An Update of the Status of the Witch Flounder Resource in NAFO Divisions 2J, 3K and 3L

by

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Abstract

Catches of witch flounder in Div. 2J, 3K and 3L peaked at about 24,000 t in 1973, declined almost steadily to 1980 at about 3500 t, and remained stable to 1985. The 1986 catch of 1300 t is the lowest reported catch in more than 20 years. A biomass estimate for 1986 for the three divisions combined as determined from fall surveys indicates a minimum trawlable biomass of 25,000 t which is low compared to recent years. Age compositions from both research and commercial samples indicate a stable age structure in recent years at low levels of fishing pressure and despite this the age span has not increased. Long-term estimates of mortality suggest that fishing mortality in the late 1970's was probably 2-3 times the $F_{0.1}$ level of about 0.30.

Résumé

Les prises de plie grise dans les divisions 2J, 3K et 3L ont culminé à environ 24 000 t en 1973, puis ont décliné de façon presque constante jusqu'en 1980 pour s'établir à environ 3 500 t, et ce niveau s'est maintenu jusqu'en 1985. La prise de 1 300 t en 1986 est la plus faible, rapportée sur une période de plus de 20 ans. Une estimation de la biomasse pour 1986, en ce qui concerne les trois divisions combinées, d'après des relevés automnaux, indique une biomasse chalutable minimale de 25 000 t, faible comparativement aux dernières années. Les compositions d'âge à partir des prélèvements tant scientifiques que commerciaux indiquent que la structure d'âge est restée stable au cours des dernières années, en présence de faibles efforts de pêche et que malgré cela, la gamme d'âge ne s'est pas élargie. Les estimations permettent de croire que la mortalité due à la pêche représentait probablement à long terme, vers la fin des années 70, 2 à 3 fois le niveau $F_{0,1}$ qui était d'environ 0,30.

Nominal Catches

The fishery for witch flounder in the Labrador-eastern Newfoundland area (NAFO Div. 2J, 3K and 3L) started in the early 1960's. Catches began to increase sharply in the mid 1960's to peak at about 24,000 t in 1973 (Fig. 1). It should be noted, however, the catches up to 1973 are based upon a formula designed to breakdown reported catches of unspecified flounders into their respective species groups. Subsequent to 1973 the catches of witch flounder in this area declined as sharply as they had increased and leveled off at an average of about 3000-4000 t annually from 1980-85. The catch in 1986 was less than 1300 t which is the lowest in over 20 years (Fig. 1 and Table 1).

Historically the major prosecutors of this fishery have been Poland, the Soviet Union, and Canada. The main reason for the very low catch level in 1986 was the lack of effort from Poland and the Soviet Union who usually account for a considerable proportion of the catch (Fig. 2). Early estimates from the foreign observer program indicate that as of April 24, 1987 Poland has taken 700 t of witch against an allocation of 1000 t with two weeks left to fish. During April their catch rates have been as high as 25 t/day averaged over week long periods. It would appear that should these catch rates be maintained, the Polish allocation for 1987 is likely to be taken.

Biomass Estimates From Surveys

Estimates of biomass from surveys are presented in Tables 2, 3, and 4 for NAFO Div. 2J, 3K, and 3L respectively.

For Div. 2J where survey coverage has been rather extensive (Table 2) biomass estimates have ranged from as low as 843 t in 1978 to as high as 4141 t for 1986, the most recent estimate. The average over the 10 year period is about 2700 t.

For Div. 3K, survey coverage, while extensive in general, has often missed deep strata that are quite important in assessing the abundance of deepwater species such as witch flounder (Table 3). This, unfortunately, is particularly evident in the 1986 survey where several of the deep strata were missed and the 1986 survey estimate of biomass was the lowest in the series at less than 15,000 t. The estimate of 23,560 t for 1985 was also lower than the average since 1978 of about 30,000 t, however, this was attributed largely to cold hydrographic conditions affecting the distribution and catchability of the species. This low estimate for 1986 could not be attributed to adverse temperature conditions. It is noteworthy also that the mean catch per set for nearly all strata fished have been declining since 1984.

In Div. 3L the estimated biomass from the spring survey was 2020 t compared to the 1985 estimate of 4355 t from the spring survey (Table 4). However, in 1986 several key deep strata were missed and it would appear that judging from the distribution of witch flounder from the 1985 seasonal surveys the fish accumulate in these deep zones in winter and spring compared to summer and fall. The 1986 fall survey, on the other hand, yielded an estimate of 6582 t compared to 4848 t in the 1985 fall survey despite the fact that several

key strata were missed in 1986. These data nevertheless should be treated with some degree of caution since about 60% of the estimated biomass for the division is based upon 3 strata (346, 735, and 736) and a total of only 5 of the 142 successful sets in the survey.

Given the limitations of the fall surveys as expressed, the minimum estimate for the three divisions combined in 1986 is about 25,000 t.

Age Compositions from Research Surveys

Age compositions from research vessel surveys in Div. 3K during 1978-86 inclusive are presented in Table 5 with a graph of the 1978 and 1986 age compositions presented in Fig. 3. Although the modes remain the same at age 8 (Fig. 3), the population is comprised of fewer age groups in 1986 with the older ages being less abundant as well. In 1978 fish up to age 16 were present with about 20% of the population older than age 10. In 1986, however, none were caught older than age 12 with less than 5% older than age 10.

Commercial Age Composition

Age compositions were available from the 1986 commercial fishery and are considered to be adequately representative. These data are presented for comparison along with the commercial age composition from the fishery 10 years previous in Fig. 4. In 1976 the age of the commercial catch ranged from 5 to 25 years old with about 35% of the catch older than 13 years. In 1986, the age of the commercial catch ranged from 6-13 years old with obviously no fish older than age 13 years which represents the removal of 12 entire age groups likely the result of the high exploitation levels of the early 1970's.

Mortality Estimates

Due to the nature of the data available, real time estimates of fishing mortality are not possible to compute. However, catch curves were constructed using both the 1986 commercial catch at age and the research survey catch at age from Div. 3K in 1986 in order to evaluate long term estimates of mortality (Fig. 5). The Z-values were 0.90 and 1.1 for the research and commercial data respectively. The F-values of 0.7 and 0.90 are around 2-3 times $F_{0.1}$ (about 0.3) and probably reflects the years of very high removals in the late 1970's. It is difficult to directly relate these mortality estimates to catch since catches at the time were comprised of many more age groups which no longer exist in the population. It also should be noted that despite the greatly reduced fishing pressure on this resource, the age span does not appear to be extending which suggests that the resource may have reached an equilibrium level much lower than earlier levels due to factors unknown.

Table 1. Witch flounder landings from NAFO Division 2J 3KL by country for 1986.

Country	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Month Unknown	Total
2J								1	2	1				4
Can(SF)3K	1	8	2	12	6	2	1	2	1		8	1		44
3L	2	1	1	1	4	3	1				7	24		44
EEC													2*	2
GDR	1									1		5		7
Poland										3				3
USSR								6				15		21
Japan								1	4		12	19		36
Portugal														
Norway														
Spain													1*	1
Total														
Can(N)														
2J(OT)	1						12	46						59
2J(GN)														
3K(OT)	16	105	42	29	79	7		1	2	2	4	39		326
3K(GN)							77	116	16	1				210
3L(OT)	3	4	3	26	18	19	14	17	5	41	46	12		208
3L(GN)			7	11	117	129	26							290
Total														1255

*Jan-Sept.

Table 2. Average weight (kg) per 30-minute set of witch flounder from the autumn surveys of the research vessel GADUS ATLANTICA in Division 2J (no. of sets in brackets).

Stratum	GADUS 3 1977	GADUS 12,15 1978	GADUS 27,29 1979	GADUS 42,44 1980	GADUS 58 1981	GADUS 71,72 1982	GADUS 86,87,88 1983	GADUS 101, 102,103 1984	GADUS 116, 117,118 1985	GADUS 131, 132,133 1986
201	0.0(2)	0.00(3)	0.00(2)	0.00(3)	0.00(5)	0.00(6)	0.00(6)	0.40(3)	0.00(6)	0.0(5)
202	0.0(2)	0.00(4)	0.00(4)	0.0(4)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.0(2)
203	0.0(2)	0.00(3)	0.00(3)	0.00(4)	0.00(2)	0.83(3)	2.42(3)	0.00(2)	0.00(3)	0.30(2)
204	1.59(2)	0.00(2)	1.02(2)	-	2.65(2)	3.17(3)	0.33(3)	2.25(2)	0.00(2)	1.55(2)
205	0.0(4)	0.00(4)	0.00(2)	0.00(4)	0.00(8)	0.04(12)	0.00(8)	0.00(8)	0.00(8)	0.0(7)
206	0.43(11)	0.00(7)	0.00(8)	0.00(7)	0.00(11)	0.13(18)	0.00(14)	0.00(11)	0.00(14)	0.0(11)
207	0.0(5)	0.00(4)	0.00(5)	0.00(5)	0.00(9)	0.13(15)	0.00(10)	0.00(7)	0.00(13)	0.0(7)
208	3.46(4)	0.63(5)	1.70(4)	7.75(4)	2.50(2)	13.83(3)	1.50(2)	2.25(3)	13.33(3)	1.10(2)
209	0.52(7)	0.15(6)	0.29(7)	0.67(6)	0.00(6)	0.45(11)	0.64(7)	0.09(7)	0.83(9)	0.0(7)
210	1.58(6)	0.32(7)	1.76(4)	3.00(5)	0.25(3)	1.70(6)	0.00(2)	3.57(4)	0.00(4)	0.0(3)
211	12.26(2)	5.67(4)	2.38(4)	8.71(5)	1.75(2)	6.15(2)	0.20(2)	1.75(2)	1.50(3)	0.90(2)
212	26.06(4)	1.36(2)	13.15(2)	2.75(2)	11.25(2)	19.46(5)	22.27(3)	11.33(3)	19.25(4)	47.83(3)
213	1.48(8)	1.43(7)	1.04(7)	1.66(8)	1.50(6)	1.70(10)	0.93(10)	0.65(5)	0.40(9)	0.61(9)
214	1.55(6)	0.39(7)	0.00(6)	0.52(5)	0.50(5)	0.75(8)	0.49(8)	0.38(4)	0.67(6)	0.27(6)
215	1.59(4)	0.17(8)	0.07(6)	0.00(4)	0.64(5)	0.39(9)	0.00(8)	0.33(3)	0.00(6)	0.0(5)
216	0.0(2)	0.00(3)	0.62(4)	0.63(4)	1.25(2)	1.25(2)	2.33(3)	0.00(2)	0.00(2)	1.00(2)
217	0.0(3)	0.00(2)	0.57(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	-	0.00(2)	1.64(2)
218	0.0(2)	0.00(2)	-	0.00(2)	0.00(2)	0.00(2)	0.00(2)	-	0.25(2)	0.0(2)
219	-	-	-	-	0.00(2)		0.00(2)	-	0.00(2)	0.0(2)
220	-	0.00(2)	-	-	-			-	-	
221	-	-	-	-	-			-	-	
222	4.82(4)	1.71(5)	0.51(4)	1.75(4)	4.00(2)	6.17(3)	1.33(3)	0.83(3)	0.85(2)	0.0(2)
223	0.68(2)	0.00(2)	0.00(2)	0.00(2)	2.00(2)	0.00(2)	0.00(2)	1.00(2)	0.00(2)	6.80(2)
224	0.0(2)	0.00(2)	0.0(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.75(2)
225	0.0(2)	0.00(2)	-	-	-				-	

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Table 2 (Cont'd.)

Stratum	GADUS 3 1977	GADUS 12,15 1978	GADUS 27,29 1979	GADUS 42,44 1980	GADUS 58 1981	GADUS 71,72 1982	GADUS 86,87,88 1983	GADUS 101, 102,103 1984	GADUS 116, 117,118 1985	GADUS 131, 132,133 1986
226	-	-	-	-	-				-	
227	2.72(4)	0.00(2)	0.86(2)	6.75(2)	2.50(2)	5.30(5)	3.25(4)	1.50(3)	2.25(4)	3.97(3)
228	3.43(8)	1.59(2)	2.64(6)	3.30(5)	1.08(6)	4.20(10)	1.58(6)	3.00(7)	0.36(7)	4.97(6)
229	2.67(4)	0.74(3)	2.55(4)	2.50(4)	2.00(2)	2.25(4)	1.76(4)	1.43(3)	0.73(3)	13.00(3)
230	0.0(3)	2.50(4)	-	0.50(2)	0.00(2)	0.00(2)	0.00(2)	0.75(2)	0.00(2)	1.65(2)
231	0.0(2)	0.00(2)	-	0.00(2)	-	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.0(2)
232	0.0(2)	0.00(2)	-	-	-			-	-	
233	-	0.00(2)	-	-	-			-	-	
234	0.0(2)	-	0.79(4)	0.00(4)	0.00(2)	0.00(3)	0.00(2)	0.00(2)	0.00(3)	0.0(2)
235	17.76(4)	0.45(5)	9.30(2)	10.00(2)	11.50(2)	9.00(3)	22.25(2)	11.17(3)	7.75(2)	1.75(2)
236	0.0(2)	0.00(2)	-	-	0.85(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.0(2)
		-								
Total weight (tons)	3,829	843	1884	2337	1,968	3,575	2,751	2,020	2,122	4,141

Table 3. Average weight (kg) per 30-minute set of witch flounder from the autumn surveys of the research vessel GADUS ATLANTICA in Division 3K (no. of sets in brackets).

Stratum	GADUS 12,15 1978	GADUS 27,29 1979	GADUS 42,44 1980	GADUS 58,59 1981	GADUS 71,72 1982	GADUS 86,87,88 1983	GADUS 101, 102,103 1984	GADUS 116, 117,118 1985	GADUS 131 132,133 1986
618	-	-	-	-	-	-	-	0.00(6)	0.0(5)
619	-	-	-	-	-	-	-	0.00(7)	0.0(5)
620	2.65(12)	4.83(10)	1.79(12)	0.45(10)	0.61(9)	0.55(10)	0.36(13)	0.16(14)	0.61(9)
621	2.46(12)	13.07(11)	2.42(13)	1.64(11)	0.69(14)	3.30(12)	1.11(14)	1.20(15)	0.07(14)
622	3.39(2)	16.48(3)	25.25(2)	14.75(2)	7.50(3)	13.50(2)	10.00(4)	19.38(4)	2.75(2)
623	3.64(6)	6.52(4)	4.50(6)	5.41(4)	3.40(5)	6.75(6)	3.30(5)	5.50(6)	1.22(4)
624	4.09(7)	1.98(4)	1.15(4)	5.25(2)	6.00(4)	1.75(4)	4.88(4)	1.00(4)	0.80(2)
625	7.98(6)	23.72(5)	11.58(6)	16.88(4)	5.00(2)	18.00(3)	14.95(5)	14.58(5)	0.48(3)
626	29.51(7)	52.80(5)	55.40(5)	11.30(5)	39.60(5)	36.88(4)	12.67(6)	10.57(5)	0.45(4)
627	18.14(2)	23.59(3)	66.25(2)	94.75(6)	63.00(7)	77.25(6)	63.75(8)	25.64(7)	8.40(5)
628	20.49(7)	55.17(5)	33.00(6)	10.83(6)	22.25(6)	46.83(6)	19.14(7)	21.67(6)	6.05(4)
629	29.65(6)	28.58(2)	41.40(5)	42.33(3)	23.25(2)	42.83(3)	20.75(4)	17.38(4)	4.27(3)
630	14.52(2)	11.74(4)	16.02(4)	15.75(2)	-	12.25(2)	8.80(3)	4.12(4)	2.40(2)
631	8.18(2)	12.26(3)	16.17(3)	60.90(5)	6.00(2)	46.30(5)	48.90(5)	30.36(7)	19.82(4)
632	7.43(7)	13.32(4)	4.26(4)	10.00(2)	8.00(3)	9.17(3)	-	4.67(3)	2.00(2)
633	10.84(9)	12.37(10)	16.90(10)	6.32(8)	10.96(7)	12.49(12)	14.10(10)	8.97(12)	6.09(8)
634	4.09(9)	5.07(8)	5.79(7)	2.94(7)	5.60(11)	1.04(5)	5.25(7)	1.80(9)	1.34(5)
635	13.49(9)	15.59(8)	11.92(6)	10.80(5)	5.50(5)	3.52(6)	15.59(8)	5.49(7)	0.11(6)
636	10.25(7)	10.89(7)	12.21(7)	7.50(6)	5.85(10)	5.00(6)	22.72(8)	4.84(8)	1.77(4)
637	10.11(9)	19.77(7)	12.67(6)	17.00(6)	17.36(7)	35.32(5)	25.08(6)	21.21(7)	5.50(4)
638	13.31(8)	38.64(9)	18.93(9)	26.75(8)	14.62(15)	20.82(11)	40.35(10)	31.32(11)	41.63(4)
639	8.60(9)	8.22(4)	13.67(6)	11.23(6)	7.55(10)	26.71(7)	24.67(8)	12.25(8)	11.08(6)
640	5.45(2)	-	8.00(2)	3.25(2)	23.00(2)	-	21.25(2)	48.33(3)	86.75(2)
641	0.00(2)	0.00(2)	0.50(2)	1.15(2)	1.25(4)	4.33(3)	0.00(3)	17.00(4)	-

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Table 3 (Cont'd.)

Stratum	GADUS 12,15 1978	GADUS 27,29 1979	GADUS 42,44 1980	GADUS 58,59 1981	GADUS 71,72 1982	GADUS 86,87,88 1983	GADUS 101, 102,103 1984	GADUS 116, 117,118 1985	GADUS 131 132,133 1986
642	0.00(2)	-	0.50(2)	0.00(3)	0.33(6)	-	1.33(6)	0.72(5)	-
643	0.00(2)	0.00(2)	-	-	-	-	-	-	-
644	0.00(2)	0.00(2)	-	-	-	-	-	-	-
645	0.34(2)	-	0.00(2)	0.50(2)	16.33(3)	13.25(2)	89.25(2)	9.97(3)	-
646	0.00(2)	0.00(2)	1.75(2)	0.25(2)	0.60(2)	18.50(2)	3.00(2)	2.37(3)	-
647	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	-	-	0.50(3)	-
648	0.00(2)	-	-	-	-	-	-	-	-
649	0.00(2)	-	-	-	-	-	-	-	-
Total weight (tons)	18,855	33,896	31,002	31,210	22,220	36,090	35,730	23,569	14,589

Table 4. Average weight (kg) per 30-minute set of witch flounder from surveys of the research vessel A. T. CAMERON, WILFRED TEMPLEMAN and ALFRED NEEDLER in Division 3L (no. of sets in brackets).

Stratum	ATC 323,325 1981 (Fall)	ATC 333,334 1982 (Fall)	W.T. 7,8,9 1983 (Fall)	W.T. 16,17,18 1984 (Summer)	W.T. 22,23,24 1985 (Winter)	W.T. 28,29,30 1985 (Spring)	W.T. 32,33,34 1985 (Summer)	W.T. 37,38,39 1985 (Fall)	W.T. 48 1986 (Spring)	A. Needler 72 1986 (Fall)
328	-	-	-	-	-	0.00(4)	0.00(4)	0.00(8)	0.0(9)	0.0(6)
341	0.00(2)	0.20(4)	0.00(4)	0.25(4)	0.03(6)	0.00(9)	0.75(4)	0.00(7)	0.0(9)	0.0(7)
342	0.00(3)	0.00(3)	0.00(4)	1.00(5)	0.00(8)	0.00(3)	0.32(2)	0.00(3)	0.0(3)	0.0(3)
343	0.00(4)	-	0.00(3)	0.00(2)	0.00(3)	0.00(3)	1.00(2)	0.00(3)	0.0(4)	0.00(3)
344	1.75(4)	0.00(3)	0.50(6)	1.25(4)	0.00(3)	0.00(5)	9.75(4)	0.06(9)	0.0(8)	0.06(7)
345	19.88(4)	21.87(6)	34.63(8)	1.00(6)	0.00(7)	1.46(5)	19.36(7)	7.11(9)	0.43(7)	3.25(4)
346	46.50(3)	18.63(4)	19.50(5)	27.00(7)	3.67(3)	3.15(2)	9.67(3)	20.60(5)	8.60(5)	32.62(3)
347	2.83(3)	0.40(4)	0.33(6)	14.17(6)	14.88(4)	0.12(5)	3.50(3)	0.00(4)	0.0(5)	0.37(4)
348	0.17(6)	0.60(5)	0.14(11)	4.33(6)	0.00(5)	0.00(18)	1.35(13)	0.00(14)	0.0(12)	0.0(5)
349	0.00(7)	0.00(5)	0.00(9)	1.09(11)	0.03(8)	0.00(14)	0.81(7)	0.00(10)	0.0(14)	0.57(9)
350	0.00(6)	0.00(2)	0.00(8)	1.00(14)	0.00(10)	0.00(12)	0.25(11)	0.00(9)	0.0(11)	0.0(11)
363	0.00(4)	0.50(3)	0.00(3)	0.58(12)	0.00(9)	0.08(8)	1.37(10)	0.00(10)	0.0(10)	0.20(7)
364	1.06(9)	0.46(11)	0.12(11)	0.63(8)	0.41(8)	0.18(18)	0.39(12)	0.00(18)	0.0(17)	0.46(5)
365	0.25(4)	1.25(4)	0.00(5)	0.70(10)	0.08(12)	0.00(7)	0.44(7)	0.00(8)	0.0(5)	0.64(5)
366	1.67(3)	3.50(6)	0.00(4)	1.00(4)	0.00(4)	0.22(6)	0.50(5)	1.94(9)	0.38(8)	1.69(4)
368	0.50(2)	0.75(2)	-	0.82(11)	0.20(5)	2.10(2)	2.75(2)	0.75(2)	1.00(2)	8.57(2)
369	5.75(2)	5.07(4)	1.75(6)	1.00(2)	3.75(2)	2.20(5)	1.82(6)	5.33(6)	10.25(6)	5.77(3)
370	0.25(4)	0.00(6)	0.00(6)	2.86(7)	0.30(5)	0.52(8)	1.08(6)	0.00(9)	0.0(8)	0.0(2)
371	0.00(4)	0.00(5)	0.00(5)	1.29(7)	0.00(7)	0.00(7)	0.42(6)	0.00(7)	0.0(6)	0.0(3)
372	0.00(5)	0.00(7)	0.00(4)	0.29(7)	0.00(6)	0.07(12)	0.23(10)	0.00(17)	0.0(14)	0.0(9)
384	-	0.00(4)	1.00(3)	0.54(13)	0.09(11)	0.00(6)	0.00(2)	0.00(8)	0.0(6)	0.0(5)
385	0.00(8)	0.00(8)	0.00(5)	0.83(6)	0.00(4)	0.13(15)	0.89(8)	0.00(12)	0.08(13)	0.20(8)
386	10.50(3)	1.75(4)	-	1.00(12)	0.00(11)	1.74(5)	1.30(5)	4.36(5)	2.92(6)	10.05(4)

. . . Cont'd.

Table 4 (Cont'd.)

Stratum	ATC 323,325 1981 (Fall)	ATC 333,334 1982 (Fall)	W.T. 7,8,9 1983 (Fall)	W.T. 16,17,18 1984 (Summer)	W.T. 22,23,24 1985 (Winter)	W.T. 28,29,30 1985 (Spring)	W.T. 32,33,34 1985 (Summer)	W.T. 37,38,39 1985 (Fall)	W.T. 48 1986 (Spring)	A. Needler 72 1986 (Fall)
387	4.25(2)	13.83(3)	-	1.38(8)	0.70(5)	5.90(6)	6.17(3)	4.70(4)	2.57(4)	2.50(2)
388	-	0.87(3)	-	1.67(3)	11.63(4)	2.50(2)	7.20(2)	0.90(2)	2.00(2)	
389	-	4.38(4)	-	31.00(2)	10.33(3)	1.10(5)	1.95(4)	1.20(5)	2.70(5)	8.14(4)
390	0.00(3)	0.00(4)	0.00(3)	1.50(6)	0.00(4)	0.00(9)	0.93(7)	0.00(7)	0.06(8)	0.0(6)
391	-	0.00(2)	0.00(2)	0.67(3)	0.12(5)	0.00(2)	0.00(2)	0.75(2)	0.30(2)	0.0(2)
392	-	0.00(2)	1.00(2)	0.00(2)	0.00(2)	2.00(2)	1.25(2)	0.52(2)	0.95(2)	1.00(2)
729	-		-	4.00(2)	0.00(2)	1.25(2)	7.15(2)	11.25(2)	-	11.61(2)
730	-	-		8.50(2)	65.75(2)	8.00(2)	2.00(2)	1.00(2)	-	-
731				4.50(2)	2.25(2)	31.00(2)	3.50(2)	9.50(2)	-	-
732				24.50(2)	44.83(3)	17.75(2)	9.50(2)	8.00(2)	-	-
733				11.00(2)	12.25(2)	3.13(3)	22.25(2)	19.67(3)	-	-
734				5.25(4)	25.33(3)	48.75(2)	1.50(2)	6.00(2)	-	-
735		57.25(2)		0.67(3)	79.00(2)	26.50(2)	5.25(2)	1.50(2)	-	50.00(2)
736			23.00(2)	14.67(3)	14.25(2)	45.50(2)	7.25(2)	11.50(2)	-	30.56(2)
Total weight (tons)	7,461	7,059	5,638	8,498	6,995	4,355	7,697	4,848	2,020	6,582

Table 5. Abundance estimates (000's) of witch flounder from research vessel surveys in Division 3K.

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	Total
1									36	36
2						72		13	18	103
3	29	52	231	15	25	14	146	89	54	655
4	471	402	195	587	462	175	376	460	569	3,697
5	3,234	3,900	387	1,026	1,337	857	1,590	1,620	1535	15,486
6	3,608	6,600	1,354	1,728	1,673	1,747	1,838	2,013	938	21,499
7	4,858	10,634	7,991	8,734	6,569	5,465	4,248	2,477	3139	54,115
8	5,109	8,954	10,273	12,009	8,814	10,585	9,878	9,181	5774	80,577
9	3,153	5,371	7,224	6,721	4,982	10,704	11,045	7,943	3698	60,841
10	2,416	3,849	5,777	4,235	2,149	6,984	6,942	4,297	1921	38,570
11	1,669	2,441	2,921	1,871	1,441	3,776	3,389	2,075	757	20,340
12	1,421	1,274	1,671	831	120	1,098	2,011	704	135	9,265
13	798	528	960	109	17	351	707	86		3,556
14	277	36	161	14			25			513
15	177		20							197
16	18									18

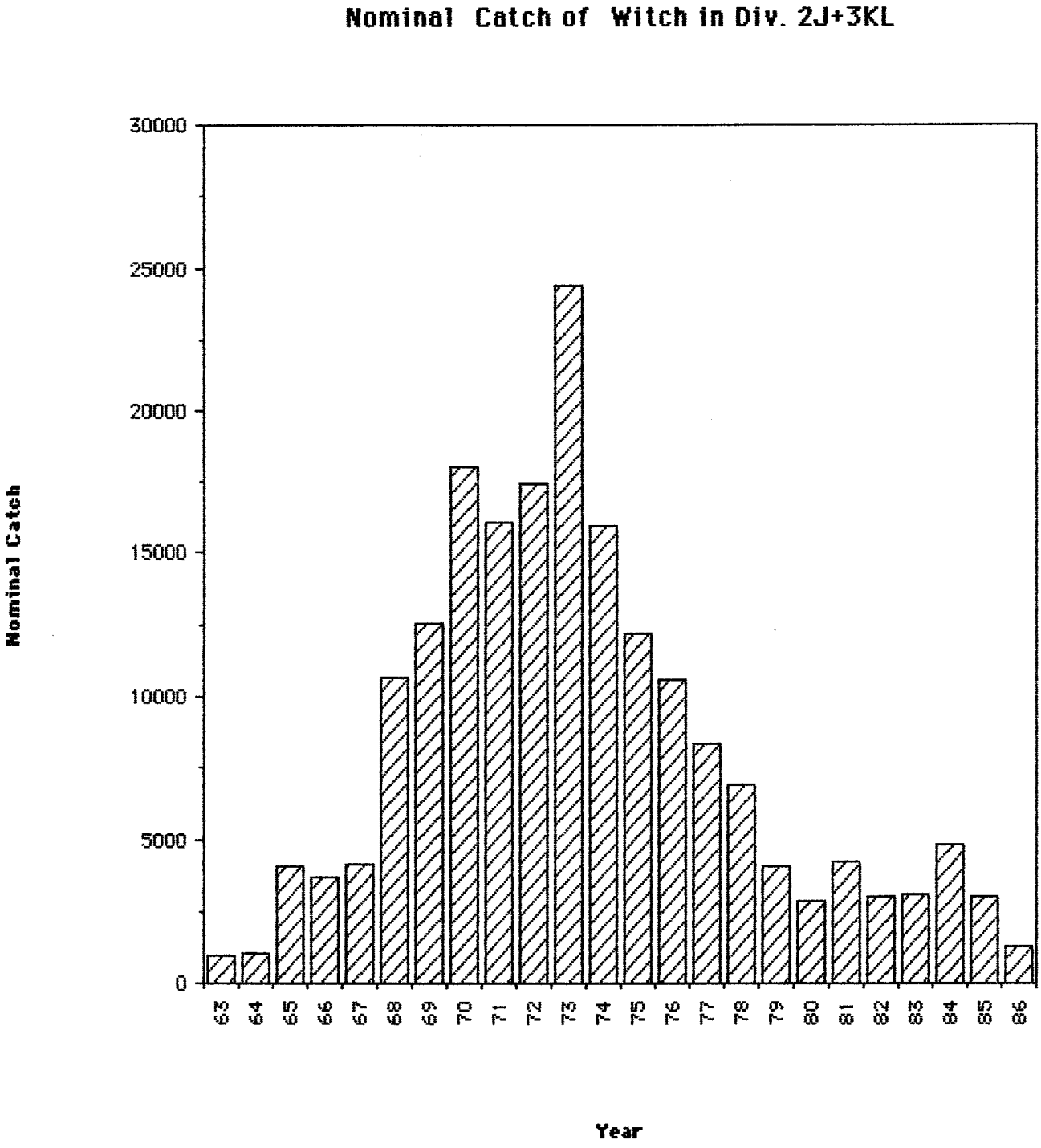


Fig.1 Nominal catch of Witch in NAFO Div. 2J+3KL from 1963-1986.

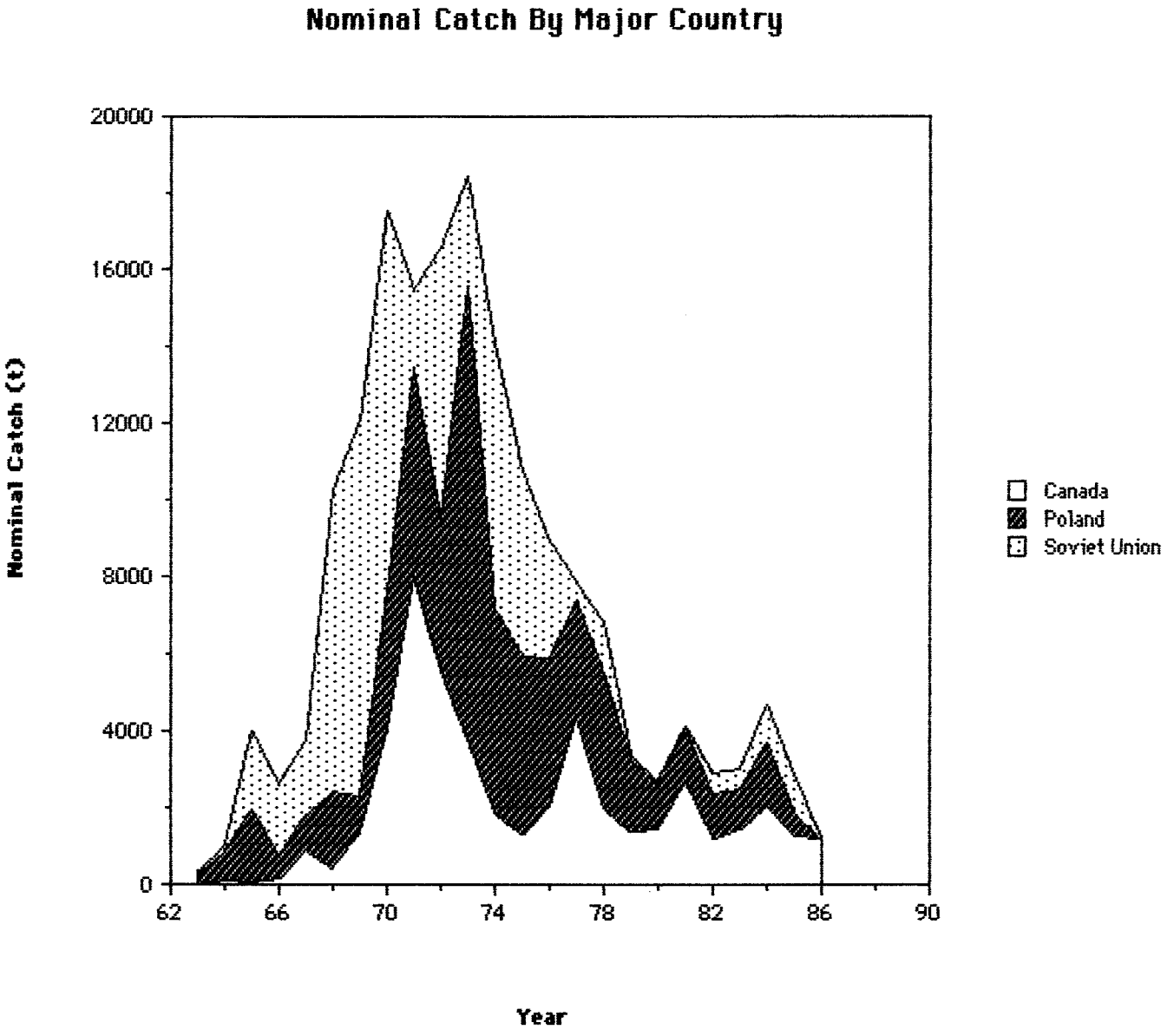


Fig.2. Nominal catch of witch in NAFO Div. 2J+3KL by Canada, Poland and the Soviet Union during 1963-1986.

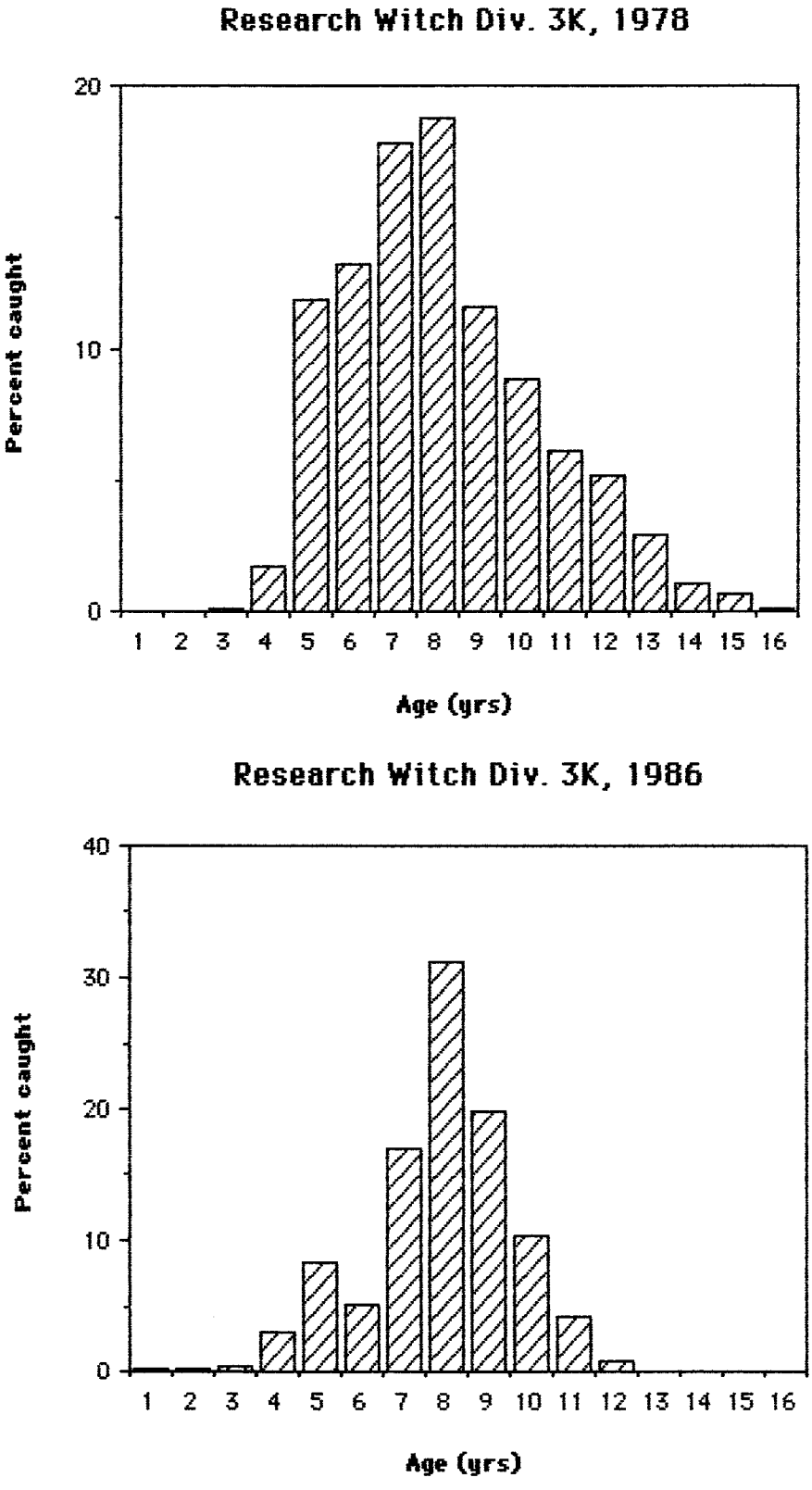
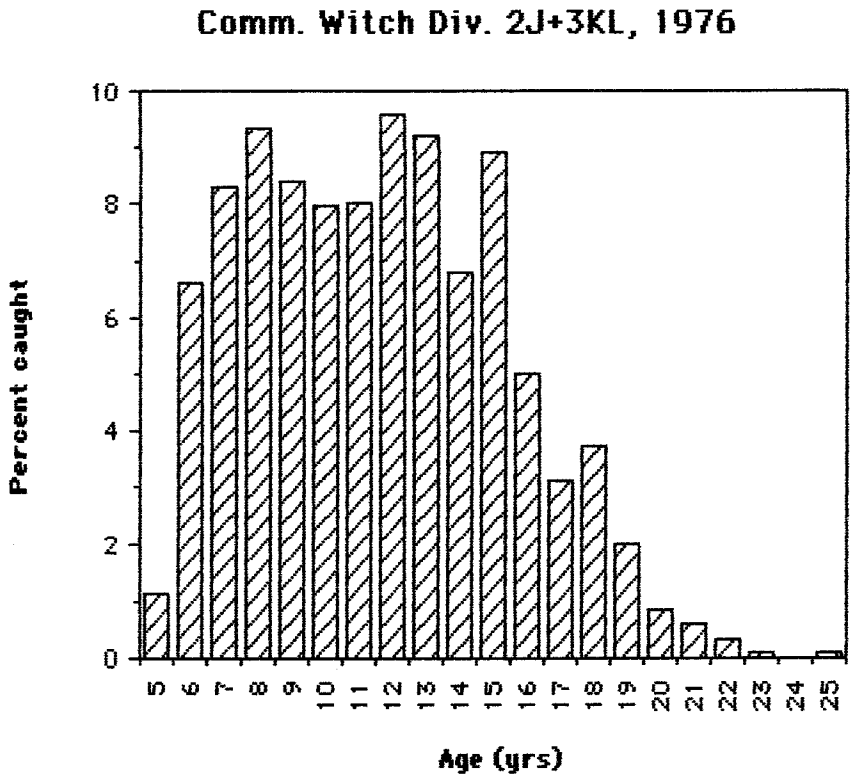


Fig. 3. Age compositions of witch flounder from research vessel surveys in NAFO Div. 3K during 1978 and 1986.



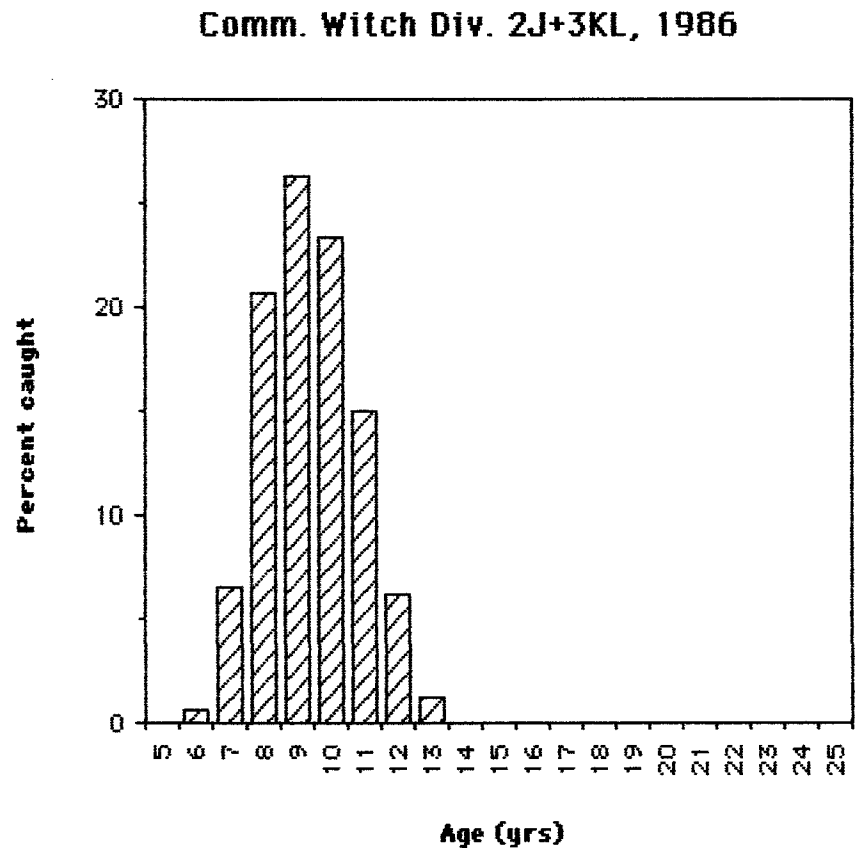


Fig. 4. Age compositions of witch flounder from the commercial fishery in NAFO Div. 2J+3KL during 1976 and 1986.

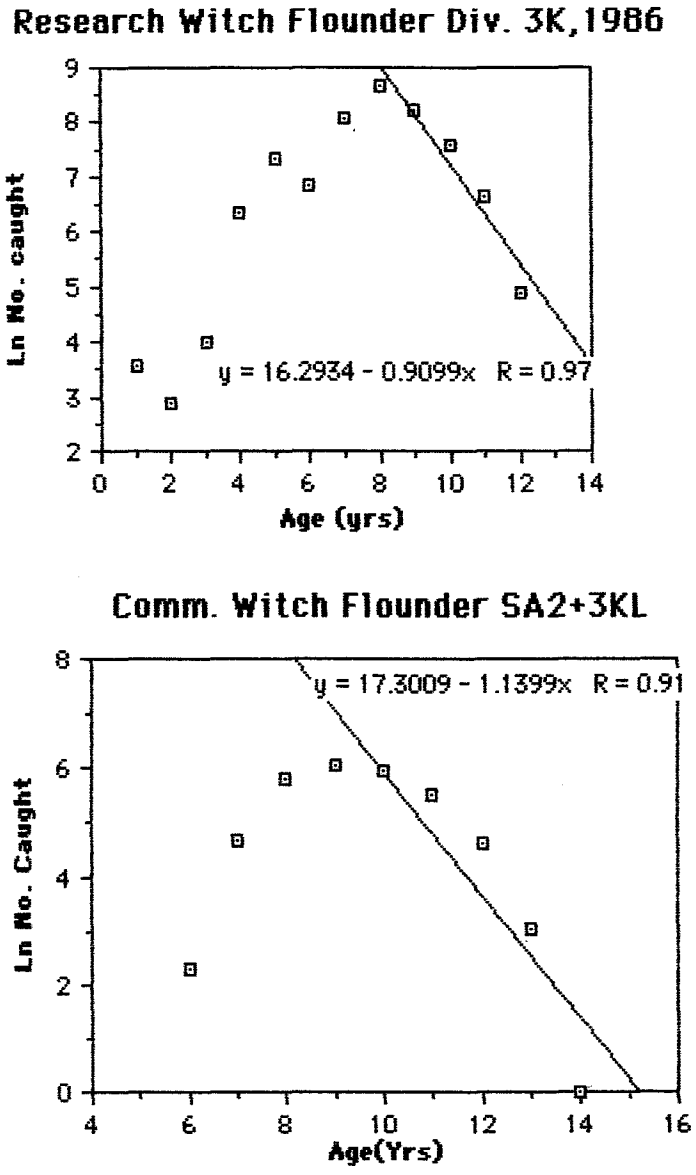


Fig5 Catch curves of Witch Flounder from both research and commercial data, 1986