

Not to be cited without
permission of the authors¹

Canadian Atlantic Fisheries
Scientific Advisory Committee

CAFSAC Research Document 86/69

Ne pas citer sans
autorisation des auteurs¹

Comité scientifique consultatif des
pêches canadiennes dans l'Atlantique

CSCPCA Document de recherche 86/69

Status of the Witch Flounder Resource in NAFO Divisions 2J3KL

by

W. R. Bowering
Fisheries Research Branch
Department of Fisheries and Oceans
P. O. Box 5667
St. John's, Newfoundland A1C 5X1

¹ This series documents the scientific basis for fisheries management advice in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the Research Documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research Documents are produced in the official language in which they are provided to the Secretariat by the author.

¹ Cette série documente les bases scientifiques des conseils de gestion des pêches sur la côte atlantique du Canada. Comme telle, elle couvre les problèmes actuels selon les échéanciers voulus et les Documents de recherche qu'elle contient ne doivent pas être considérés comme des énoncés finals sur les sujets traités mais plutôt comme des rapports d'étape sur les études en cours.

Les Documents de recherche sont publiés dans la langue officielle utilisée par les auteurs dans le manuscrit envoyé au secrétariat.

Abstract

Nominal catches peaked at 24,000 t in 1973 and have declined steadily since that time. Catches since 1979 have been between 3,000-5,000 t annually. Recent estimates of biomass suggest a level of about 32,000 t for the stock area with 75% of the biomass located in Div. 3K alone. The maximum age in the stock prior to high exploitation during the late 1960's and early 1970's was 26 years with most of the catches made up of ages 12+. Since 1978 the maximum age is about 14 years old with most of the exploitation occurring on ages 7-10. Considering the relative abundance indices and stable age composition of recent years, it appears that the stock may have reached a new equilibrium with recent landings of about 4,000 t being near the sustainable level.

Résumé

Les prises nominales ont plafonné à 24 000 t en 1973 et elles ont diminué régulièrement depuis. Les prises annuelles depuis 1979 se sont situées entre 3 000 t et 5 000 t. Les estimations récentes de la biomasse indiquent un niveau d'environ 32 000 t pour le lieu de pêche; 75 % de la biomasse se retrouve cependant dans la seule division 3K. L'âge maximal de la population de poissons avant la forte période d'exploitation de la fin des années 1960 et du début des années 1970 était 26 ans et la plupart des prises étaient composées de poissons de 12 ans ou plus. Depuis 1978, l'âge maximal est de 14 ans environ et les prises comprennent, en grande partie, des poissons de 7 à 10 ans. Compte tenu des indices d'abondance relative et de la composition par âge stabilisée des dernières années, il semble que le stock aurait atteint un nouvel équilibre, les récents débarquements de 4 000 t étant près du niveau optimal.

Nominal catches

Nominal catches of witch flounder from NAFO Divisions 2J,3K and 3L since the fishery began with any intensity from the early 1960's is presented in Fig. 1. Catches in the earlier years were mainly from Div. 2J, however, as the fishery intensified most of the landings were taken in Div. 3K followed by Div. 3L. In recent years, although the catches are considerably lower than during the mid 1970's, nominal catches come almost entirely from Div. 3K.

Catches reached a peak in 1973 at about 24,000 t and has steadily declined to an average of about 3,000-3,500 t over the last several years (Fig. 1). Preliminary figures for 1984 and 1985 are 4,725 t and 2,499 t respectively (Table 1). The major prosecutors of the fishery are Canada, Poland, and the Soviet Union. The major reason for the reduced catch in the 1985 fishery compared to that of 1984 was the result of reduced effort. The portion of the nominal catch by Poland was down by more than 1,000 t in 1985 compared to 1984. This was attributed to late entry into the fishery when the fish are less concentrated as well as malfunctions of the fishing vessels involved. This alone would account for the difference compared to the average of the last several years. Poland also indicated that their witch flounder catch in 1986 is likely to be very low for similar reasons.

Biomass estimates from surveys

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

For Div. 2J, survey coverage has been quite extensive and strata that have generally been missed are not considered to be of particular importance for witch flounder (Table 2). Biomass estimates from this area over the last 9 years since the surveys began ranged from less than 1,000 t in 1978 to near 4,000 t in 1977. The average over the 9 year period is about 2,600 t. The level of biomass over the period in any year is much less than the catch levels experienced during the early years of the fishery. Despite the fact that removals from Div. 2J is negligible during recent years there does not appear to be any real increase in stock biomass in this area.

In Div. 3K most strata have been covered reasonably well since the surveys began in 1978 although there are some years where certain strata are missed which could influence the overall biomass estimate. Estimates ranged from near 19,000 t in 1978 to about 36,000 t in 1983 and 1984. The 1985 estimate is about 24,000 t, much lower than in the past two years but similar to the level in 1982. The average over the eight year period is about 29,000 t.

In Div. 3L, survey coverage for the summer of 1984 and all 4 seasonal surveys in 1986 has been complete. The biomass estimates range from about 4,400 t in the spring of 1985 to near 8,500 t in the summer of 1984. The average for the 5 surveys is about 6,500 t. It should be noted that the summer survey in 1985 provided a lower estimate of biomass than a similar survey in 1984 as did the fall surveys in the other divisions.

The overall average biomass estimate for 1985 for the three divisions is about 32,000 t. This level is down considerably compared to the last 2 years, however, it is not an unusual occurrence over the period of the surveys and is unlikely to be a direct result of exploitation considering the levels of removals in recent years.

Age composition - research

Age compositions of witch flounder for Div. 3K from research vessel surveys are presented in Table 5 and Fig. 2 for 1978-85 inclusive. Ages in Div. 3K ranged from maxima of 13 years to 16 years over the period, however, the age distributions did not vary significantly from one year to the next (Table 5, Fig. 2). It would suggest that there does not appear to be much fluctuation in year-class strength and also that removals during recent years do not seem to be having an adverse effect on the stock at present levels. The high catch levels during the earlier years reduced the maximum age from about 26 years to that which is shown here. This indicates a complete removal of 10 age groups.

The age distributions from the seasonal surveys in Div. 3L in 1985 are generally similar throughout the year despite some variation in abundance estimates (Table 6; Fig. 3). The distribution is not all that different from that of Div. 3K even though they are believed to be separate breeding stocks.

Age composition - commercial

Data on age composition from the commercial fishery for witch flounder in Div. 2J3KL for most years have not been adequate to fully represent the age composition of the total annual catches. However, the 1984 data presented in the previous paper and the 1985 sampling data (Table 7) are probably reasonable approximations of the catch at age during those years. These are presented in Table 8 and Fig. 4. The ages ranged from 4 to 15 years in 1984 and from 5 to 15 years in 1985. There was a slight shift to the younger ages in 1985 mostly as a result of reduced Polish and USSR catches in 1985 who generally fished in deeper offshore waters where larger fish are usually found.

Mortality estimates

Due to the nature of the data available from this fishery, calculation of real time estimates of mortality is not possible. Therefore, long term estimates can only be calculated as done in Table 5 using catch curves. The long term estimate of fishing mortality is $F=0.81$ compared to $F=0.34$ used in the previous assessment, however, the present value is based upon considerably more data. The long term average fishing mortality is quite high and probably reflects the stock decline after the high catches in the late 1960's and early 1970's as well as the virtual annihilation of many older age groups.

Considering the relative abundance indices and stable age compositions of recent years it appears that the stock may have reached a new equilibrium with recent annual landings of about 4,000 t being near the sustainable level. Therefore the TAC advised for 1987, is 4,000 t, down from the current level of 8,000 t.

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
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
218	0.0(2)	0.00(2)	-	0.00(2)	0.00(2)	0.00(2)	0.00(2)	-	0.25(2)
219	-	-	-	-	0.00(2)	-	0.00(2)	-	0.00(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)
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)
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)
225	0.0(2)	0.00(2)	-	-	-	-	-	-	-
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)
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)
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)
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)
231	0.0(2)	0.00(2)	-	0.00(2)	-	0.00(2)	0.00(2)	0.00(2)	0.00(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)
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)
236	0.0(2)	0.00(2)	-	-	0.85(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)
	-	-	-	-	-	-	-	-	-
Total weight (tons)	3,829	843	1884	2337	1,968	3,575	2,751	2,020	2122

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
618	-	-	-	-	-	-	-	0.00(6)
619	-	-	-	-	-	-	-	0.00(7)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
630	14.52(2)	11.74(4)	16.02(4)	15.75(2)	-	12.25(2)	8.80(3)	4.12(4)
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)
632	7.43(7)	13.32(4)	4.26(4)	10.00(2)	8.00(3)	9.17(3)	-	4.67(3)
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)
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)
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)
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)
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)
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)
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)
640	5.45(2)	-	8.00(2)	3.25(2)	23.00(2)	-	21.25(2)	48.33(3)
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)
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

Table 4. Average weight (kg) per 30-minute set of witch flounder from surveys of the research vessel A. T. CAMERON and WILFRED TEMPLEMAN 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)
328	-	-	-	-	-	0.00(4)	0.00(4)	0.00(8)
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)
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)
343	0.00(4)	-	0.00(3)	0.00(2)	0.00(3)	0.00(3)	1.00(2)	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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
368	0.50(2)	0.75(2)	-	0.82(11)	0.20(5)	2.10(2)	2.75(2)	0.75(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)
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)
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)
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)
384	-	0.00(4)	1.00(3)	0.54(13)	0.09(11)	0.00(6)	0.00(2)	0.00(8)
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)
386	10.50(3)	1.75(4)	-	1.00(12)	0.00(11)	1.74(5)	1.30(5)	4.36(5)
387	4.25(2)	13.83(3)	-	1.38(8)	0.70(5)	5.90(6)	6.17(3)	4.70(4)
388	-	0.87(3)	-	1.67(3)	11.63(4)	2.50(2)	7.20(2)	0.90(2)
389	-	4.38(4)	-	31.00(2)	10.33(3)	1.10(5)	1.95(4)	1.20(5)
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)
391	-	0.00(2)	0.00(2)	0.67(3)	0.12(5)	0.00(2)	0.00(2)	0.75(2)
392	-	0.00(2)	1.00(2)	0.00(2)	0.00(2)	2.00(2)	1.25(2)	0.52(2)
729	-	-	-	4.00(2)	0.00(2)	1.25(2)	7.15(2)	11.25(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)
736	-	-	23.00(2)	14.67(3)	14.25(2)	45.50(2)	7.25(2)	11.50(2)
Total weight (tons)	7,461	7,059	5,638	8,498	6,995	4,355	7,697	4,848

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	Total
1									
2						72		13	85
3	29	52	231	15	25	14	146	89	601
4	471	402	195	587	462	175	376	460	3,128
5	3,234	3,900	387	1,026	1,337	857	1,590	1,620	13,951
6	3,608	6,600	1,354	1,728	1,673	1,747	1,838	2,013	20,561
7	4,858	10,634	7,991	8,734	6,569	5,465	4,248	2,477	50,976
8	5,109	8,954	10,273	12,009	8,814	10,585	9,878	9,181	74,803
9	3,153	5,371	7,224	6,721	4,982	10,704	11,045	7,943	57,143
10	2,416	3,849	5,777	4,235	2,149	6,984	6,942	4,297	36,649
11	1,669	2,441	2,921	1,871	1,441	3,776	3,389	2,075	19,583
12	1,421	1,274	1,671	831	120	1,098	2,011	704	9,130
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
Age	8+	7+	8+	8+	8+	9+	9+	8+	8+
r ²	0.87	0.84	0.88	0.91	0.91	0.96	0.84	0.89	0.92
a	13.86	14.85	16.54	18.72	19.54	17.40	19.71	16.93	20.37
b	-0.61	-0.70	-0.82	-1.08	-1.22	-0.87	-1.08	-0.90	-1.01

Table 6. Abundance (000's) of witch flounder by age in Div. 3L from seasonal surveys during 1985 (sexes combined).

Age	Winter	Spring	Summer	Fall
2	-	-	-	13
3	-	-	-	-
4	91	7	15	13
5	19	21	52	28
6	70	29	71	26
7	252	74	313	200
8	1834	1058	1285	1085
9	2212	1757	1976	1710
10	2389	1353	1920	1257
11	1012	781	1227	656
12	322	187	649	351
13	39		113	76
Total	8240	5267	7621	5415

Table 7. List of commercial length frequency and age-length key samples available for the Divisions 2J3KL witch flounder stock in 1985.

Month	Country	Gear	NAFO Division	Number measured	Number aged
Aug.	Can(N)	OT	2J	512	90
July	Can(N)	GN	3K	446	157
Aug.	Can(N)	GN	3K	841	205
Sept.	Can(N)	GN	3K	1059	402
March	Can(N)	OT	3K	398	117
April	Can(N)	OT	3K	282	96
June	Can(N)	OT	3K	267	86
July	Can(N)	GN	3L	2316	707
Aug.	Can(N)	GN	3L	266	81
Sept.	Can(N)	GN	3L	367	87
Sept.	Can(N)	OT	3L	377	88

Table 8. Average weight at age (kg), length at age (cm) and catch numbers at age ('000's) with associated statistics for witch flounder in the commercial fishery in Div. 2J3KL in 1984 and 1985.

1984

AGE	AVERAGE		CATCH		
	WEIGHT	LENGTH	MEAN	STD, ERR,	C, V,
4	0.066	23.333	34	3.75	0.11
5	0.172	30.660	176	21.83	0.12
6	0.261	34.479	700	70.41	0.10
7	0.356	37.678	853	89.82	0.11
8	0.490	41.294	1187	96.34	0.08
9	0.660	44.956	1685	105.65	0.06
10	0.834	48.085	1579	92.52	0.06
11	1.083	51.875	856	56.11	0.07
12	1.384	55.649	405	30.56	0.08
13	1.739	59.417	183	15.83	0.09
14	2.083	62.550	30	6.52	0.22
15	2.707	67.524	2	1.39	0.68

1985

AGE	AVERAGE		CATCH		
	WEIGHT	LENGTH	MEAN	STD, ERR,	C, V,
5	0.178	31.000			0.03
6	0.265	34.699	5	0.34	0.07
7	0.421	39.472	136	19.99	0.15
8	0.568	43.013	559	55.68	0.10
9	0.751	46.608	833	76.28	0.09
10	0.947	49.839	859	71.28	0.08
11	1.135	52.448	428	54.55	0.13
12	1.419	55.947	229	34.02	0.15
13	1.857	60.522	82	12.37	0.15
14	2.499	65.844	2	0.59	0.24
15	1.688	59.000	1	0.83	1.03

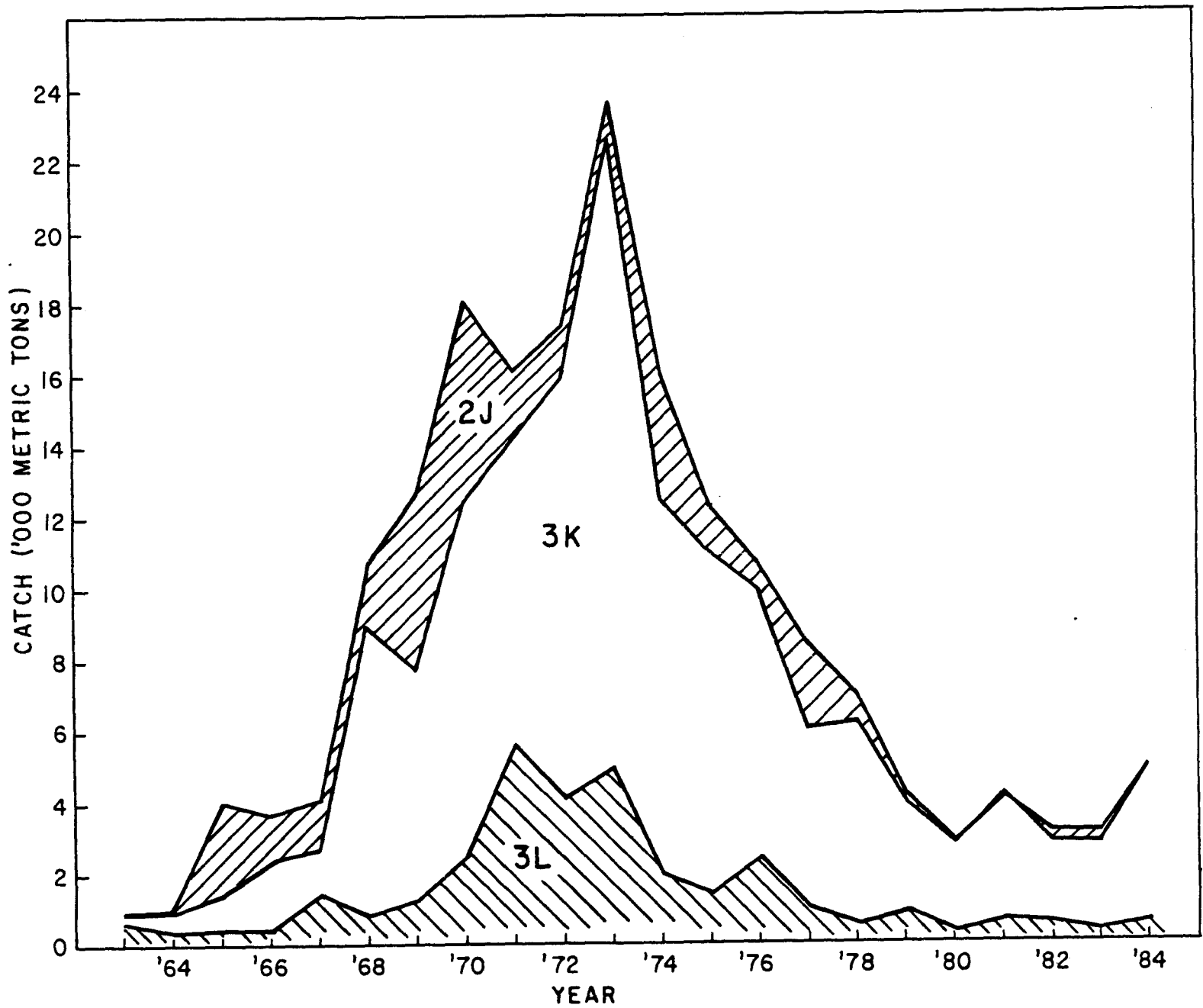


Fig. 1. Landings of witch flounder in NAFO Div. 2J3KL from 1964-84.

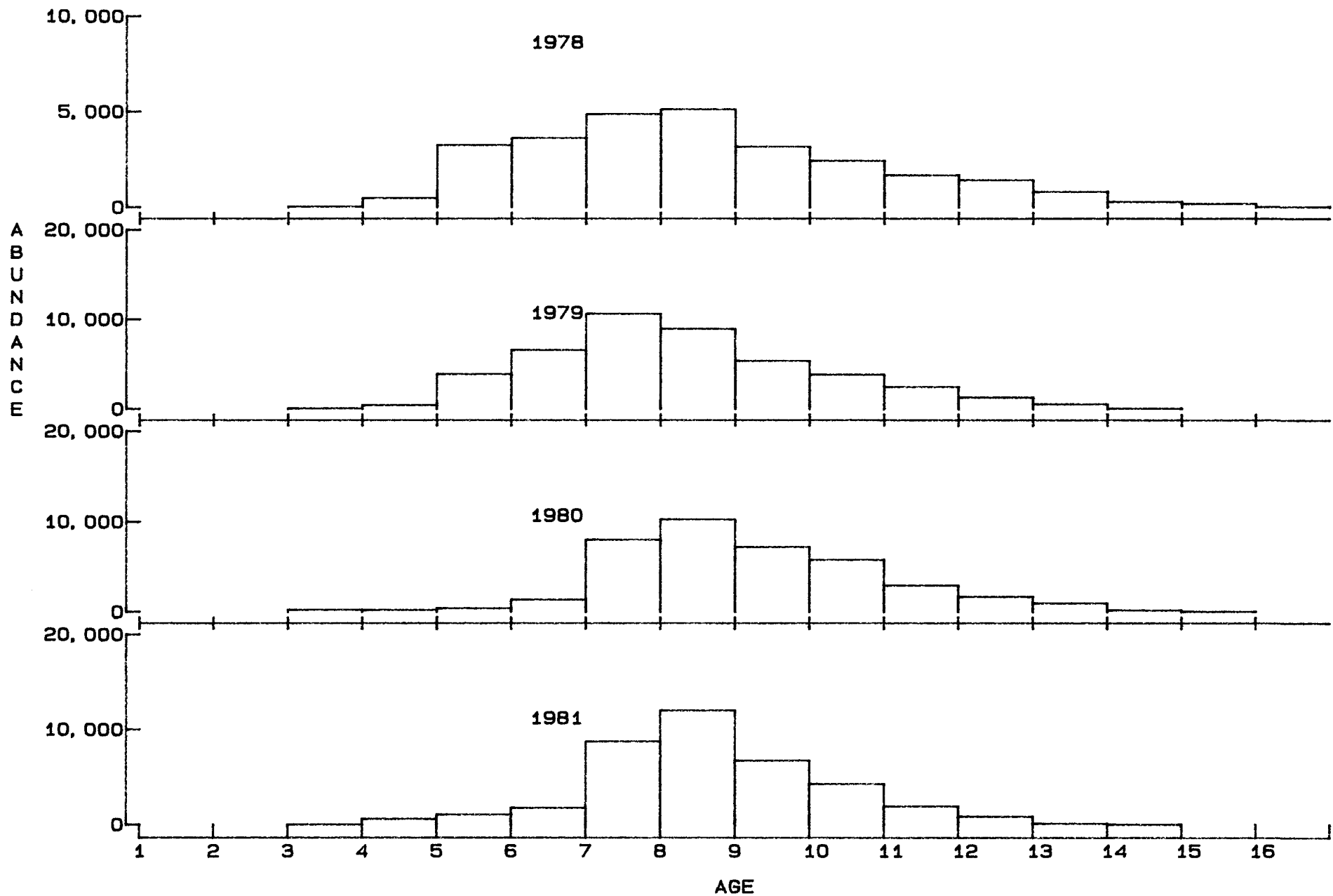


FIG 2A. ABUNDANCE ESTIMATES (000 S) OF WITCH FLOUNDER FROM RESEARCH VESSEL SURVEYS IN DIVISION 3K.

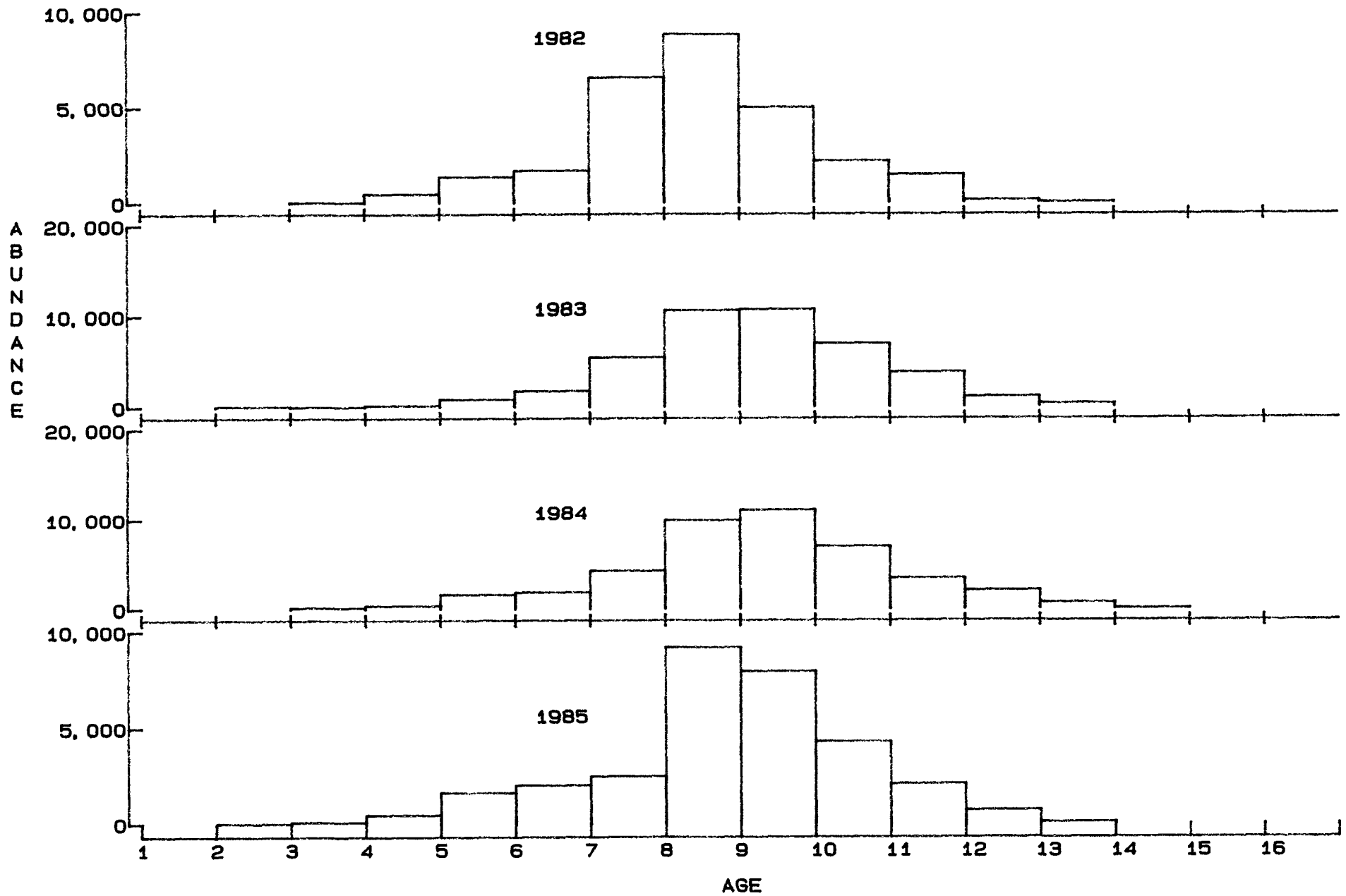


FIG 2B. ABUNDANCE ESTIMATES (000 S) OF WITCH FLOUNDER FROM RESEARCH VESSEL SURVEYS IN DIVISION 3K.

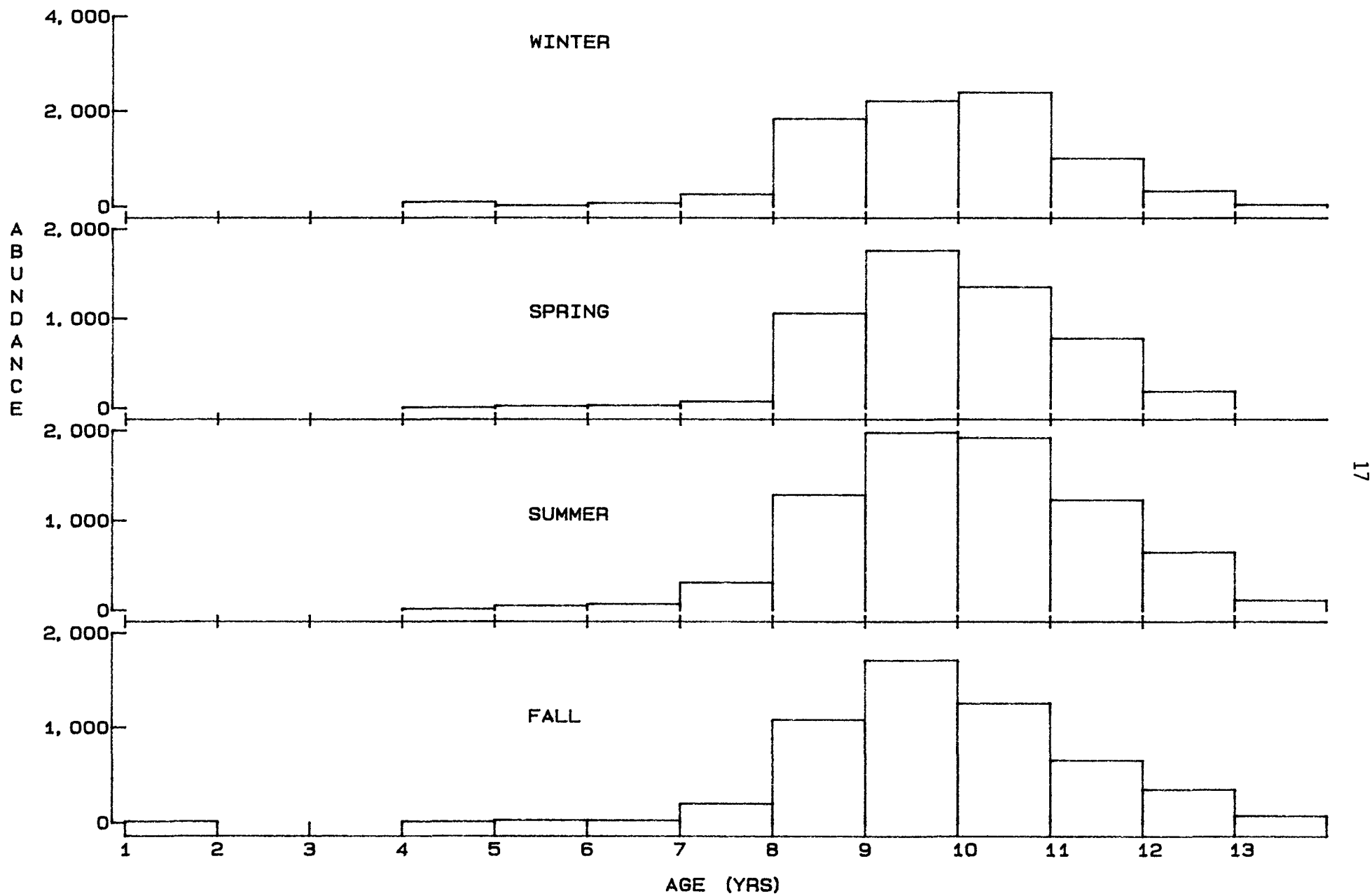


FIG 3. ABUNDANCE (000 S) OF WITCH FLOUNDER BY AGE IN DIV. 3L FROM SEASONAL SURVEYS DURING 1985. (SEXES COMBINED)

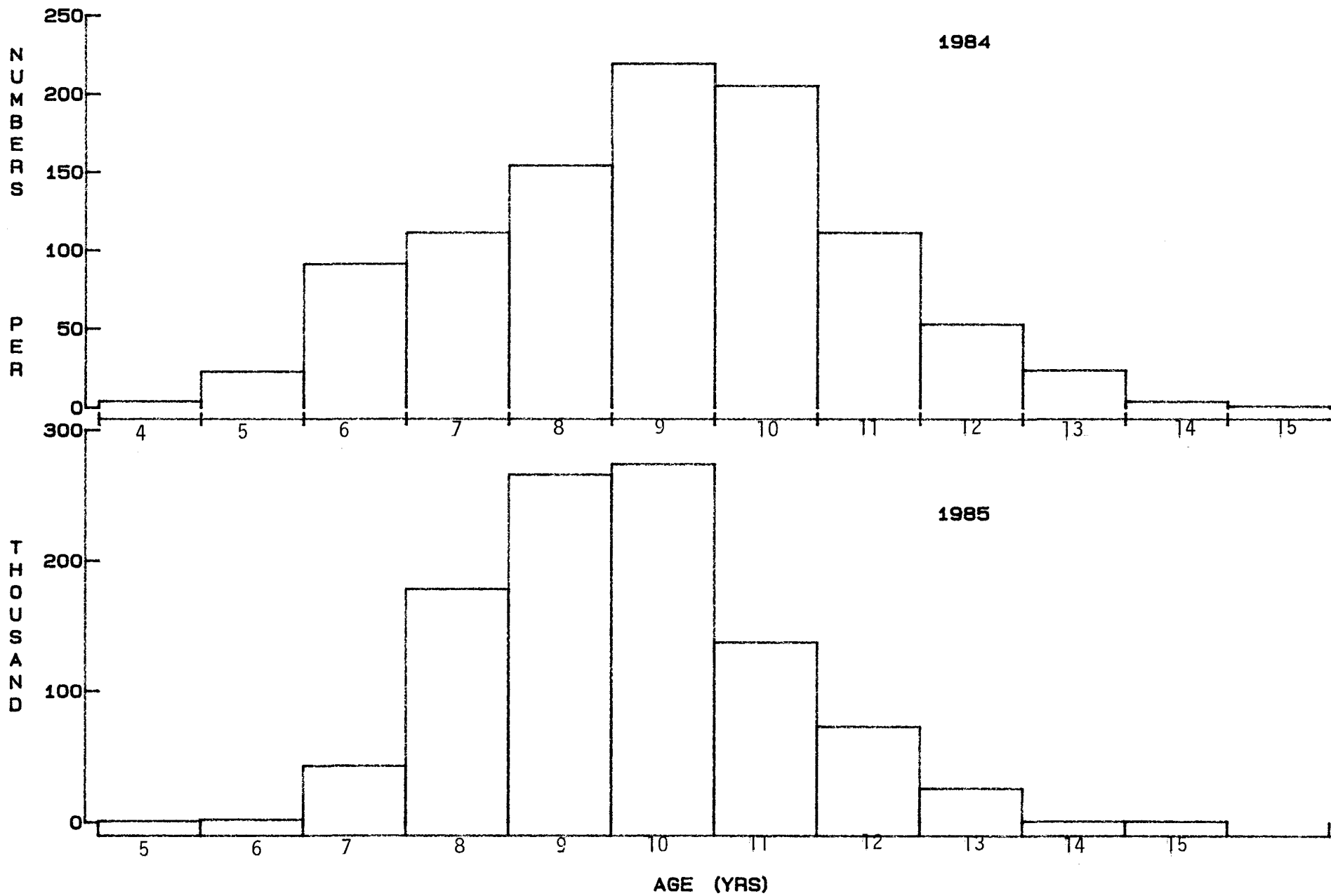


FIG 4. AGE DISTRIBUTION OF WITCH FLOUNDER FROM THE COMMERCIAL FISHERY DURING 1984 AND 1985.