8	.015	.016	.022	.42	.78	.39	.55	.90	.84	.84	.39	.61	100
9	.045	.022	.038	.37	.82	.40	.91	.92	.89	.89	.47	.68	100
10	.070	.035	.025	.22	.88	.28	.51	.95	.97	.97	.34	.59	100
11	.083	.039	.045	.29	.83	.29	.88	.89	1.04	1.04	.54	.68	100
12	.077	.036	.039	.19	.73	.62	.54	1.09	-	-	.46	.61	100
13	.15	.041	.026	.22	.96	.31	1.23	.89	1.51	1.51	-	.85	100
14	.23	.055	.053	.30	.91	.43	.88	.88	-	-	.47	.65	100
15	.32	.16	.016	.23	1.14	.37	1.61	.89	-	-	-	.85	100
16	.52	.15	.046	.19	.72	.30	1.91	.89	-	-	-	.80	100
17	.17	.29	.020	.72	.52	.21	-	.91	-	-	-	.59	100
18	1.07	.064	.55	.23	1.23	.38	-	-	-	-	-	.61	100
Av. 8-13	.073	.032	.033	.29	.83	.38	.77	.94	1.05	1.05	.44		

Table 3. Numbers of cod (000's) present in the stock at the beginning of the year in ICNAF Divisions 2GH, 1962-71.

Age	Year	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
3		-	-	62,821	52,459	69,121	19,687	28,701	24,576	73,890	-
4		-	-	38,009	52,865	47,380	55,678	16,509	23,256	18,749	59,785
5		87,206	49,354	58,672	30,848	44,081	39,207	39,380	11,882	14,626	13,914
6		33,148	72,479	42,560	46,274	23,380	32,025	21,711	20,481	5,496	9,723
7		16,199	27,388	58,434	35,907	32,328	14,947	16,710	11,742	8,717	2,910
8		13,633	12,937	22,512	44,578	19,996	17,019	7,518	9,111	4,088	4,264
9		11,751	10,820	10,166	18,071	23,885	7,500	9,427	3,561	3,031	1,450
10		5,901	9,248	8,484	7,924	10,189	8,680	4,121	3,120	1,161	1,019
11		5,782	4,501	7,346	6,766	5,192	3,447	5,393	2,025	988	360
12		5,040	4,362	3,558	5,699	4,186	1,861	2,120	1,826	645	285
13		1,817	3,832	3,443	2,788	3,860	1,656	826	1,014	501	96
13+		11,929	10,392	10,243	7,648	5,780	3,452	2,999	1,199	503	203
Total		192,406	205,313	326,248	311,827	289,378	205,159	155,415	113,793	132,395	94,009

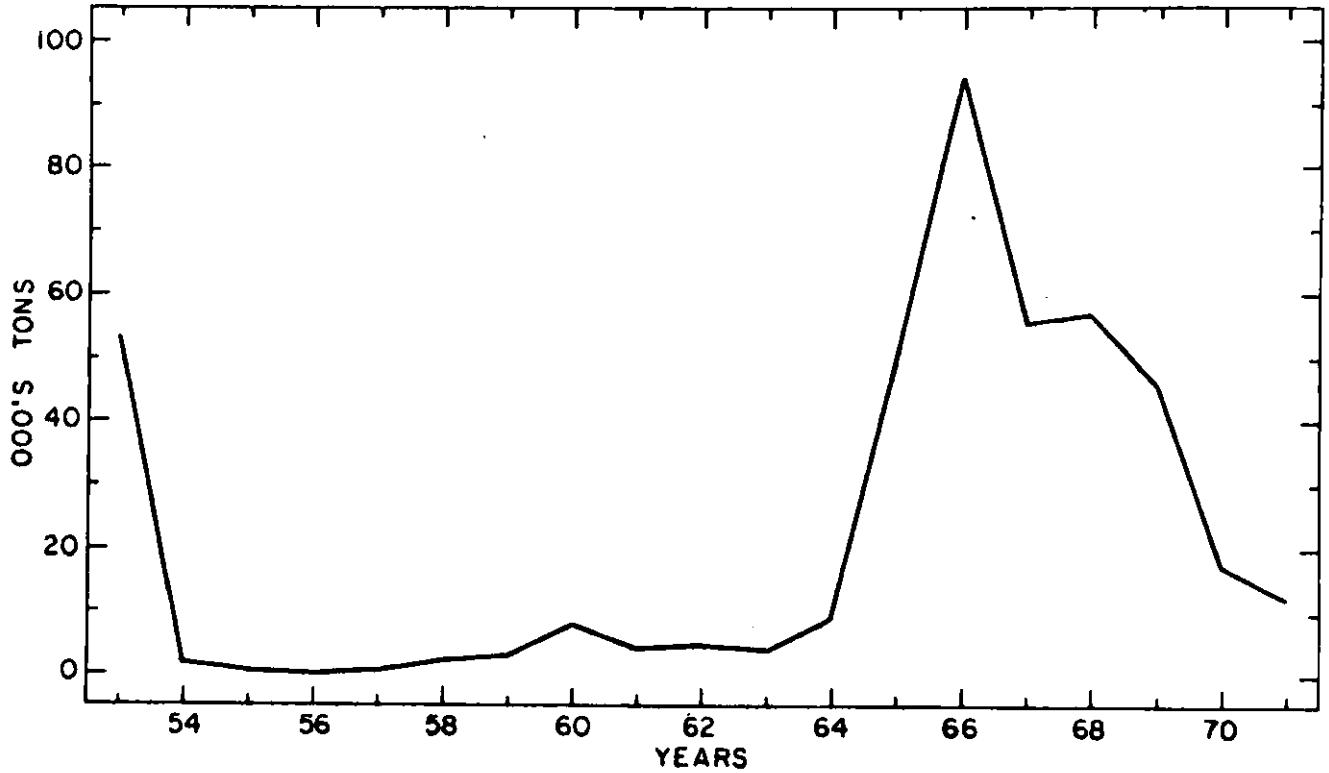


Fig. 1. Landings (000's metric tons) of cod in ICNAF Divisions 2GH in the years 1953-71.

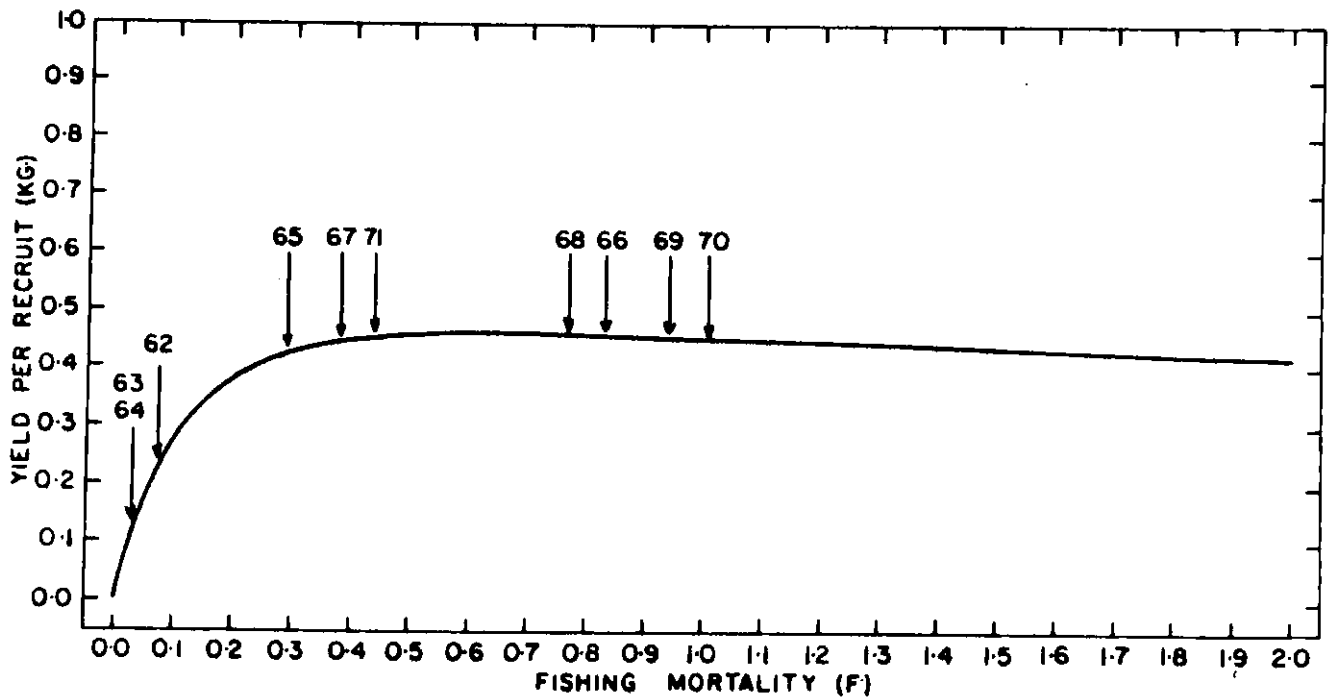


Fig. 2. Yield per 3-year-old recruit in ICNAF Divisions 2GH.