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The Status of the Witch Flounder Resource on the

Southern Grand Bank (NAFO Div. 3N and 3O)

by

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The commercial fishery

Catches of witch flounder prior to 1985 have ranged from 8000 t in 1974 to about 2400 t in 1980 and 1981. Provisional data for 1985 and 1986 indicate catches of 8700 t and 9100 t respectively (Table 1 and 3), the catch in both years being nearly 2 times the total allowable catch of 5000 t. The major prosecutors of this fishery have traditionally been Canada and the Soviet Union both of which accounted for almost the entire catch prior to 1985 (see Table 2). However, in 1985 and 1986 substantial catches have been reported by others such as EEC, Spain, Portugal and the United States particularly in 1987 (Table 1).

The first TAC was placed on this stock during 1974-78 inclusive at 10,000 t based upon average catch levels for the period just prior to that time. Based upon declining catch rates the TAC was reduced to 7000 t in 1979 and 1980 and further reduced to 5000 t in 1981 based upon the results of an equilibrium general production analysis. To the lack of adequate information to perform a detailed analytical assessment the TAC of 5000 t has remained in effect through 1987. An attempt was made in 1986 to update the general production analysis, however, the required relationship between catch rate and effort was not statistically significant. Therefore, the analysis was not considered acceptable.

Catch and effort

As in previous assessments catch and effort statistics were available from the Canada(N) OTB5 otter trawl fishery and are presented for the period 1972-86 in Table 3 and Fig. 1. Catch rates declined from 1972 at .72 t/hr to a low of 0.19 t/hr in 1979 although the values from 1978-82 should be treated with a great deal of caution due to the low levels of main species catch (Table 3). The catch rates for 1985 and 1986 are based upon most of the Canadian catch and should be reasonably acceptable. Although there was a slight decline from 1985 to 1986 the catch rates of 0.54 t/hr and 0.51 t/hr respectively are at about the average level of the 1972-74 period when average removals were about 8000 t.

Commercial catch at age

The catch at age from the Canadian commercial fishery in Div. 3O from 1982-86 is presented in Fig. 2. In 1982, the age ranged from 7 to 16 years with most of the catch in the 10-13 year old range. In 1983, no fish were caught older than 14 years old with most fish in the 9-12 years old range. This pattern has remained relatively constant through 1986. It was reported in the previous assessment that as late as 1974 the commercial catch was comprised of fish as old as 19 years with more than half the catch being 14-19 years old. In recent years fish older than 14 years do not appear to exist any longer in the population. It should be realized that these age compositions came from the Canadian fishery in Div. 3O which has been relatively stable over the period discussed whereas the very high catches in recent years are mainly from Div. 3N outside the Canadian fishery zone. Therefore the catch rates and catch-at-age may only be a reflection of the impact of exploitation in Div. 3O only and not the Div. 3N management unit as a whole.

Research vessel data

Results of Canadian stratified-random surveys in Div. 3N and 3O are presented in Tables 4 and 5 respectively. Survey data were available for 1971-87 for Div. 3N and 1973-87. No survey was conducted in Div. 3N in 1981. These data are only presented for information purposes only since the surveys do not cover depths beyond 200 fms which are particularly important for examining witch distribution. This is particularly evident for Div. 3N where the biomass estimate may only be about 10% of recent catch levels.

Nevertheless, a catch curve was constructed on the catch at age data from surveys in Div. 3N and 3Ø combined for 1982 plus 1984-86 surveys (Fig. 3). The total mortality estimate was high at $Z=0.79$ ($F=0.59$) well beyond an average $F_{0.1}=0.30-0.35$ for witch flounder stocks. However, given the lack of survey coverage such calculations should not be taken at face value.

Prognoses

Given the stability in Canadian commercial catch rates in Div. 3Ø, stability in commercial age composition (and some concept of stability in surveys) in Div. 3Ø and relative stability of commercial catch levels in Div. 3Ø it may be inferred that the component of the resource in that division may be at some stable level of abundance. However, little information is available to evaluate the status of the Div. 3N component except to say that if recent catch levels are reasonably accurate this component should be experiencing a severe decline in abundance.

Table 1. Catches of witch flounder in NAFO Divisions 3NØ by country during 1986.

Country	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Can(M) 3NØ													146
Cuba													46
USSR		10	284	488				2		95	234	466	1724
Japan											1		1
Portugal													1755
Spain									2931 ^b				2033
USA			1	8	68	170	173	87	23	4	2	3	539
Can(N)													
3N		3	6	2	1	6	8	11	4	3	2		46
3Ø	233	535	1388	55	221	243	64	2	7	10	15	45	2818
Panama ^c													450 ^c
Total													9558

^bJanuary-September.

^cInspected and estimated catches.

Table 2. Landings of witch flounder in NAFO Divisions 3N and 3Ø by Canada and USSR from 1974-86.

Year	Country	3N	3Ø
1974	Canada	454	2353
	USSR	1765	3470
	Total	2219	5823
1975	Canada	407	730
	USSR	2135	2884
	Total	2542	3614
1976	Canada	1325	1719
	USSR	1103	1888
	Total	2428	3607
1977	Canada	337	2676
	USSR	1768	974
	Total	2105	3650
1978	Canada	378	787
	USSR	2108	167
	Total	2486	954
1979	Canada	559	634
	USSR	1477	391
	Total	2036	1025
1980	Canada	219	206
	USSR	1069	925
	Total	1288	1131
1981	Canada	313	68
	USSR	2034	10
	Total	2347	78
1982	Canada	383	1377
	USSR	1551	418
	Total	1934	1795
1983	Canada	526	1148
	USSR	1853	89
	Total	2379	1237
1984	Canada	108	726
	USSR	1677	303
	Total	1763	1029
1985	Canada	121 ^a	2625 ^a
	USSR	1840 ^a	68 ^a
	Total	1961 ^a	2693 ^a
1986	Canada	47 ^a	2963 ^a
	USSR	1675 ^a	49 ^a
	Total	1722 ^a	3012 ^a

^aProvisional.

Table 3. Catch effort statistics for witch flounder in Divisions 30, 1972-86 from Canada (N) based trawlers (TC5).

Year	CPUE (t/hr)	Main species catch (t)	Total catch	% Main species
1972	0.716	2751	9177	30
1973	0.502	4080	6691	61
1974	0.337	1015	8045	13
1975	0.252	595	6156	10
1976	0.271	1291	6035	21
1977	0.365	2436	5806	42
1978	0.249	452	3454	13
1979	0.186	25	3051	1
1980	0.267	25	2419	1
1981	0.352	177	2425	7
1982	0.667	601	3729	16
1983	0.379	816	3616	23
1984	0.327	160	2809	6
1985	0.543	1756	8701 ^a	20
1986	0.511	1946	9108 ^a	21

^aProvisional.

Table 4. Average weight per set of witch flounder in NAFO Division 3N from research vessel surveys from 1971-87.

Stratum	ATC 1971	ATC 1972	ATC 1973	ATC 1974	ATC 1975	ATC 1976	ATC 1977	ATC 1978	ATC 1979	ATC 1980	ATC 327-329 1982	A.N. 1984	W.T. 1985	W.T. 1986	W.T. 1987
357	-	-	1.20(2)	-	-	-	7.26(2)	-	6.50(3)	0.5(3)	0.8(2)	0.0(2)	4.25(2)	5.40(2)	7.00(1)
358	-	2.95(4)	2.42(3)	-	-	-	6.02(2)	-	1.13(2)	1.8(3)	3.5(2)	3.5(2)	11.0(2)	1.20(2)	4.50(2)
359	-	8.47(3)	20.88(3)	-	-	43.28(3)	1.82(2)	-	2.72(4)	36.0(4)	28.5(2)	51.8(2)	1.1(2)	1.90(2)	0.88(2)
360	-	0.11(4)	-	-	0.0(4)	1.36(4)	0.17(4)	2.61(4)	3.23(9)	39.9(11)	37.8(7)	47.3(7)	0.27(16)	1.80(13)	1.63(15)
361	0.0(2)	0.0(3)	0.0(4)	0.0(4)	1.46(4)	0.0(5)	0.45(3)	0.0(4)	0.14(8)	33.7(7)	45.5(6)	39.0(5)	0.0(7)	0.00(10)	0.13(9)
362	1.82(2)	0.0(4)	0.0(5)	0.0(4)	0.0(5)	0.0(5)	0.0(5)	0.0(3)	0.08(12)	46.5(11)	46.8(8)	89.9(7)	0.23(11)	0.20(14)	0.05(12)
373	0.0(4)	0.0(4)	0.0(4)	0.0(4)	-	0.0(5)	0.0(4)	0.31(4)	0.08(11)	33.6(8)	31.8(5)	66.1(7)	0.0(9)	0.00(14)	0.00(13)
374	0.0(2)	0.0(2)	0.0(4)	0.0(2)	0.0(2)	-	0.0(3)	0.0(4)	0.0(4)	54.7(3)	12.4(4)	112.1(3)	0.0(4)	0.00(16)	0.00(5)
375	0.30(3)	0.0(3)	0.0(3)	0.0(3)	0.0(3)	-	0.0(4)	0.09(5)	0.0(5)	16.8(4)	18.5(5)	46.2(5)	0.0(8)	0.00(18)	0.00(8)
376	1.13(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(3)	0.0(3)	0.0(2)	0.0(4)	71.3(3)	22.9(7)	10.6(4)	0.0(7)	0.00(9)	0.06(8)
377	0.45(2)	0.0(2)	0.0(2)	1.13(3)	0.0(2)	-	13.17(2)	0.0(2)	1.29(3)	36.1(4)	62.0(2)	319.5(2)	0.0(2)	0.00(2)	5.00(2)
378	0.0(3)	0.45(2)	1.36(2)	2.88(3)	-	-	4.81(2)	11.81(2)	7.57(3)	10.0(2)	6.5(2)	21.5(2)	1.13(2)	1.70(2)	8.75(2)
379	0.68(2)	-	0.68(2)	1.82(2)	-	-	14.30(2)	4.77(2)	5.60(3)	9.7(3)	2.0(2)	4.5(2)	0.9(2)	1.80(2)	1.00(2)
380	-	5.56(2)	2.12(3)	1.99(4)	-	-	6.81(2)	-	4.20(2)	2.7(3)	-	1.3(2)	3.25(2)	0.00(3)	9.50(2)
381	-	0.91(4)	0.0(3)	0.0(3)	1.08(2)	-	5.45(2)	11.35(3)	2.57(3)	13.1(4)	5.6(2)	53.8(2)	0.3(2)	1.50(3)	4.00(2)
382	-	0.0(4)	0.0(3)	0.0(2)	-	0.0(2)	0.61(3)	0.0(3)	0.0(3)	25.5(4)	56.8(2)	2.8(3)	0.0(4)	0.00(4)	0.13(3)
383	-	0.0(2)	0.0(2)	-	-	0.0(3)	0.0(3)	0.0(3)	0.0(3)	33.0(4)	19.8(2)	61.5(3)	0.67(3)	0.00(4)	0.42(3)
723	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
724	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
725	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
726	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
727	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
728	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total wt (tons)	432	409	754	776	218	1674	768	973	1165	556	1166	1439	462	638	974

Table 5. Average weight per set of witch flounder in NAFO Division 38 from research vessels surveys from 1973-87.

Stratum	1973		1975		1976		1977		1978		1979		1980		1981		1982		1984		1985		1986		1987		
	ATC 207	208 209	ATC 233	ATC 245	ATC 245	ATC 263	ATC 277	ATC 291	ATC 303	ATC 318-319	ATC 327-329	A.N.27	A.N.43	A.N.43	ATC 327-329	A.N.27	A.N.43	ATC 327-329	A.N.27	A.N.43	W.T.	W.T.	W.T.	W.T.	W.T.	W.T.	W.T.
329	0.0(2)	-	-	29.96(2)	1.36(3)	0.96(5)	0.04 (6)	0.0 (2)	0.0(2)	0.0(6)	0.0(5)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)	0.0(8)
330	0.15(6)	0.15(3)	0.0 (3)	0.0 (2)	0.0 (2)	0.42(6)	1.62 (7)	0.0 (2)	1.13(4)	0.0(7)	0.0(4)	0.0(10)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.0(9)
331	0.0 (2)	0.0 (2)	-	0.0 (2)	-	6.14(2)	0.76 (3)	6.25 (2)	-	0.07(4)	28.83(3)	5.5(3)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)	0.50(4)
332	-	3.40(2)	9.69(3)	12.41(3)	9.69(3)	10.76(3)	0.40 (4)	15.50 (2)	-	72.75(4)	19.0(2)	61.5(5)	15.50(6)	22.96(5)	15.50(6)	15.50(6)	15.50(6)	15.50(6)	15.50(6)	15.50(6)	15.50(6)	15.50(6)	15.50(6)	15.50(6)	15.50(6)	15.50(6)	15.50(6)
333	-	0.68(2)	1.59(2)	1.59(2)	0.23(2)	1.51(3)	0.34 (2)	3.25 (2)	-	19.38(4)	0.40(2)	2.38(2)	0.30(3)	0.00(2)	0.30(3)	0.30(3)	0.30(3)	0.30(3)	0.30(3)	0.30(3)	0.30(3)	0.30(3)	0.30(3)	0.30(3)	0.30(3)	0.30(3)	0.30(3)
334	-	-	1.36(2)	1.36(2)	0.11(2)	1.36(3)	0.38 (3)	1.75 (2)	-	9.07(4)	0.0(2)	3.25(2)	2.50(2)	0.07(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)	2.50(2)
335	0.0 (2)	-	-	4.62(3)	-	0.79(2)	0.0 (2)	7.17 (3)	-	2.25(2)	0.0(2)	12.15(2)	1.90(2)	0.01(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)	1.90(2)
336	0.61(3)	1.25(2)	6.81(2)	15.89(2)	6.81(2)	1.59(2)	0.28 (4)	12.50 (2)	-	15.00(2)	0.50(2)	0.5(2)	2.00(2)	1.30(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)	2.00(2)
337	2.80(3)	0.68(3)	6.54(2)	6.54(2)	3.63(2)	1.25(2)	0.0 (4)	2.17 (3)	-	1.67(3)	0.45(2)	29.7(5)	11.60(5)	4.88(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)	11.60(5)
338	13.26(5)	5.90(2)	10.74(3)	10.74(3)	3.63(4)	0.14(5)	0.32 (7)	4.40 (5)	-	0.28(5)	0.70(5)	32.22(9)	5.30(9)	9.79(10)	5.30(9)	5.30(9)	5.30(9)	5.30(9)	5.30(9)	5.30(9)	5.30(9)	5.30(9)	5.30(9)	5.30(9)	5.30(9)	5.30(9)	5.30(9)
339	2.95(2)	0.0 (2)	-	-	-	2.95(2)	2.42 (3)	-	6.75(2)	0.45(4)	4.00(2)	0.0(3)	0.10(3)	3.40(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)	0.10(3)
340	-	0.0 (3)	2.19(6)	2.19(6)	0.0 (3)	0.57(2)	3.15 (7)	0.0 (2)	0.40(3)	0.07(6)	0.13(4)	0.64(9)	0.00(8)	0.11(9)	0.00(8)	0.00(8)	0.00(8)	0.00(8)	0.00(8)	0.00(8)	0.00(8)	0.00(8)	0.00(8)	0.00(8)	0.00(8)	0.00(8)	0.00(8)
341	0.0 (2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
351	0.14(5)	0.67(4)	0.0 (4)	0.0 (4)	0.32(5)	0.0 (5)	0.91(11)	0.65(10)	19.50(4)	0.39(9)	2.23(6)	0.87(9)	1.60(14)	0.86(13)	1.60(14)	1.60(14)	1.60(14)	1.60(14)	1.60(14)	1.60(14)	1.60(14)	1.60(14)	1.60(14)	1.60(14)	1.60(14)	1.60(14)	1.60(14)
352	0.09(5)	2.83(4)	0.17(4)	0.17(4)	0.23(5)	0.34(4)	0.87 (6)	3.14(11)	-	0.61(7)	0.29(7)	3.32(11)	0.70(14)	4.34(13)	0.70(14)	0.70(14)	0.70(14)	0.70(14)	0.70(14)	0.70(14)	0.70(14)	0.70(14)	0.70(14)	0.70(14)	0.70(14)	0.70(14)	0.70(14)
353	18.77(3)	7.42(3)	11.80(2)	11.80(2)	8.78(3)	11.36(3)	1.59 (5)	7.50 (4)	-	23.83(3)	25.00(2)	8.33(6)	7.70(7)	12.08(6)	7.70(7)	7.70(7)	7.70(7)	7.70(7)	7.70(7)	7.70(7)	7.70(7)	7.70(7)	7.70(7)	7.70(7)	7.70(7)	7.70(7)	7.70(7)
354	22.40(3)	-	14.07(3)	14.07(3)	2.27(2)	-	1.19 (4)	8.50 (3)	0.25(2)	7.50(2)	8.00(2)	2.0(3)	17.00(3)	4.25(2)	17.00(3)	17.00(3)	17.00(3)	17.00(3)	17.00(3)	17.00(3)	17.00(3)	17.00(3)	17.00(3)	17.00(3)	17.00(3)	17.00(3)	17.00(3)
355	0.23(2)	2.72(2)	4.99(2)	4.99(2)	-	-	0.45 (4)	2.75 (2)	1.90(2)	12.75(2)	4.00(2)	13.0(2)	2.60(2)	4.75(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)	2.60(2)
356	0.91(2)	-	-	-	-	-	0.68 (2)	27.50 (2)	0.85(2)	-	0.50(2)	8.75(2)	2.10(2)	2.15(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)	0.50(2)
717	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
718	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
719	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
720	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
721	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
722	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total wt. (tons)	4899	2609	9025	2808	2760	1425	4309	6014	13,735	4,675	6,100	4,675	6,100	4,675	6,100	4,675	6,100	4,675	6,100	4,675	6,100	4,675	6,100	4,675	6,100	4,675	6,100

Catch Rates of Witch in Div. 3N0, 1972-1986

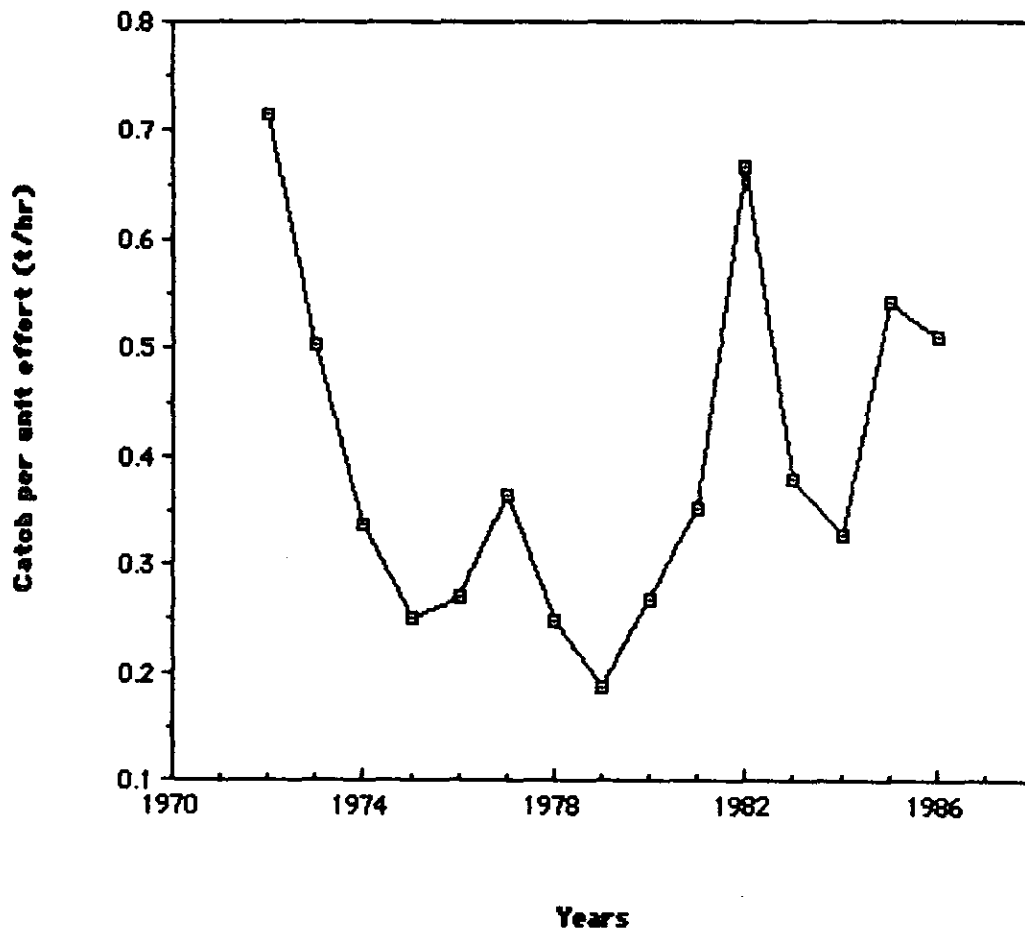


Fig.1 Catch per unit of effort of witch from Canadian TC5 trawlers fishing main species witch in Div 30 from 1972-1986.

Comm. Age Composition, Witch Div. 30

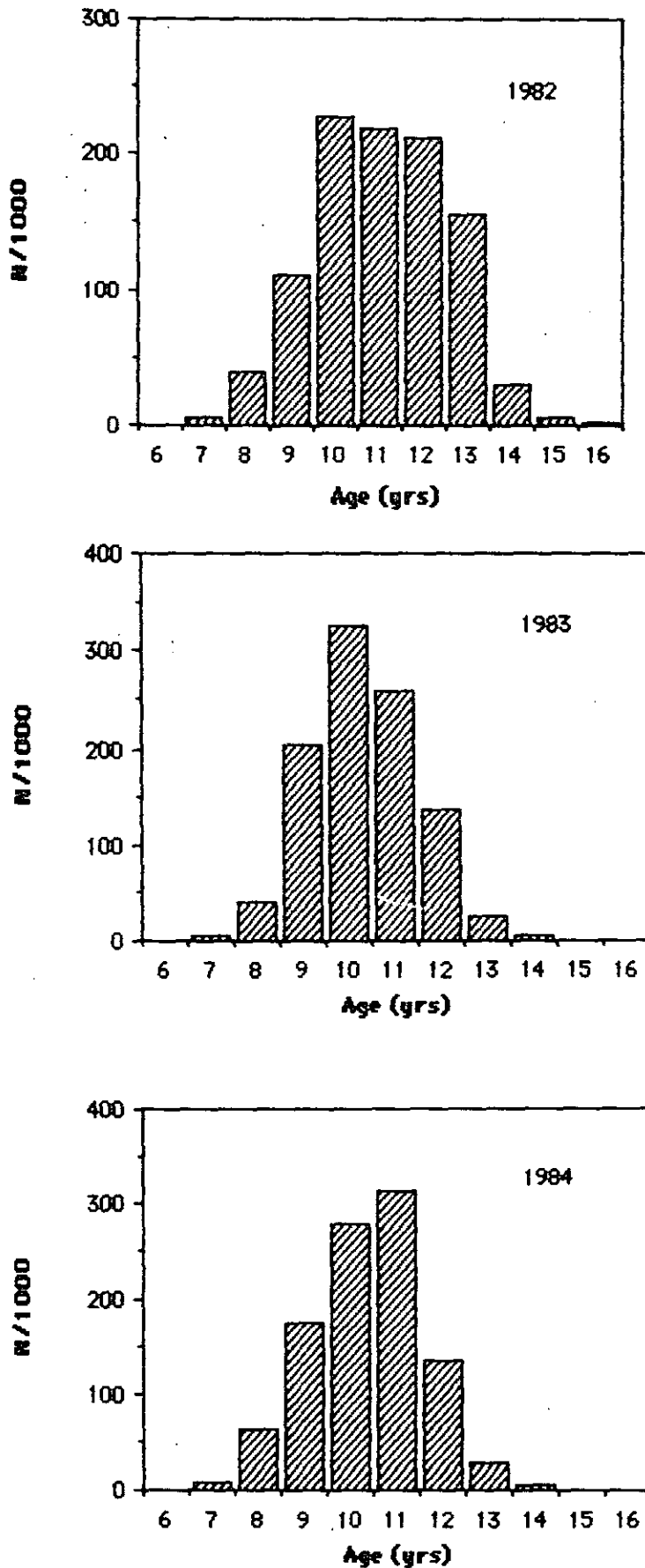


Fig. 2. Catch at age of witch from Division 30 by Canada.

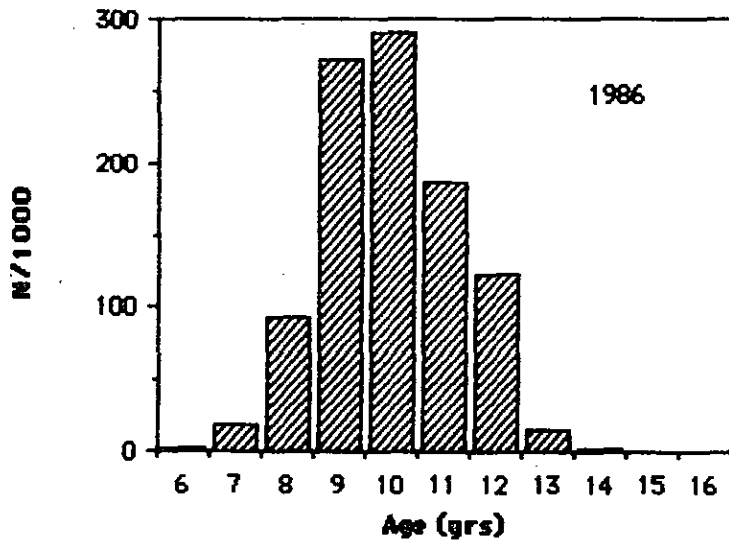
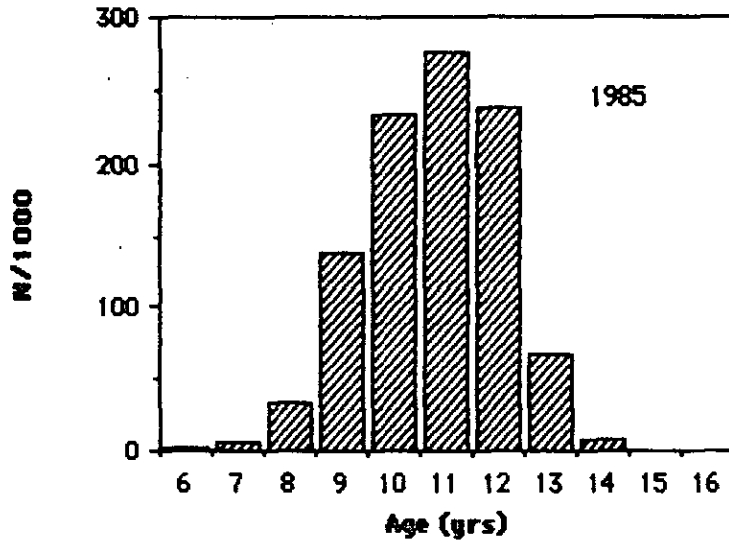


Fig. 2. Cont'd.

Catch Curve, Witch Div. 3NO Research Data

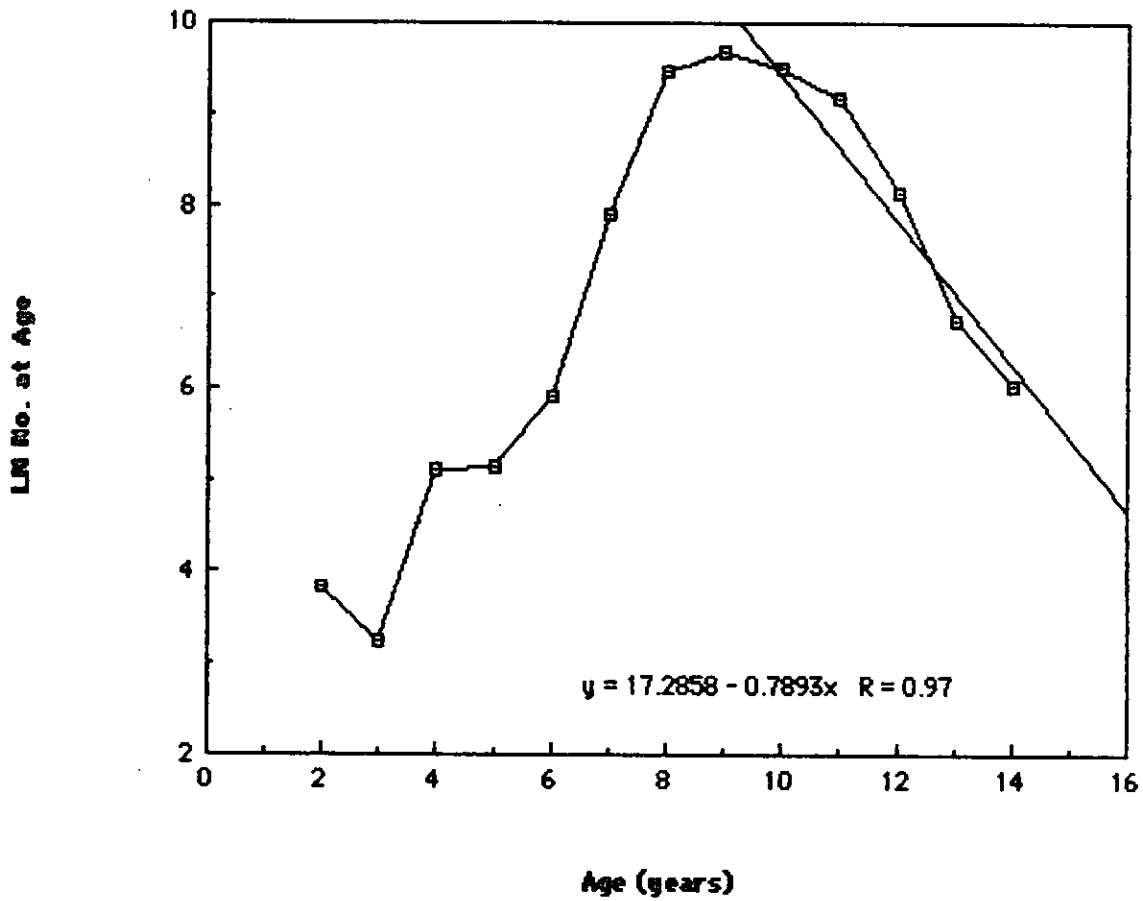


Fig. 3. Catch curve of witch in Div. 3NO from research vessel data collected during 1982 and 1984-1986.