The Northeast Newfoundland Witch Flounder "Stock" (Divisions 2J3KL)

by

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Abstract

Nominal catches in the 1960's increased from less than 5,000 t to a high of 24,000 t in 1973 and declined to 3,000 t in 1980. Catches increased to 4,000 t in 1981 however declined to about 3,000 t in 1982. Research vessel surveys indicate that about 80-90% of the exploitable biomass is located in Div. 3K where most of the fishery also occurs. Biomass is estimated to be in excess of 30,000 t. Age composition has changed dramatically since 1976 where fish were commonly caught up to 25 years old. In 1982, however, the oldest fish caught was 15 years old. Fishing at $F_{0.1}$ would indicate removals at about 8,000 t similar to the present TAC.

Résumé

Les prises nominales, dans les années 60, augmentèrent, passant de moins de 5 000 t à un sommet de 24 000 t en 1973, pour diminuer par la suite à 3 000 t en 1980. Elles augmentèrent à 4 000 t en 1981, mais diminuèrent de nouveau à 3 000 t en 1982. Les relevés par navires de recherche indiquent qu'environ 80 - 90 % de la biomasse exploitable est située dans la div. 3K, où d'ailleurs se pratique le plus gros de la pêche. On estime à plus de 30 000 t la biomasse présente. La composition par âge a changé dramatiquement depuis 1976, alors que des poissons d'âge allant jusqu'à 25 ans étaient communément capturés. Par contre, les plus vieux poissons capturés en 1982 étaient âgés de 15 ans. Une pêche à $F_{0,1}$ donnerait une récolte d'environ 8 000 t, soit au niveau de TPA actuel.

Catches

Nominal catches increased from less than 5000 in the mid-1960's to a high of 24,000 t in 1973 and declined steadily to a level of 3,000 t in 1982 (Fig. 1). Landings prior to 1974, however, were based on breakdowns of unspecified flounder catches and should be treated with some skepticism. Catches from 1979-82 have been relatively stable at low levels and probably reflect the allocations to foreign countries (particularly Poland) as well as the level of fishing interest towards this stock by the Canadian (N) fishermen. While the stock area is considered to be NAFO Div. 2J3KL for management purposes, the main fishing effort occurs in Div. 3K and to a slightly lesser extent Div. 3L. Very little fishing is carried out in Div. 2J for witch flounder.

The fishery for witch here, as in most other areas, is entirely a by-catch therefore obtaining CPUE figures is virtually impossible as well as obtaining adequate sampling data each year from the commercial fishery. To further complicate proper analysis of the stock, the management area of Div. 2J3KL encompases at least three different breeding populations of witch according to Fairbairn (1981) and Bowering and Misra (1982).

Age composition - Commercial

Age compositions were available since 1976 and although the numbers at age may not be entirely accurate due to poor sampling in some years the trends in age composition from the samples should be fairly reflective of the trends in age composition of the management unit. Age compositions (sexes combined) for 1976-82 are presented in Fig. 2.

Ages in the 1976 fishery ranged from 5 to 25 years with most fish in the 10-15 year old range peaking at 12-13 years old. This pattern was similar for 1977 and 1978 although the numbers of old fish were less. From 1979 to 1982 there was a shift to younger fish with a mode of 8-9 years old in 1982. Also in 1982 there were no fish caught older than 15 years compared to 25 years in 1976.

Age composition - Research

Age compositions of witch flounder in Div. 3K derived from fall surveys 1978-82 were compared for sexes combined and presented in Fig. 3. Only data from common strata to all surveys were compared. A mode of 7-10 year old fish was apparent in all years, however, the oldest age group decreased from 15 in 1978-80 to 12 in 1982. When compared to the commercial age compositions, the research data do not show many of the older fish in the population. In 1978, for example the commercial samples indicated significant numbers up to age 20 compared to a maximum of age 15 in the research data. A possible explanation may be that the offshore commercial catches are from prespawning concentrations when the oldest fish might be expected to be in abundance whereas the fall surveys are carried out when the fish are very dispersed. It

is likely at this time that old fish may be in areas beyond the range of the survey.

Mean number (with 95% confidence limits) per 30 minute tow from the survey data were plotted for all ages combined (Fig. 4) as well as separately for ages 4, 5, and 6 (Fig. 5, 6, and 7 respectively). Ages 4, 5, and 6 were used to examine for possible trends in recruiting year-classes.

The mean number per 30 minute tow for all ages combined (Fig. 4) indicated a downward trend from 1979-82, however, the change was small in the last three years. On the other hand, confidence limits overlapped for all years examined. For age 4 (Fig. 5) catches were small and indicated no change over the time frame. For ages 5 and 6 (Fig. 6 and 7 respectively) there was a substantial decrease from 1978-1979 to 1980-1982 with no overlap in confidence limits. The mean numbers per tow from 1980 to 1982 are about the same. It should be pointed out however that the numbers are very small and a slight change would probably appear substantial.

Biomass estimates from surveys

Estimates of biomass by stratum from fall surveys in Div. 2J and 3K are presented in Tables 1 and 2 respectively. Results of spring and fall surveys in Div. 3L are shown in Table 3.

For 1982 in Div. 2J (Table 1) the biomass estimate is 3,600 t up from 2,000 t in 1981. This is near the same level of 3,800 t for a similar survey in 1977, the beginning of the series. In Div. 3K the 1982 estimate (Table 2) is about 22,000 t compared to 31,000 t in 1981, down about 25%. For Div. 3L (Table 3) the estimate of biomass is 7,100 t up about 100% from the 1981 estimate. For the three divisions combined the estimate of biomass for 1982 is 32,900 t compared to 36,700 t in 1981 down about 10%. These estimates, however, are mean estimates with rather wide limits of confidence. Considering the difference between the age composition from research data and that of commercial data (ie: many older, heavier fish) the estimates are considered low.

Mortality estimates

Due to the lack of effort data it was impossible to obtain point estimates of mortality from the commercial age compositions. Furthermore, since the commercial age compositions are comprised of fish from at least 3 different breeding stocks, such estimates would probably not be very informative.

Estimates were derived from survey data for Div. 3K (Table 4) for the 8+ age groups from CPUE of survival per fully recruited year-class. The estimates were Z=1.24 for males and Z=0.36 for females compared to $F_{0.1}$ values of 0.43 for males and 0.27 for females. The estimate for males is considerably higher than $F_{0.1}$ whereas the female estimate is somewhat lower than $F_{0.1}$. However, considering that many of the old fish in the population are not sampled during

the surveys as shown by the commercial age composition these estimates may be biased upwards. It should also be remembered that the confidence limits from which these numbers at age were derived are very broad.

References

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Fairbairn, D. J. 1981. Which witch is which? A study of the stock structure of witch flounder in the Newfoundland Region. Can. J. Fish. Aquat. Sci. 38: 782-794.

Table 1. 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 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58 1981	Gadus 71&72 1982
201	0.0(2)	0.0(3)	0.0(2)	0.00(3)	0.00(5)	0.00(6)
202	0.0(2)	0.0(2)	0.0(2)	0.00(2)	0.00(2)	0.00(2)
203	0.0(2)			0.00(2)	0.00(2)	0.83(3)
204	1.59(2)				2.65(2)	3.17(3)
205	0.0(4)	0.0(4)	0.0(2)	0.00(4)	0.00(8)	0.04(12)
206	0.43(11)	0.0(7)	0.0(8)	0.00(7)	0.00(11)	0.13(18)
207	0.0(5)	0.0(4)	0.0(5)	0.00(5)	0.00(9)	0.13(15)
208	3.46(4)	0.61(3)	0.91(2)	0.50(2)	2.50(2)	13.83(3)
209	0.52(7)	0.0(4)	0.0(5)	0.50(4)	0.00(6)	0.45(11)
210	1.58(6)	0.34(4)	2.84(2)	4.67(3)	0.25(3)	1.70(6)
211	12.26(2)	9.53(2)	0.0(2)	0.85(3)	1.75(2)	6.15(2)
212	26.06(4)				11.25(2)	19.46(5)
213	1.48(8)	2.50(4)	1.59(4)	0.40(5)	1.50(6)	1.70(10)
214	1.55(6)	0.69(4)	0.0(4)	0.00(3)	0.50(5)	0.75(8)
215	1.59(4)	0.27(5)	0.11(4)	0.00(2)	0.64(5)	0.39(9)
216	0.0(2)		1.24(2)	1.25(2)	1.25(2)	1.25(2)
217	0.0(3)				0.00(2)	0.00(2)
218	0.0(2)				0.00(2)	0.00(2)
219					0.00(2)	
220						
221						
222	4.82(4)	2.86(3)	1.02(2)	1.25(2)	4.00(2)	6.17(3)
223	0.68(2)				2.00(2)	0.00(2)
224	0.0(2)				0.00(2)	0.00(2)
225	0.0(2)					
226						
227	2.72(4)				2.50(2)	5.30(5)
228	3.43(8)		3.63(4)	4.50(3)	1.08(6)	4.20(10)
229	2.67(4)	4.99(2)	4.43(2)	3.00(2)	2.00(2)	2.25(4)
230	0.0(3)				0.00(2)	0.00(2)
231	0.0(2)					0.00(2)
232	0.0(2)					
233						
234	0.0(2)	0.0(2)	0.0(2)	0.00(2)	0.00(2)	0.00(3)
235	17.76(4)				11.50(2)	9.00(3)
236	0.0(2)				0.85(2)	0.00(2)
TOTAL WEIGHT (TONS)	3,829	993	1,058	1,109	1,968	3,575

Table 2. 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 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58&59 1981	Gadus 71&72 1982
620	4.54(7)	3.30(7)	2.00(9)	0.45(10)	0.61(9)
621	3.97(7)	9.41(8)	1.25(10)	1.64(11)	0.69(14)
622				14.75(2)	7.50(3)
623	5.94(3)	6.57(3)	2.88(4)	5.41(4)	3.40(5)
624	6.51(3)	2.15(2)	1.75(2)	5.25(2)	6.00(4)
625	12.71(3)	32.51(3)	10.63(4)	16.88(4)	5.00(2)
626	47.79(4)	53.83(3)	9.33(3)	11.30(5)	39.60(5)
627				94.75(6)	63.00(7)
628	23.88(5)	52.65(2)	26.50(4)	10.83(6)	22.25(6)
629	48.73(3)	28.58(2)	34.67(3)	42.33(3)	23.25(2)
630		16.55(2)	6.03(2)	15.75(2)	
631				60.90(5)	6.00(2)
632	13.77(3)	22.22(2)	5.77(2)	10.00(2)	8.00(3)
633	19.28(5)	14.02(6)	17.93(7)	6.32(8)	10.96(7)
634	2.72(5)	6.16(6)	5.50(5)	2.94(7)	5.60(11)
635	20.61(5)	16.87(5)	13.50(4)	10.80(5)	5.50(5)
636	17.25(3)	11.25(5)	12.20(5)	7.50(6)	5.85(10)
637	18.04(4)	28.02(4)	16.00(4)	17.00(6)	17.36(7)
638	17.43(5)	41.12(7)	26.42(6)	26.75(8)	14.62(15)
639	14.08(5)	10.44(2)	15.00(4)	11.23(6)	7.55(10)
640				3.25(2)	23.00(2)
641				1.15(2)	1.25(4)
642				0.00(3)	0.33(6)
643					
644					
645				0.50(2)	16.33(3)
646				0.25(2)	0.60(2)
647				0.00(2)	0.00(2)
648					
649					
TOTAL WEIGHT (TONS)	23,996	31,632	19,517	31,210	22,220

Table 3. Average weight (kg) per 30-minute set of witch flounder from the spring and fall surveys of the research vessel A.T. Cameron in Division 3L (no. of sets in brackets)

Stratum	ATC 246 1976	ATC 262 1977	ATC 276 1978	ATC 290 1979	ATC 305 1980	ATC 317,318 1981	ATC 323,325 1981	ATC 327,328,329 1982	ATC 333,334 1982
328		0.0(3)		0.0(5)		0.00(2)		0.03(3)	
341		0.0(4)	0.0(4)	0.15(6)		0.00(2)	0.00(3)	0.00(5)	0.20(4)
342		0.0(2)	0.0(2)	0.0(4)			0.00(3)	0.00(3)	0.00(3)
343		0.0(2)	0.0(3)	0.29(4)		0.00(2)	0.00(4)	0.00(4)	
344	0.18(4)	0.91(4)	0.05(4)	0.91(2)	0.80(3)	0.00(5)	1.75(4)	0.50(4)	0.00(3)
345	7.70(4)	36.06(4)	4.31(2)	19.97(4)	8.80(5)	0.38(4)	19.88(4)	6.13(4)	21.87(6)
346	28.15(2)	45.58(3)		53.85(4)	7.33(3)	24.50(3)	46.50(3)	26.33(3)	18.63(4)
347	4.81(3)	0.0(3)	0.45(4)	1.42(4)	2.70(5)	0.00(4)	2.83(3)	0.00(2)	0.40(4)
348	0.0(6)	0.0(6)	0.0(6)	0.0(6)	0.00(3)	0.00(7)	0.17(6)	0.00(4)	0.60(5)
349	0.0(3)	0.0(6)	0.0(6)	0.39(7)		0.00(4)	0.00(7)	0.00(6)	0.00(5)
350	0.0(4)	0.0(4)	0.0(6)	0.08(9)		0.00(3)	0.00(6)	0.00(7)	0.00(2)
363	0.0(4)	0.0(5)	0.0(5)	0.14(8)	0.50(3)	0.00(3)	0.00(4)	0.00(5)	0.50(3)
364	0.0(3)	0.0(7)	0.0(6)	0.0(8)	0.00(5)	0.00(2)	1.06(9)	0.00(6)	0.46(11)
365	0.0(3)	0.0(3)	0.0(2)	0.79(4)	1.00(4)		0.25(4)	0.00(3)	1.25(4)
366	0.23(4)	0.57(4)		0.74(4)	1.25(4)	0.63(3)	1.67(3)	1.10(5)	3.50(6)
368	1.51(3)	3.74(3)		2.10(4)	0.00(2)	5.00(2)	0.50(2)	2.25(2)	0.75(2)
369	0.71(4)	2.23(3)	2.27(2)	2.10(4)	10.50(3)	0.75(2)	5.75(2)	1.75(2)	5.07(4)
370	0.0(3)	0.0(3)	0.0(3)	0.0(4)	0.00(3)	0.00(2)	0.25(4)	0.00(2)	0.00(6)
371		0.0(3)	0.0(3)	0.0(3)	0.00(3)	0.00(2)	0.00(4)	0.38(4)	0.00(5)
372	0.0(3)	0.0(6)	0.0(7)	0.27(9)	0.00(4)	0.00(4)	0.00(5)	0.00(6)	0.00(7)
384		0.0(2)	0.0(3)	0.0(4)	0.00(2)	0.00(2)		0.00(2)	0.00(4)
385	0.0(2)	0.19(6)	0.26(6)	0.0(7)	1.31(4)	0.67(3)	0.00(8)	0.00(3)	0.00(8)
386	1.04(2)	20.13(3)	12.26(3)	12.60(4)	0.88(2)	6.25(2)	10.50(3)	8.00(3)	1.75(4)
387	29.14(3)	11.58(2)	5.15(3)	2.21(4)	6.00(2)	13.00(2)	4.25(2)	2.87(3)	13.83(3)
388	99.30(2)	9.99(2)	22.70(2)	2.98(3)	1.75(2)	5.00(2)		0.75(2)	0.87(3)
389	0.48(2)	2.57(3)	1.29(3)	0.11(4)	0.17(3)	3.00(2)		0.00(2)	4.38(4)
390		0.00(2)	0.45(4)	0.0(5)	0.00(3)	1.00(2)	0.00(3)	0.00(4)	0.00(4)
391		0.91(2)	0.0(2)	0.96(4)	1.25(2)	1.00(2)		0.75(2)	0.00(2)
392		2.50(2)	0.45(3)	0.61(3)	0.50(2)	1.25(2)		0.20(2)	0.00(2)
735									57.25(2)
TOTAL WEIGHT (TONS)	7,512	9,869	2,644	7,529	3,454	3,669	7,461	3,540	7,059

Table 4. Abundance estimates of witch flounder in Division 3K from Autumn surveys with between year estimates of mortality. Only strata surveyed in all years are included in the analysis.

Age	1978	1979	1980	1981	1982
			MALES		
3	48		89		
4	62	104	40	57	71
5	1056	1013	50	85	190
6	1134	3090	244	220	455
7	2800	7390	1932	2647	2921
8	3340	5103	2251	3533	3389
9	2055	2004	1454	1209	1296
10	1647	1105	1609	772	229
11	884	126	443	59	65
12	213	22	43		
	Z_{8+}=0.89		Z_{8+}=0.85	Z_{8+}=0.96	Z_{8+}=1.24
			FEMALES		
3			92		
4	108	80	46	36	51
5	1235	841	67	102	157
6	1183	1339	275	177	165
7	1892	3258	1637	1360	931
8	3111	4178	2003	2134	2413
9	2463	2310	2082	2104	2304
10	1796	2599	2052	1475	1369
11	1626	1490	1190	1001	904
12	1677	638	904	576	105
13	1083	196	683	71	
14	403		95		
15	173		18		
16	40				
	Z_{8+}=0.39		Z_{8+}=0.49	Z_{8+}=0.45	Z_{8+}=0.36

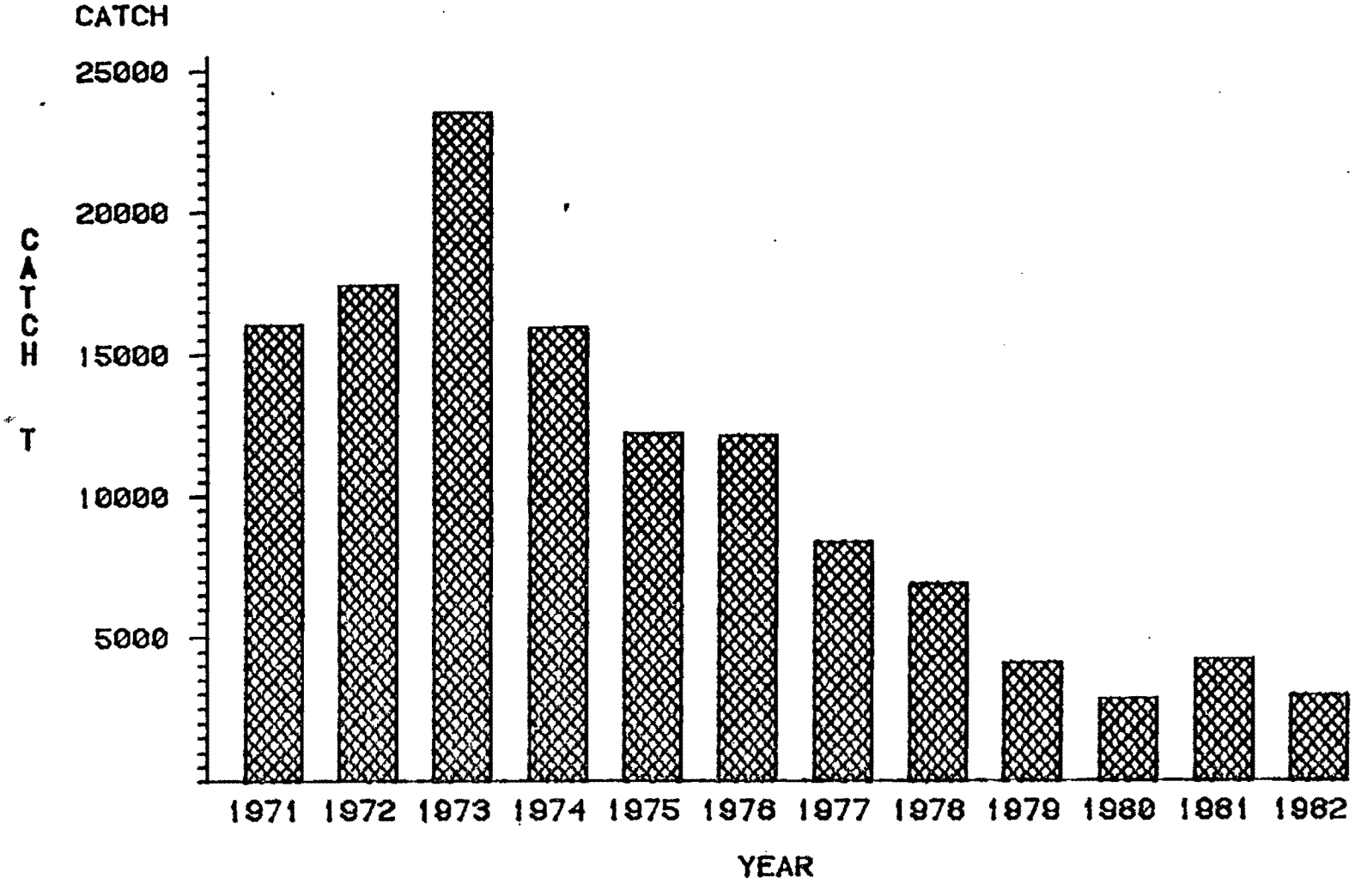

FIG.1: NOMINAL CATCHES OF WITCH FLOUNDER IN NAFO DIV.2J+3KL (1982 IS PROVISIONAL)

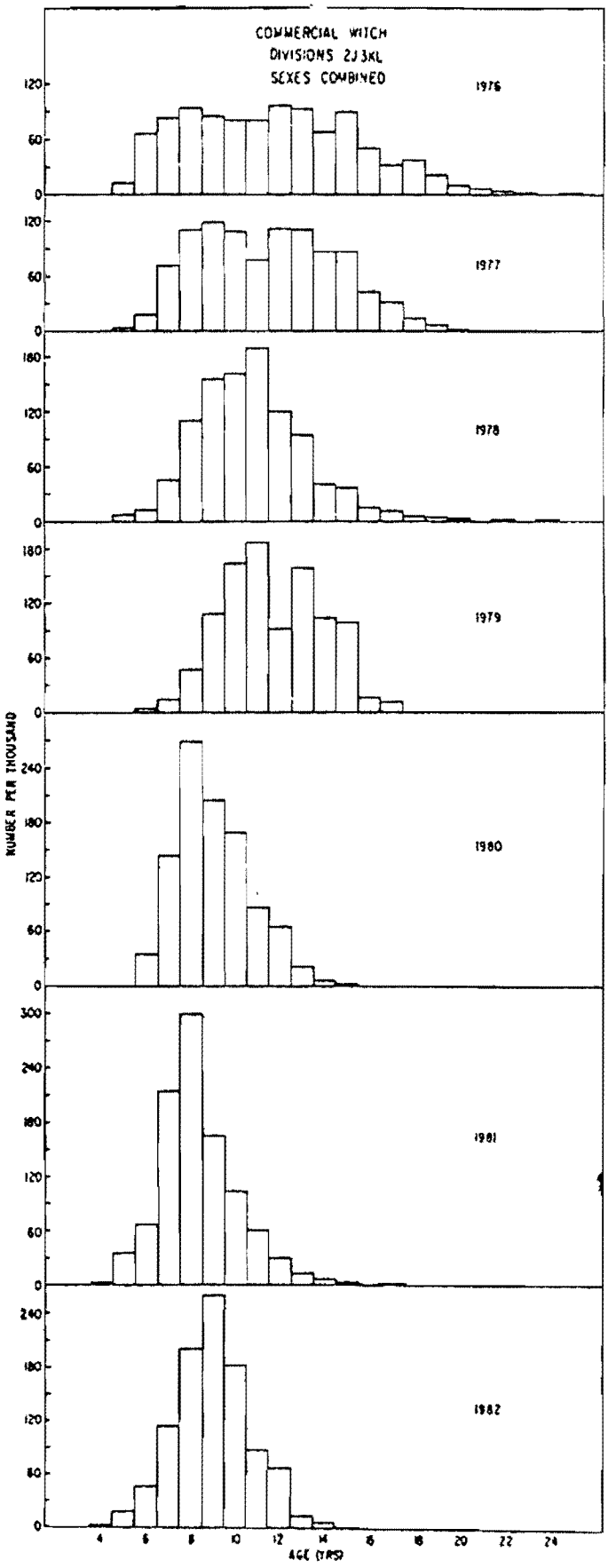

Fig. 2. Age compostition of commercial witch flounder (sexes combined) from Division 2J3KL during 1976-82.

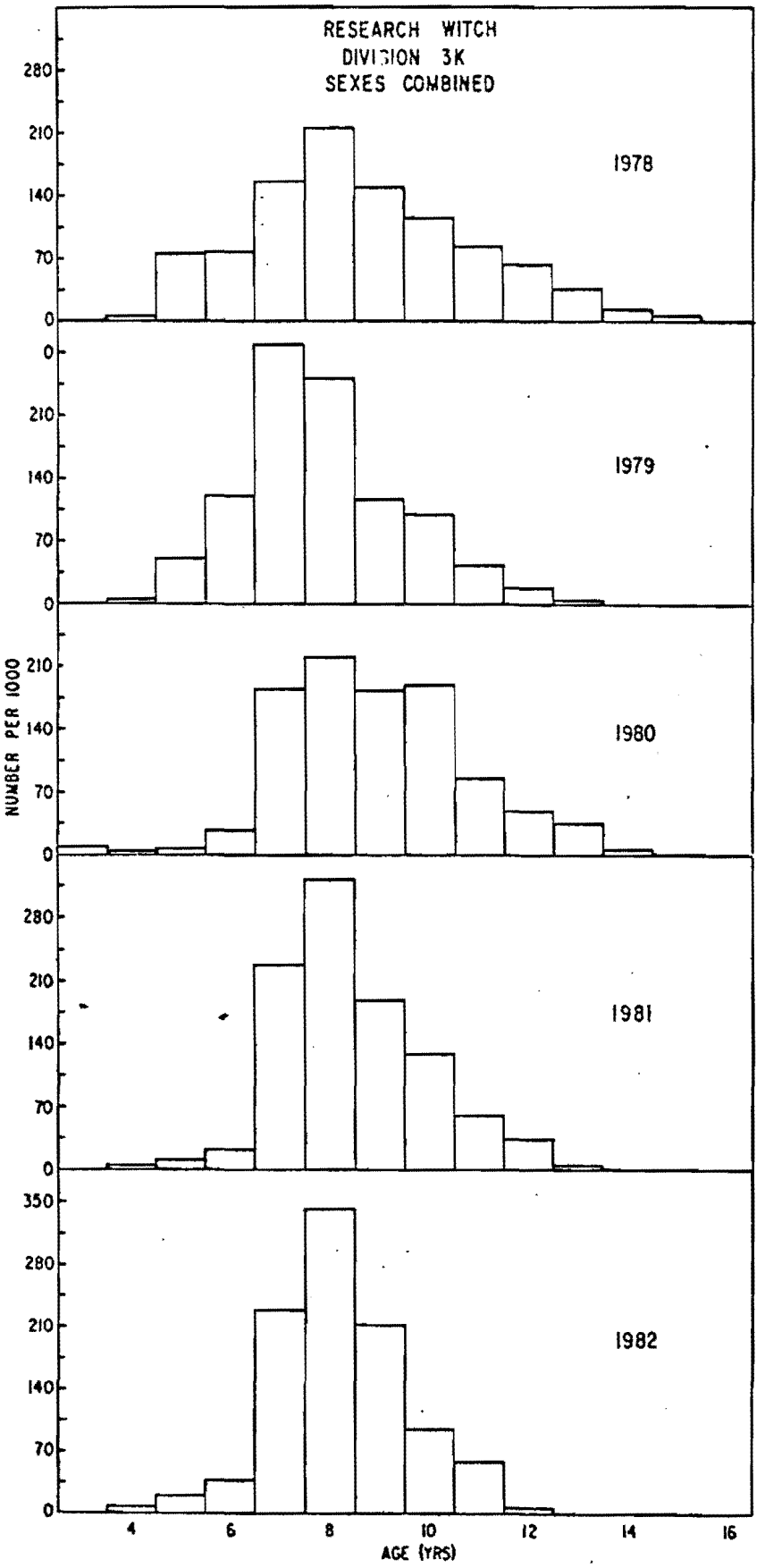

Fig. 3. Age composition of research witch flounder (sexes combined) from autumn surveys of the research vessel GADUS ATLANTICA in Division 3K during 1979-82.

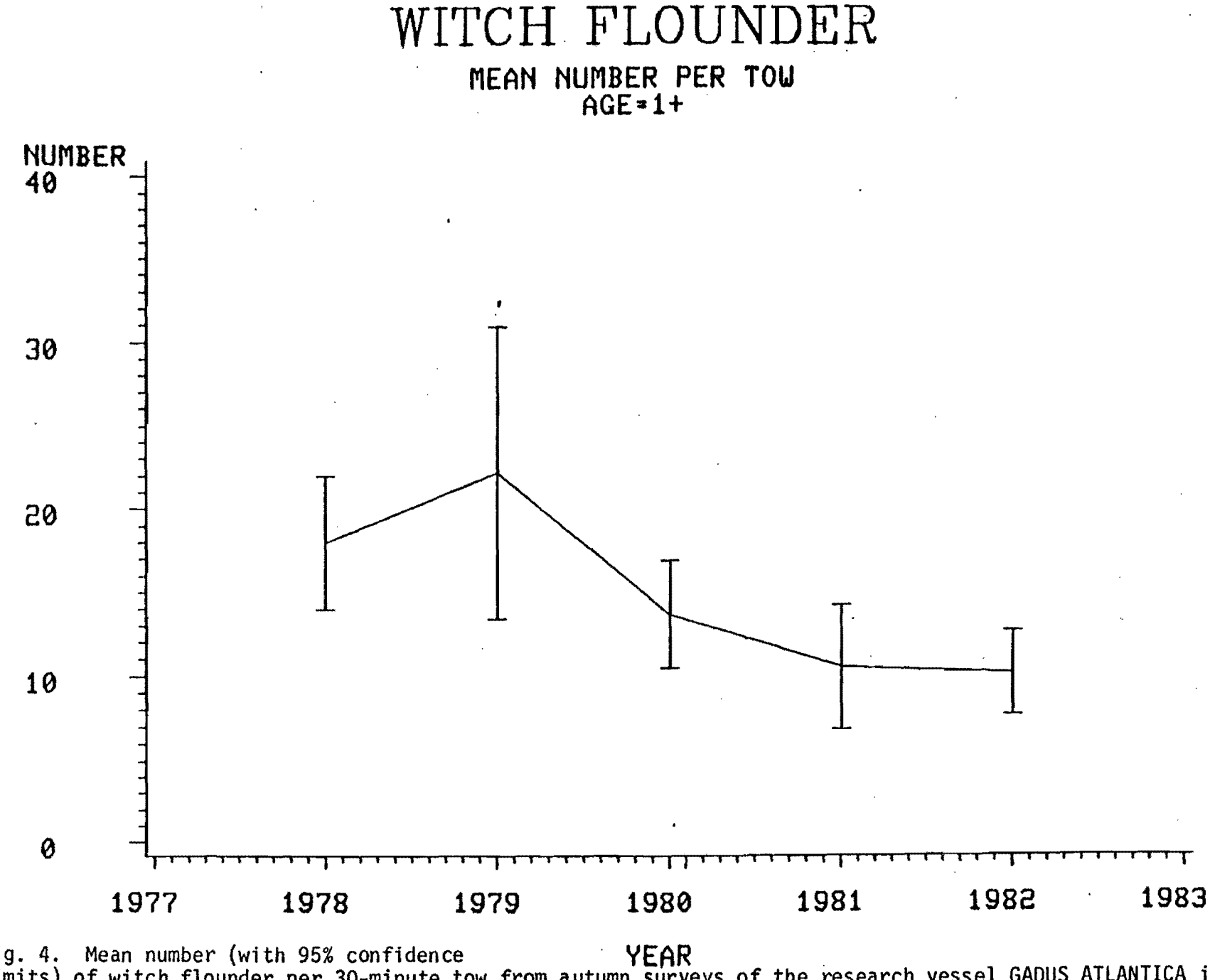

Fig. 4. Mean number (with 95% confidence limits) of witch flounder per 30-minute tow from autumn surveys of the research vessel GADUS ATLANTICA in Division 3K during 1978-82.

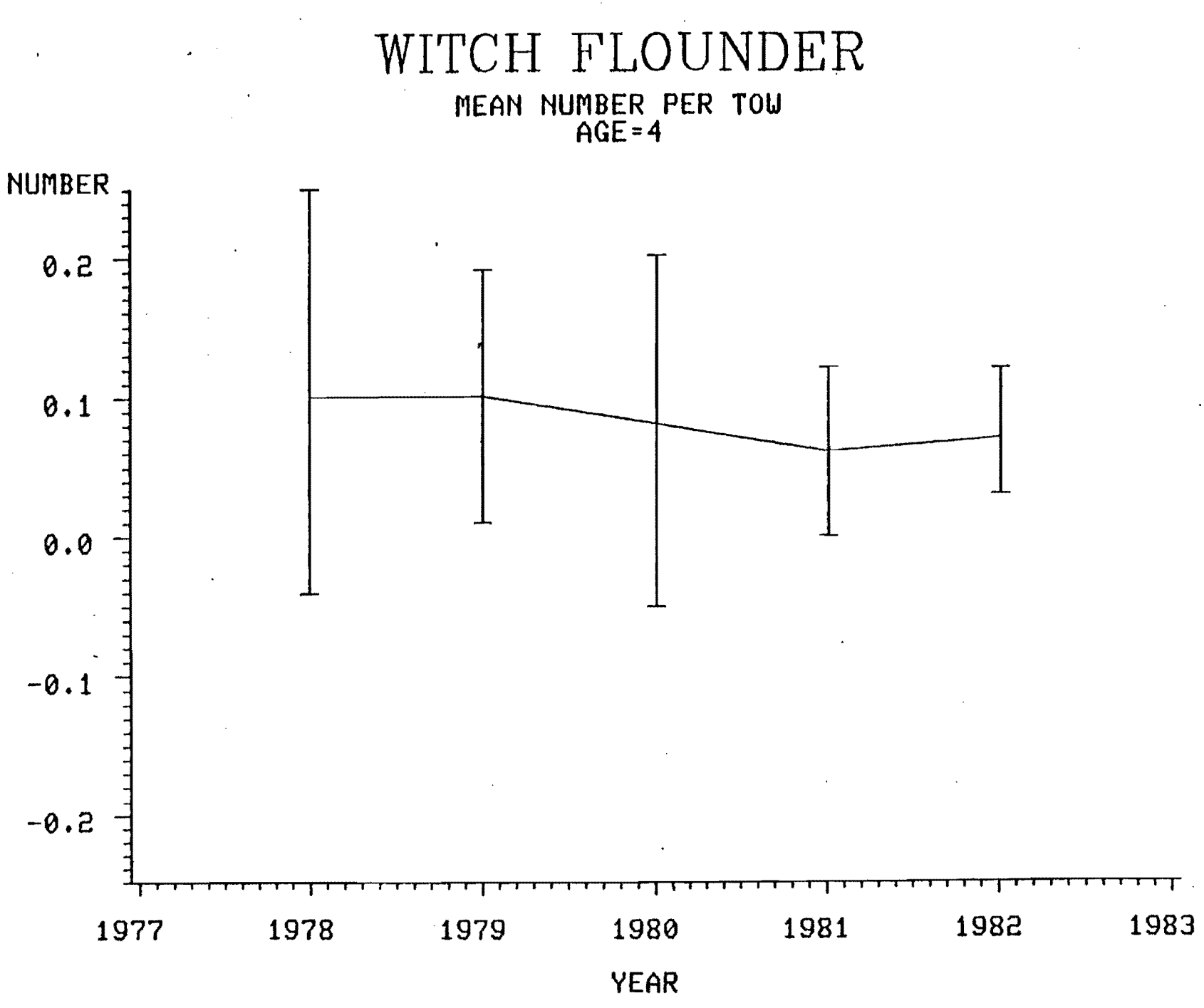

Fig. 5. Mean number (with 95% confidence limits) of 4-year old witch flounder per 30-minute tow from autumn surveys of the research vessel GADUS ATLANTICA in Division 3K during 1978-82.

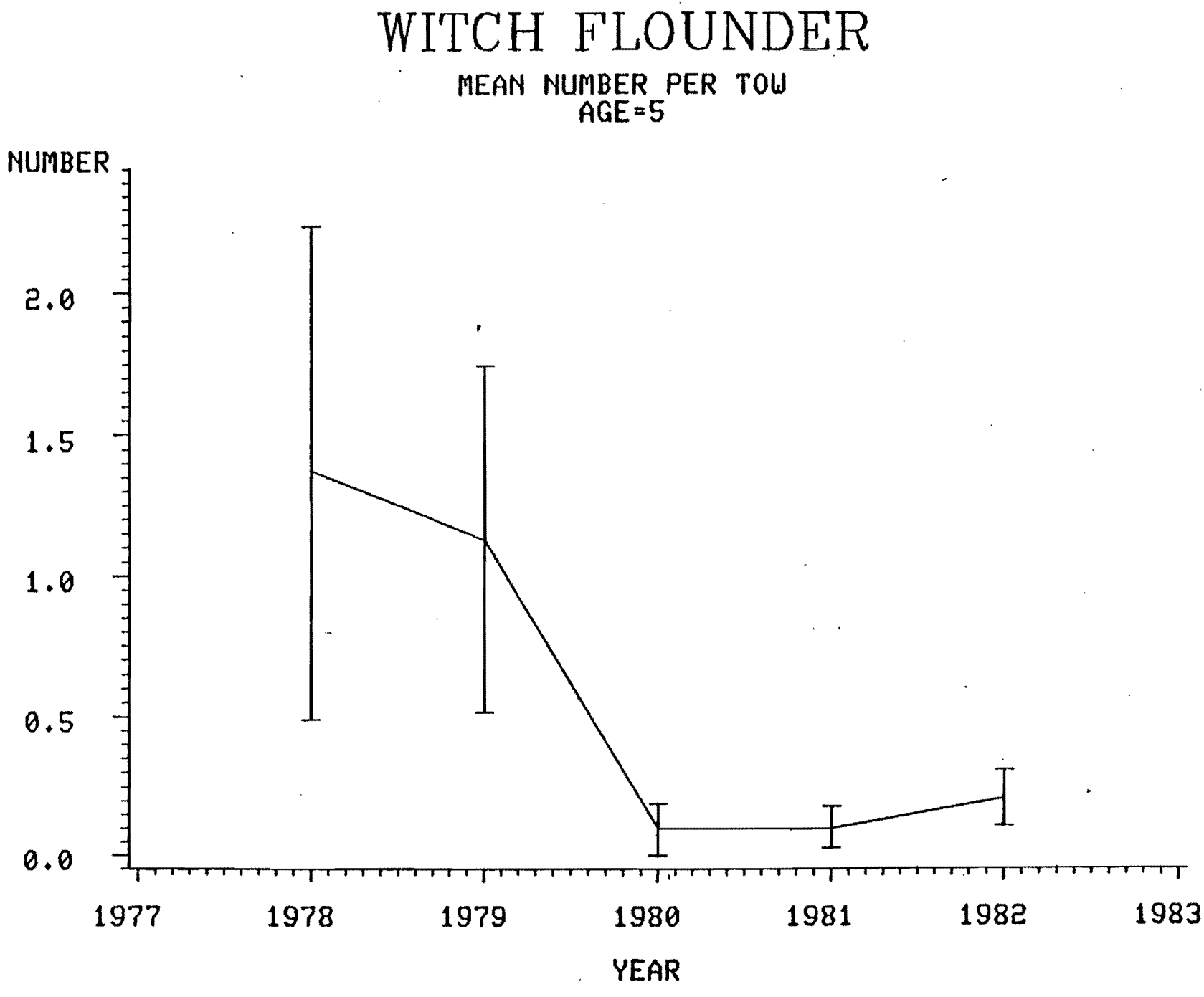

Fig. 6. Mean number (with 95% confidence limits) of 5-year old witch flounder per 30-minute tow from autumn surveys of the research vessel GADUS ATLANTICA in Division 3K during 1978-82.

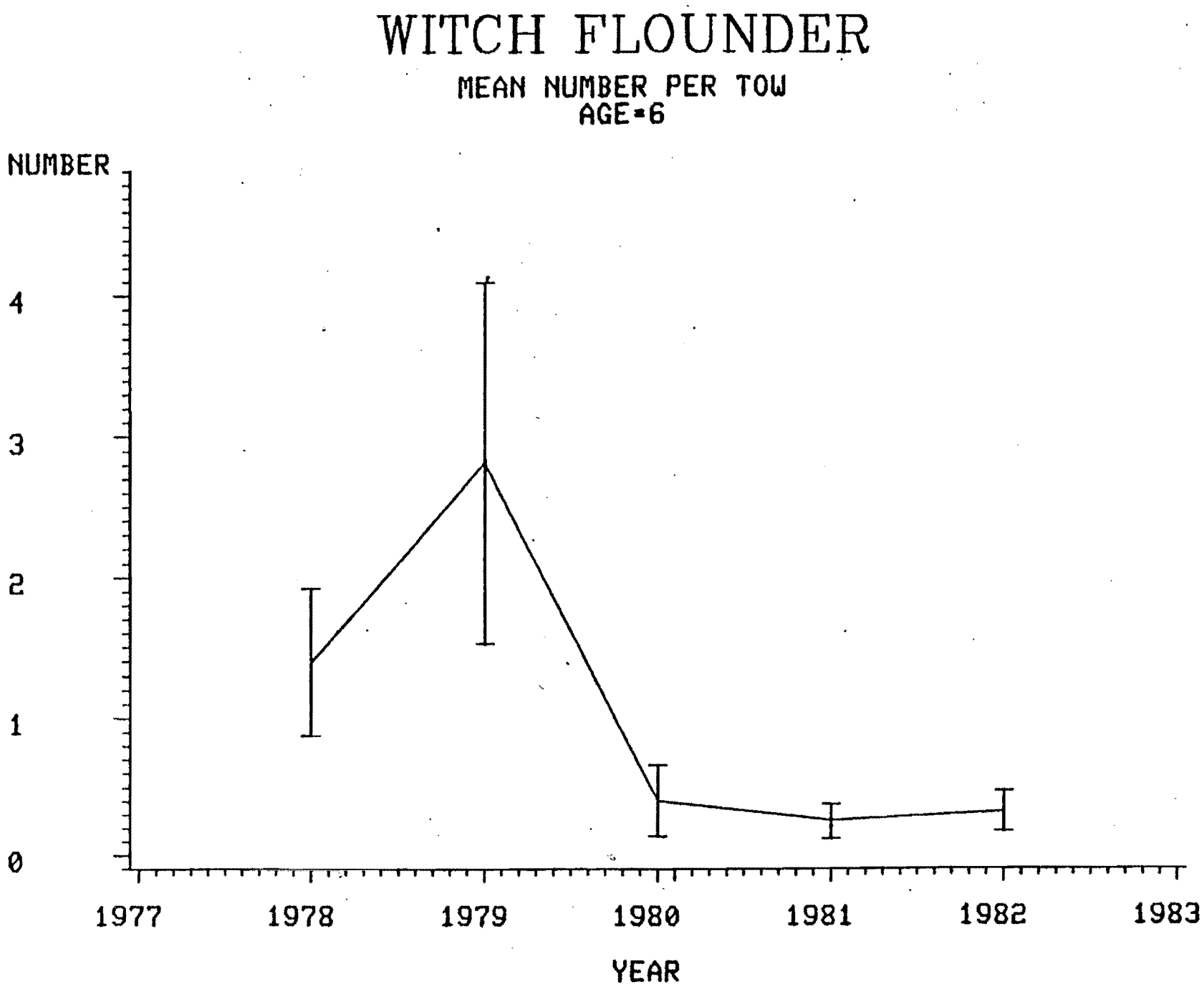

Fig. 7. Mean number (with 95% confidence limits) of 6-year old witch flounder per 30-minute tow from autumn surveys of the research vessel GADUS ATLANTICA in Division 3K during 1978-82.