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Witch Flounder in NAFO Divisions 2J and 3KL -
Another By-catch

by

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ABSTRACT

Landings have declined steadily from a high of 24,000 t in 1973 to a low of less than 4000 t in 1980. This fishery has been conducted mainly by inshore gillnets and offshore otter trawlers particularly in NAFO Div. 3K, however, in the more recent years the inshore gillnet fishery for witch flounder in this area produced negligible proportions. Biomass surveys since 1978 have shown that more than 75% of this stock is located in Div. 3K and biomass estimates since that time appear to be relatively stable. This apparent stability has been generated by average annual removals through fishing of 8000 t which is very close to $F_{0.1}$.

RESUME

Les débarquements de plie grise ont diminué régulièrement, passant d'un pic de 24 000 t en 1973 à un creux de moins de 4 000 t en 1980. Ce sont surtout les filets maillants côtiers et les chalutiers hauturiers, en grande partie dans la division 3K de l'OPANO, qui pratiquent cette pêche. Récemment toutefois, les prises des filets maillants dans cette région ont représenté des proportions négligeables. Les relevés de biomasse effectués depuis 1978 démontrent que plus de 75 % de ce stock se trouve dans la division 3K. Ces relevés démontrent en outre que la biomasse semble relativement stable. Des prélèvement annuels par pêche de 8 000 t, très proches du niveau de $F_{0,1}$, ont engendré cette apparence stabilité.

THE FISHERY

The fishery for witch flounder in this area has been comprised mainly of an offshore otter trawl fishery by Canada, Poland and the USSR and a near shore gillnet fishery by Canadian Newfoundland fishermen. The gillnet fishery occurs mainly in Notre Dame Bay and to a lesser extent in Bonavista Bay and Trinity Bay. For practical purposes, this stock is essentially found in Division 3K only. From 1967-73, landings increased rapidly (Fig. 1) on a virgin stock and since that time have decreased continuously. In 1980 landings at a level of about 2800 t are the lowest recorded since 1967. The near shore gillnet fishery which escalated in the late 1960's and early 1970's has dropped to almost negligible proportions over the last couple of years. While the decrease in gillnet landings may be a reflection of stock reduction from the virgin level it may also reflect the diversion of effort to a much more lucrative cod, Greenland halibut and American plaice fishery in recent times.

Landings during the past few years have simply been from a by-catch fishery and with the buildup of the cod stocks in the north is likely to remain as such. Preliminary estimates of catch in 1981 up to the end of March indicate that there may be a slight increase in Canadian offshore landings during this year. The main reason for this is the diversion of trawler effort to such deep sea species as Greenland halibut, redfish and witch since the quotas for cod and American plaice have been taken unusually early in this stock area.

COMMERCIAL DATA

Due to the very low landings over the past few years it has been impossible to obtain adequate sampling data from this fishery, especially when it has become a by-catch of very large landings of other species. However, some small samples from the Canadian otter trawl landings in Division 3K were available since 1976 and are shown in Fig. 2 as numbers per thousand at age of the total landings. While this figure may not be an accurate description of the stock status, it does give some representation of the basic change in age structure of this fishery over the past 5 years.

In 1976, the age composition of the commercial otter trawl catch ranged from 5-22 years-old with most of the catch made up of about 10-12 equally represented age groups. As each year progressed the older age groups disappeared and in 1980 the oldest fish caught was 15 years-old. Furthermore, the number of age groups comprising the bulk of the commercial landings have been reduced from 10-12 to about 5 (Fig. 2). This would undoubtedly reflect the reduction from virgin levels.

BIOMASS SURVEYS

Since 1977, stratified-random biomass survey activity has been conducted in Division 2J by the Canadian research vessel Gadus Atlantica. With the exception of 1977 the same surveys have been extended to cover Division 3K. In Division 3L, stratified-random biomass surveys have been conducted annually

by the Canadian research vessel A. T. Cameron since the early 1970's, however, only in recent years has there been adequate coverage. The average numbers and weights per set per stratum are presented in Tables 1 and 2 for Division 2J; Tables 3 and 4 for Division 3L and Tables 5 and 6 for Division 3K. Blank areas in the tables indicate where strata were not fished in a particular year.

Division 2J

This area is the northern limits of this species and according to biomass estimates over the past few years is an area of low concentration (Tables 1 and 2). A comparison of Gadus 15, 1978; Gadus 29, 1979 and Gadus 44, 1980 which are November cruises show a consistent estimate of about 1000 t over the last 3 years.

Division 3K

As previously mentioned, this area is the region of the main distribution of witch in this stock area. Estimates of biomass from the autumn surveys over the past 3 years indicate a variation in biomass of about 20,000 t in 1980 to about 30,000 t in 1979 (Tables 3 and 4). However, both surveys in 1979 indicated about 30,000 t and when compared with the September survey in 1980 the estimates are about equal in the 30,000 t to 32,000 t range. The September surveys appear to be the most complete, particularly Gadus 42, 1980 and are probably most representative of current conditions.

Division 3L

The distribution of witch in this division is generally associated with the deep waters on the northern cape of the Grand Bank and biomass estimates are essentially based upon very few strata where witch are located (Tables 5 and 6). Most strata in this division are associated with shallow, cold water on top of the Grand Bank and are not suitable for which. Had stratum 346 been surveyed in 1978, biomass estimates for 1976-1979 would probably have been relatively stable between 7500-10,000 t. The estimate for 1980 of 3500 t is low in comparison to other years although the main strata were surveyed. Since, from Tables 5 and 6, witch are confined to small areas in Division 3L the estimates would be very sensitive to slight changes in distribution due to environmental factors.

AGE COMPOSITION FROM SURVEYS IN DIVISION 3K

Since Division 3K comprises almost the entire stock, the age composition for November, 1978-80 for this division is presented in Figures 3 and 4 for comparison with the commercial data.

The age composition has not changed all that much over the last 3 years and still shows fair numbers of age groups present in the stock with no apparent

fluctuation in strength in any particular year-class (Fig. 3 and 4). Catch curves derived from the research data in Figures 3 and 4 were constructed in order to give some average estimate of fishing mortality. The total mortality value for males was $Z=0.69$ and for females $Z=0.66$ (Fig. 5) both of which are beyond $F_{0.1}$ (Fig. 6). As pointed out by Bowering and Baird (1980) this probably represents removals averaging about 10,000 t annually. The relative stability in biomass is represented by an average of 8000 t which would probably be very near $F_{0.1}$ and is also the present TAC and there appears to be no necessity to change this for 1982. In any case, with this fishery now a by-catch, the likelihood of catches for 1981 and possibly beyond to be above 3000-4000 t annually is rather poor.

REFERENCES

- Bowering W. R., and J. Baird. 1980. Estimates of stock biomass and long-term mortality of the northern witch flounder stock. NAFO SCR Doc. 80/VI/108.

Table 1. *Gadus* 2J - Witch average number per set (numbers in parentheses in this and subsequent tables are numbers of sets).

Stratum	Gadus 3 1977	Gadus 12 1978	Gadus 15 1978	Gadus 27 1979	Gadus 29 1979	Gadus 42 1980	Gadus 44 1980
201	0.00(2)		0.00(3)		0.00(2)		0.00(3)
202	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)
203	0.00(2)	0.00(2)		0.00(2)		0.00(2)	0.00(2)
204	1.50(2)	0.00(2)		1.50(2)			
205	0.00(4)		0.00(4)		0.00(2)		0.00(4)
206	0.36(11)		0.00(7)		0.00(8)		0.00(7)
207	0.00(5)		0.00(4)		0.00(5)		0.00(5)
208	5.25(4)	1.00(2)	1.00(3)	3.50(2)	1.00(2)	17.00(2)	0.50(2)
209	0.71(7)	0.50(2)	0.00(4)	0.50(2)	0.00(5)	1.50(2)	0.25(4)
210	1.36(6)	0.67(3)	0.25(4)	0.50(2)	1.50(2)	0.50(2)	6.00(3)
211	12.00(2)	3.00(2)	10.50(2)	6.50(2)	0.00(2)	23.50(2)	1.07(3)
212	27.97(4)	1.50(2)		12.50(2)		3.00(2)	
213	1.62(8)	0.00(3)	2.25(4)	0.33(3)	1.25(4)	3.00(3)	0.40(5)
214	1.67(6)	0.00(3)	0.75(4)	0.00(2)	0.00(4)	1.50(2)	0.00(3)
215	1.25(4)	0.00(3)	0.20(5)	0.00(2)	0.25(4)	0.00(2)	0.00(2)
216	0.00(2)	0.00(2)		0.00(2)	1.50(2)	0.00(2)	1.50(2)
217	0.00(3)	0.00(2)		0.50(2)		0.00(2)	
218	0.00(2)	0.00(2)				0.00(2)	
219			0.00(2)				
220							
221							
222	5.50(4)	0.00(2)	5.00(3)	0.00(2)	1.50(2)	3.00(2)	2.00(2)
223	0.50(2)	0.00(2)		0.00(2)		0.00(2)	
224	0.00(2)	0.00(2)		0.00(2)		0.00(2)	
225	0.00(2)						
226		0.00(2)					
227	2.50(4)	2.00(2)		0.75(2)		6.50(2)	
228	2.87(8)	1.33(3)		1.00(2)	3.00(4)	1.50(2)	5.67(3)
229	3.67(4)	0.00(2)	8.50(2)	1.00(2)	3.50(2)	2.50(2)	5.50(2)
230	0.00(3)	0.00(2)				0.50(2)	
231	0.00(2)	0.00(2)				0.00(2)	
232	0.00(2)	0.00(2)					
233							
234	0.00(2)	1.00(3)	0.00(2)	1.00(2)	0.00(2)	0.00(2)	0.00(2)
235	24.25(4)	0.00(2)		11.00(2)		11.50(2)	
236	0.00(2)						
Total Number ('000)	4,166	566	1,212	1,658	870	3,106	1,425

Table 2. Gadus 2J - Witch average weight per set

Stratum	Gadus 3 1977	Gadus 12 1978	Gadus 15 1978	Gadus 27 1979	Gadus 29 1979	Gadus 42 1980	Gadus 44 1980
201	0.00(2)		0.00(3)		0.00(2)		0.00(3)
202	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)	0.00(2)
203	0.00(2)	0.00(2)		0.00(2)		0.00(2)	0.00(2)
204	1.59(2)	0.00(2)		1.02(2)			
205	0.00(4)		0.00(4)		0.00(2)		0.00(4)
206	0.43(11)		0.00(7)		0.00(8)		0.00(7)
207	0.00(5)		0.00(4)		0.00(5)		0.00(5)
208	3.46(4)	0.67(2)	0.61(3)	2.49(2)	0.91(2)	15.00(2)	0.50(2)
209	0.52(7)	0.44(2)	0.00(4)	1.02(2)	0.00(5)	1.00(2)	0.50(4)
210	1.58(6)	0.30(3)	0.34(4)	0.68(2)	2.84(2)	0.50(2)	4.67(3)
211	12.26(2)	1.81(2)	9.53(2)	4.76(2)	0.00(2)	20.50(2)	0.85(3)
212	26.06(4)	1.36(2)		13.15(2)		2.75(2)	
213	1.48(8)	0.00(3)	2.50(4)	0.30(3)	1.59(4)	3.77(3)	0.40(5)
214	1.55(6)	0.00(3)	0.69(4)	0.00(2)	0.00(4)	1.30(2)	0.00(3)
215	1.59(4)	0.00(3)	0.27(5)	0.00(2)	0.11(4)	0.00(2)	0.00(2)
216	0.00(2)	0.00(2)		0.00(2)	1.24(2)	0.00(2)	1.25(2)
217	0.00(3)	0.00(2)		0.57(2)		0.00(2)	
218	0.00(2)	0.00(2)				0.00(2)	
219			0.00(2)				
220			0.00(2)				
221							
222	4.82(4)	0.00(2)	2.86(3)	0.00(2)	1.02(2)	2.25(2)	1.25(2)
223	0.68(2)	0.00(2)		0.00(2)		0.00(2)	
224	0.00(2)	0.00(2)		0.00(2)		0.00(2)	
225	0.00(2)						
226		0.00(2)					
227	2.72(4)	1.59(2)		0.86(2)		6.75(2)	
228	3.43(8)	0.74(3)		0.68(2)	3.63(4)	1.50(2)	4.50(3)
229	2.67(4)	0.00(2)	4.99(2)	0.68(2)	4.43(2)	2.00(2)	3.00(2)
230	0.00(3)	0.00(2)				0.50(2)	
231	0.00(2)	0.00(2)				0.00(2)	
232	0.00(2)	0.00(2)					
233							
234	0.00(2)	0.76(3)	0.00(2)	1.59(2)	0.00(2)	0.00(2)	0.00(2)
235	17.76(4)	0.00(2)		9.30(2)		10.00(2)	
236	0.00(2)						
Total Weight (tons)	3,829	397	993	1,598	1,058	2,893	1,109

Table 3. Gadus 3K - Witch average number per set

Stratum	Gadus 12 1978	Gadus 15 1978	Gadus 27 1979	Gadus 29 1979	Gadus 42 1980	Gadus 44 1980
620	0.00(5)	4.86(7)	10.67(3)	2.86(7)	1.00(3)	2.11(9)
621	0.80(5)	7.14(7)	24.33(3)	9.75(8)	5.67(3)	1.80(10)
622	15.00(2)		21.33(3)		38.50(2)	
623	2.00(3)	9.67(3)		5.67(3)	11.00(2)	3.75(4)
624	3.50(4)	7.00(3)	2.50(2)	2.50(2)	1.00(2)	2.50(2)
625	5.67(3)	17.33(3)	17.50(2)	43.00(3)	16.00(2)	13.75(4)
626	15.00(3)	81.50(4)	92.50(2)	77.67(3)	193.00(2)	11.00(3)
627	30.00(2)		47.33(3)		78.50(2)	
628	15.50(2)	28.60(5)	68.33(3)	54.00(2)	52.50(2)	32.38(4)
629	18.67(3)	64.33(3)		45.00(2)	85.50(2)	54.50(3)
630	27.00(2)		12.50(2)	21.50(2)	28.50(2)	7.16(2)
631	29.50(2)		24.67(3)		29.00(3)	
632	3.50(4)	16.67(3)	4.50(2)	23.50(2)	3.00(2)	6.77(2)
633	0.50(4)	20.06(5)	12.50(4)	15.06(6)	16.33(3)	18.00(7)
634	4.50(4)	3.20(5)	1.50(2)	5.33(6)	5.50(2)	6.00(5)
635	4.00(4)	17.60(5)	8.67(3)	15.40(5)	7.00(2)	13.50(4)
636	6.75(4)	14.33(3)	8.00(2)	10.00(5)	13.00(2)	10.20(5)
637	6.00(5)	17.00(4)	7.00(3)	34.00(4)	5.50(2)	16.75(4)
638	8.33(3)	27.60(5)	38.00(2)	59.14(7)	6.00(3)	39.67(6)
639	2.50(4)	16.00(5)	4.50(2)	9.50(2)	11.50(2)	16.50(4)
640	9.50(2)				9.00(2)	
641	0.00(2)		0.00(2)		1.00(2)	
642	0.00(2)				0.50(2)	
643	0.00(2)		0.00(2)			
644	0.00(2)		0.00(2)			
645	0.50(2)				0.00(2)	
646	0.00(2)		0.00(2)		1.00(2)	
647	0.00(2)		0.00(2)		0.00(2)	
648	0.00(2)					
649	0.00(2)					
Total Number ('000)	15,105	30,010	39,612	37,822	45,139	23,508
					33,481 ^a	
					40,920 ^b	

(a) Gadus 42 compared 44
 (b) Gadus 42 compared 27

Table 4. Gadus 3K - Witch average weight per set

Stratum	Gadus 12 1978	Gadus 15 1978	Gadus 27 1979	Gadus 29 1979	Gadus 42 1980	Gadus 44 1980
620	0.00(5)	4.54(7)	8.39(3)	3.30(7)	1.17(3)	2.00(9)
621	0.36(5)	3.97(7)	22.83(3)	9.41(8)	6.33(3)	1.25(10)
622	3.39(2)		16.48(3)		25.25(2)	
623	1.34(3)	5.94(3)		6.57(3)	7.75(2)	2.88(4)
624	2.27(4)	6.51(3)	1.81(2)	2.15(2)	0.55(2)	1.75(2)
625	3.25(3)	12.71(3)	10.55(2)	32.51(3)	13.50(2)	10.63(4)
626	5.14(3)	47.79(4)	51.25(2)	53.83(3)	124.50(2)	9.33(3)
627	18.14(2)		23.59(3)		66.25(2)	
628	12.02(2)	23.88(5)	56.85(3)	52.65(2)	46.00(2)	26.50(4)
629	10.58(3)	48.73(3)		28.58(2)	51.50(2)	34.67(3)
630	14.52(2)		6.92(2)	16.55(2)	26.00(2)	6.03(2)
631	8.18(2)		12.26(3)		15.17(3)	
632	2.67(4)	13.77(3)	4.43(2)	22.22(2)	2.75(2)	5.77(2)
633	0.29(4)	19.28(5)	9.90(4)	14.02(6)	14.50(3)	17.93(7)
634	5.79(4)	2.72(5)	1.81(2)	6.16(6)	6.50(2)	5.50(5)
635	4.59(4)	20.61(5)	13.46(3)	16.87(5)	8.75(2)	13.50(4)
636	4.99(4)	17.25(3)	9.98(2)	11.25(5)	12.25(2)	12.20(5)
637	3.76(5)	18.04(4)	8.78(3)	28.02(4)	6.00(2)	16.00(4)
638	6.43(3)	17.43(5)	29.95(2)	41.12(7)	3.95(3)	26.42(6)
639	1.76(4)	14.08(5)	6.01(2)	10.44(2)	11.00(2)	15.00(4)
640	5.45(2)				8.00(2)	
641	0.00(2)		0.00(2)		0.50(2)	
642	0.00(2)				0.50(2)	
643	0.00(2)		0.00(2)			
644	0.00(2)		0.00(2)			
645	0.34(2)				0.00(2)	
646	0.00(2)		0.00(2)		1.75(2)	
647	0.00(2)		0.00(2)		0.00(2)	
648	0.00(2)					
649	0.00(2)					
Total Weight (tons)	8,763	23,996	30,223	31,632	34,839	19,517
					26,165 ^a	
					32,159 ^b	

- (a) Gadus 42 compared 44
 (b) Gadus 42 compared 27

Table 5. A. T. Cameron 3L - Witch average weight per set

Stratum	ATC 246 1976	ATC 262 1977	ATC 276 1978	ATC 290 1979	ATC 305 1980
328		0.00(3)		0.00(5)	
341		0.00(4)	0.00(4)	0.15(6)	
342		0.00(2)	0.00(2)	0.00(4)	
343		0.00(2)	0.00(3)	0.29(4)	
344	0.18(4)	0.91(4)	0.05(4)	0.91(2)	0.80(3)
345	7.70(4)	36.06(4)	4.31(2)	19.97(4)	8.80(5)
346	28.15(2)	45.58(3)		53.85(4)	7.33(3)
347	4.81(3)	0.00(3)	0.45(4)	1.42(4)	2.70(5)
348	0.00(6)	0.00(6)	0.00(6)	0.00(6)	0.00(3)
349	0.00(3)	0.00(6)	0.00(6)	0.39(7)	
350	0.00(4)	0.00(4)	0.00(6)	0.08(9)	
363	0.00(4)	0.00(5)	0.00(5)	0.14(8)	0.50(3)
364	0.00(3)	0.00(7)	0.00(6)	0.00(8)	0.00(5)
365	0.00(3)	0.00(3)	0.00(2)	0.79(4)	1.00(4)
366	0.23(4)	0.57(4)		0.74(4)	1.25(4)
368	1.51(3)	3.74(3)		2.10(4)	0.00(2)
369	0.71(4)	2.23(3)	2.27(2)	2.10(4)	10.50(3)
370	0.00(3)	0.00(3)	0.00(3)	0.00(4)	0.00(3)
371		0.00(3)	0.00(3)	0.00(3)	0.00(3)
372	0.00(3)	0.00(6)	0.00(7)	0.27(9)	0.00(4)
384		0.00(2)	0.00(3)	0.00(4)	0.00(2)
385	0.00(2)	0.19(6)	0.26(6)	0.00(7)	1.31(4)
386	1.04(2)	20.13(3)	12.26(3)	12.60(4)	0.88(2)
387	29.14(3)	11.58(2)	5.15(3)	2.21(4)	6.00(2)
388	99.30(2)	9.99(2)	22.70(2)	2.98(3)	1.75(2)
389	0.48(2)	2.57(3)	1.29(3)	0.11(4)	0.17(3)
390		0.00(2)	0.45(4)	0.00(5)	0.00(3)
391		0.91(2)	0.00(2)	0.96(4)	1.25(2)
392		2.50(2)	0.45(3)	0.61(3)	0.50(2)
Total Weight (tons)	7,512	9,869	2,644	7,529	3,454

Table 6. A. T. Cameron 3L - Witch average number per set

Stratum	ATC 246 1976	ATC 262 1977	ATC 276 1978	ATC 290 1979	ATC 305 1980
328		0.00(3)		0.00(5)	
341		0.00(4)	0.00(4)	0.17(6)	
342		0.00(2)	0.00(2)	0.00(4)	
343		0.00(2)	0.00(3)	0.25(4)	
344	0.26(4)	0.75(4)	0.25(4)	1.00(2)	0.40(3)
345	6.71(4)	41.96(4)	5.00(2)	21.75(4)	9.60(5)
346	40.50(2)	51.51(3)		65.00(4)	6.67(3)
347	2.47(3)	0.00(3)	0.25(4)	1.50(4)	2.60(5)
348	0.00(6)	0.00(6)	0.00(6)	0.00(6)	0.00(3)
349	0.00(3)	0.00(6)	0.00(6)	0.43(7)	
350	0.00(4)	0.00(4)	0.00(6)	0.22(9)	
363	0.00(4)	0.00(5)	0.00(5)	0.25(8)	0.33(3)
364	0.00(3)	0.00(7)	0.00(6)	0.00(8)	0.00(5)
365	0.00(3)	0.00(3)	0.00(2)	0.75(4)	0.50(4)
366	0.25(4)	0.25(4)		1.00(4)	1.50(4)
368	2.00(3)	3.10(3)		3.00(4)	0.00(2)
369	0.78(4)	2.60(3)	2.00(2)	2.25(4)	7.33(3)
370	0.00(3)	0.00(3)	0.00(3)	0.00(4)	0.00(3)
371		0.00(3)	0.00(3)	0.00(3)	0.00(3)
372	0.00(3)	0.00(6)	0.00(7)	0.33(9)	0.00(4)
384		0.00(2)	0.00(3)	0.00(4)	0.00(2)
385	0.00(2)	0.17(6)	0.17(6)	0.00(7)	1.00(4)
386	1.03(2)	13.67(3)	8.67(3)	9.75(4)	1.00(2)
387	24.75(3)	10.50(2)	3.33(3)	3.00(4)	6.50(2)
388	49.15(2)	12.00(2)	24.50(2)	3.67(3)	1.50(2)
389	1.06(2)	1.67(3)	1.00(3)	0.25(4)	0.33(3)
390		0.00(2)	0.50(4)	0.00(5)	0.00(3)
391		1.00(2)	0.00(2)	1.00(4)	1.50(2)
392		2.50(2)	0.67(3)	0.33(3)	1.00(2)
Total number ('000)	6,502	10,311	2,365	8,430	3,176

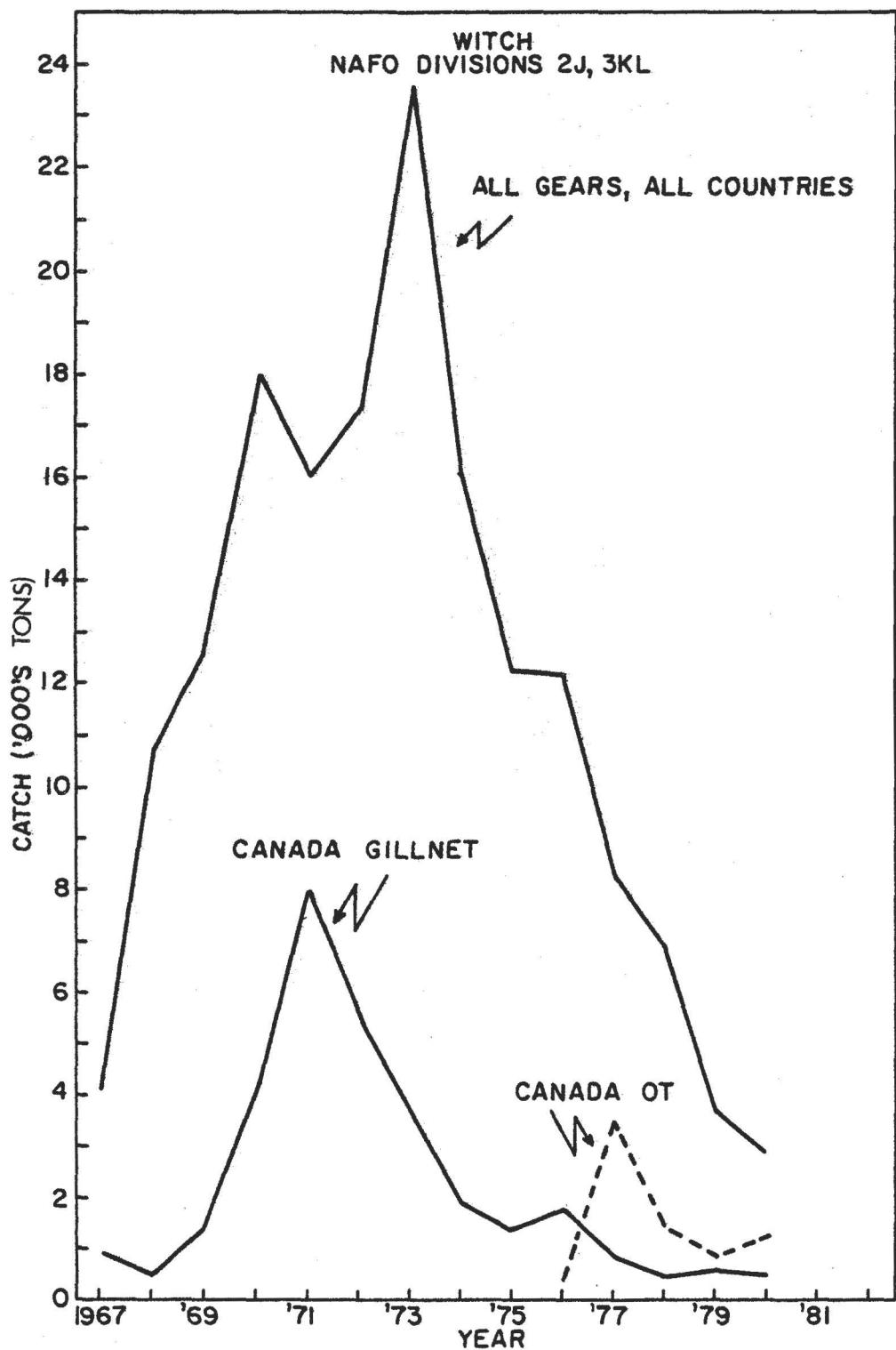


Figure 1. Commercial witch landings in NAFO Divisions 2J3KL.

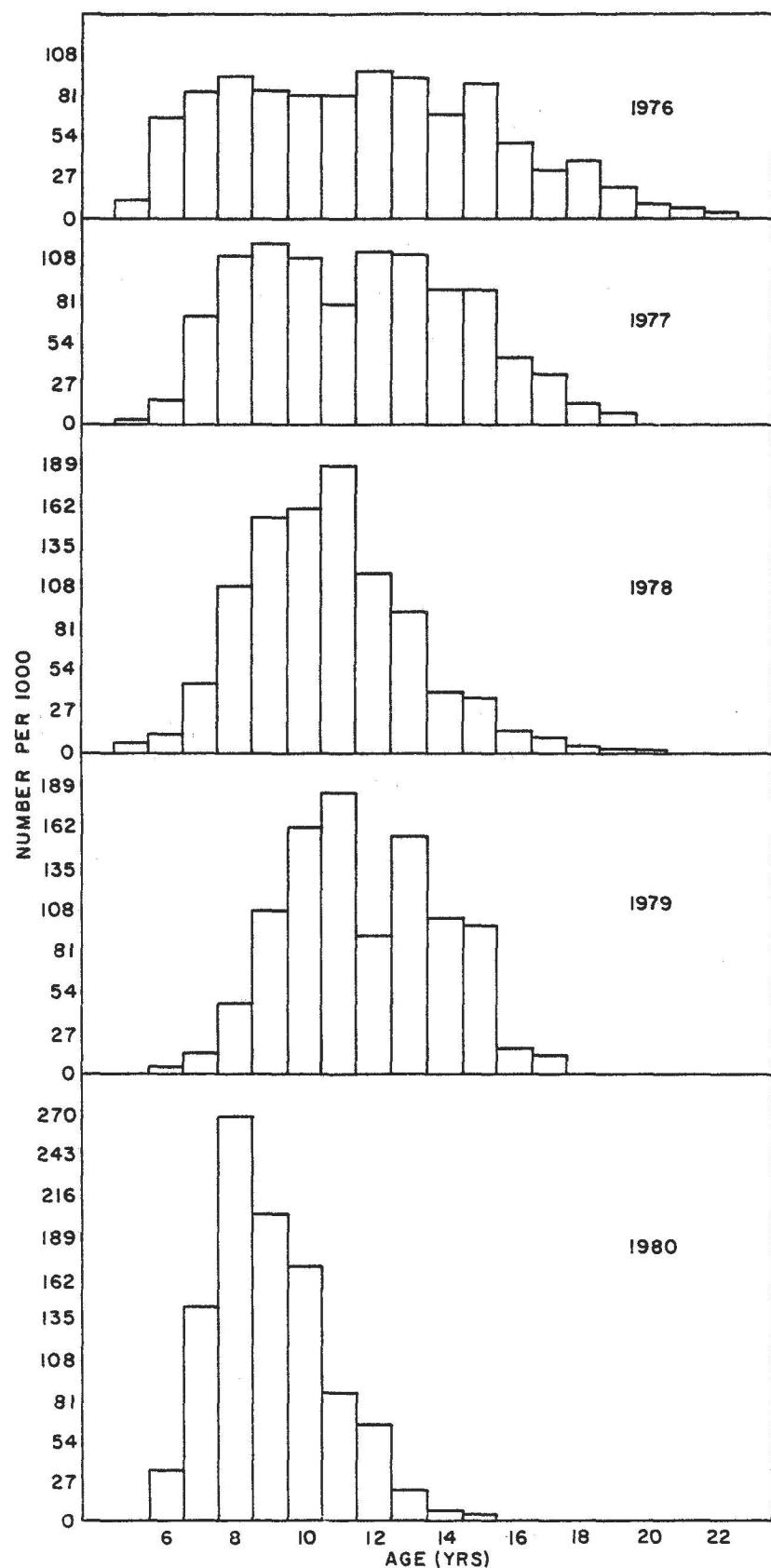


Figure 2. Commercial OT age composition, witch Division 3K.

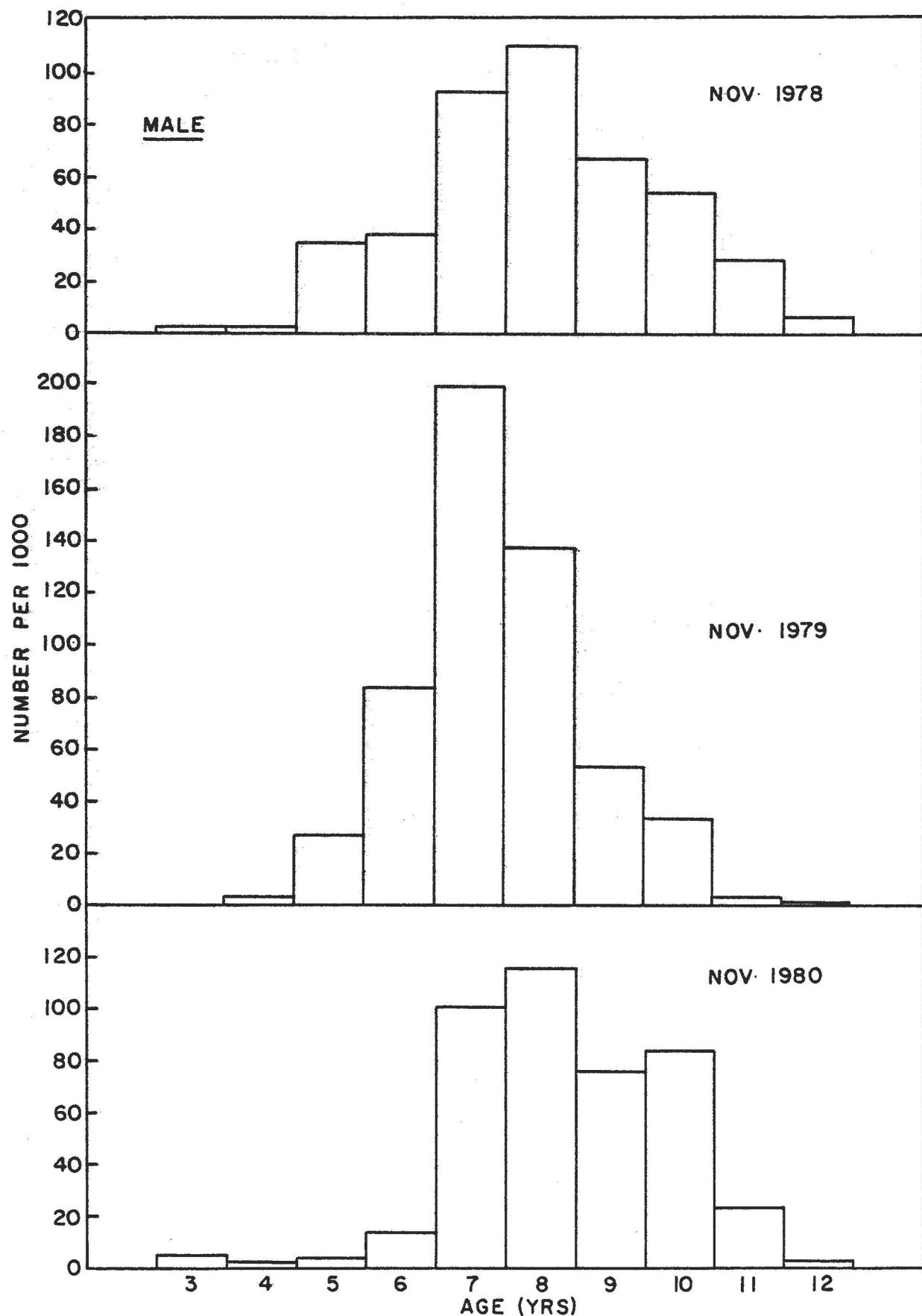


Figure 3. Age composition of male witch in NAFO Division 3K from research vessel surveys.

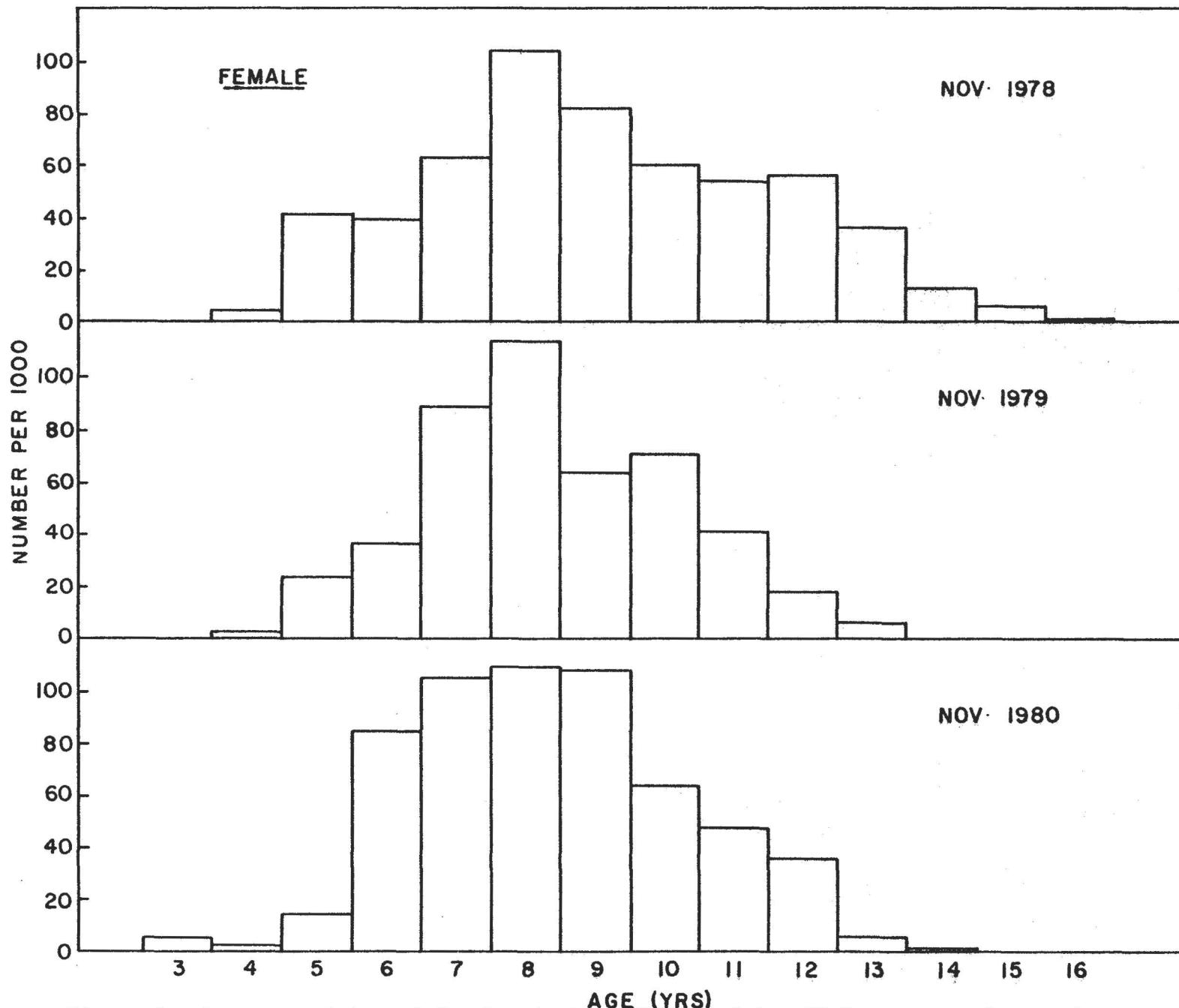


Figure 4. Age composition of female witch in NAFO Division 3K from research vessel surveys.

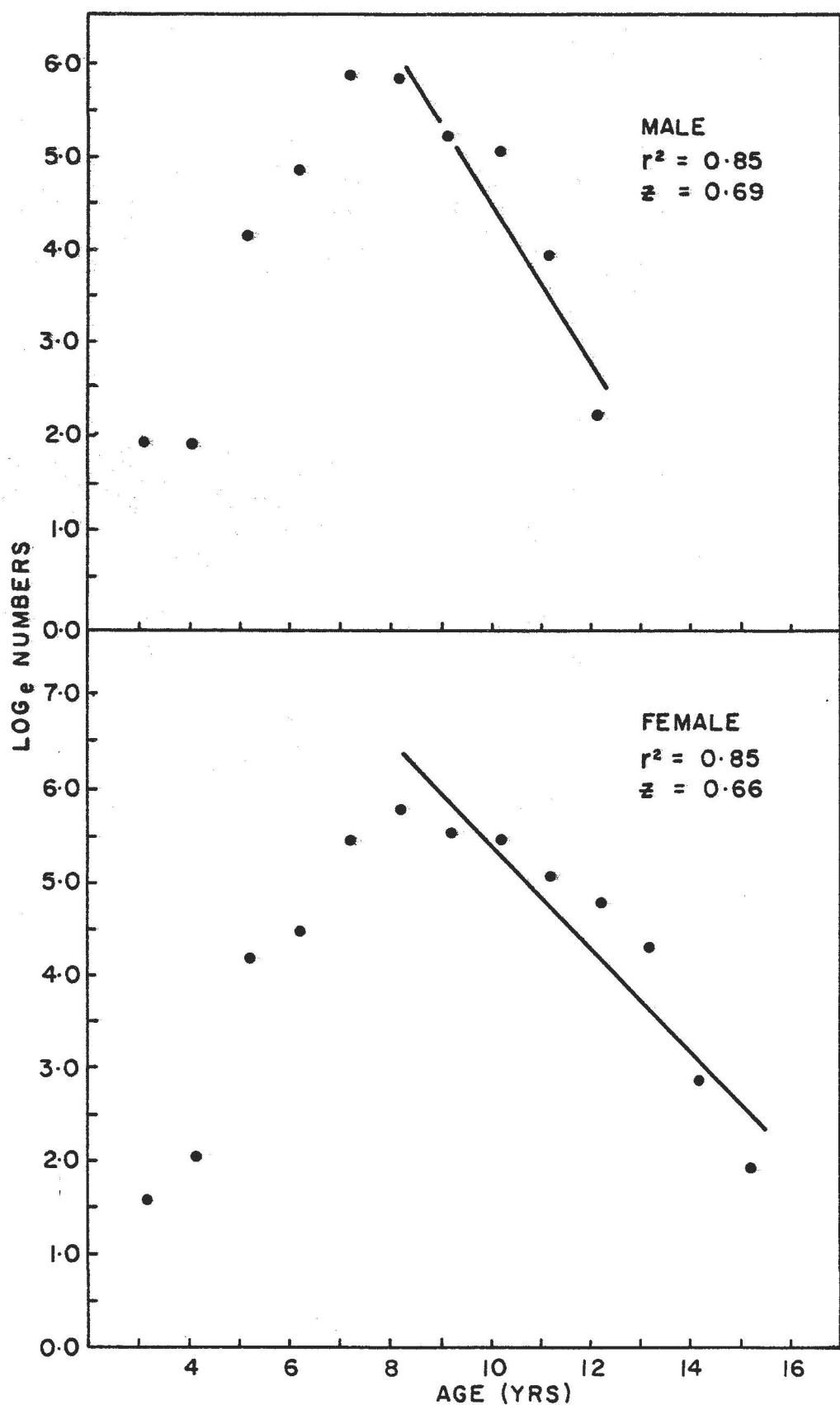


Figure 5. Catch curves for male and female witch from research vessel surveys, Division 3K, 1978-80.

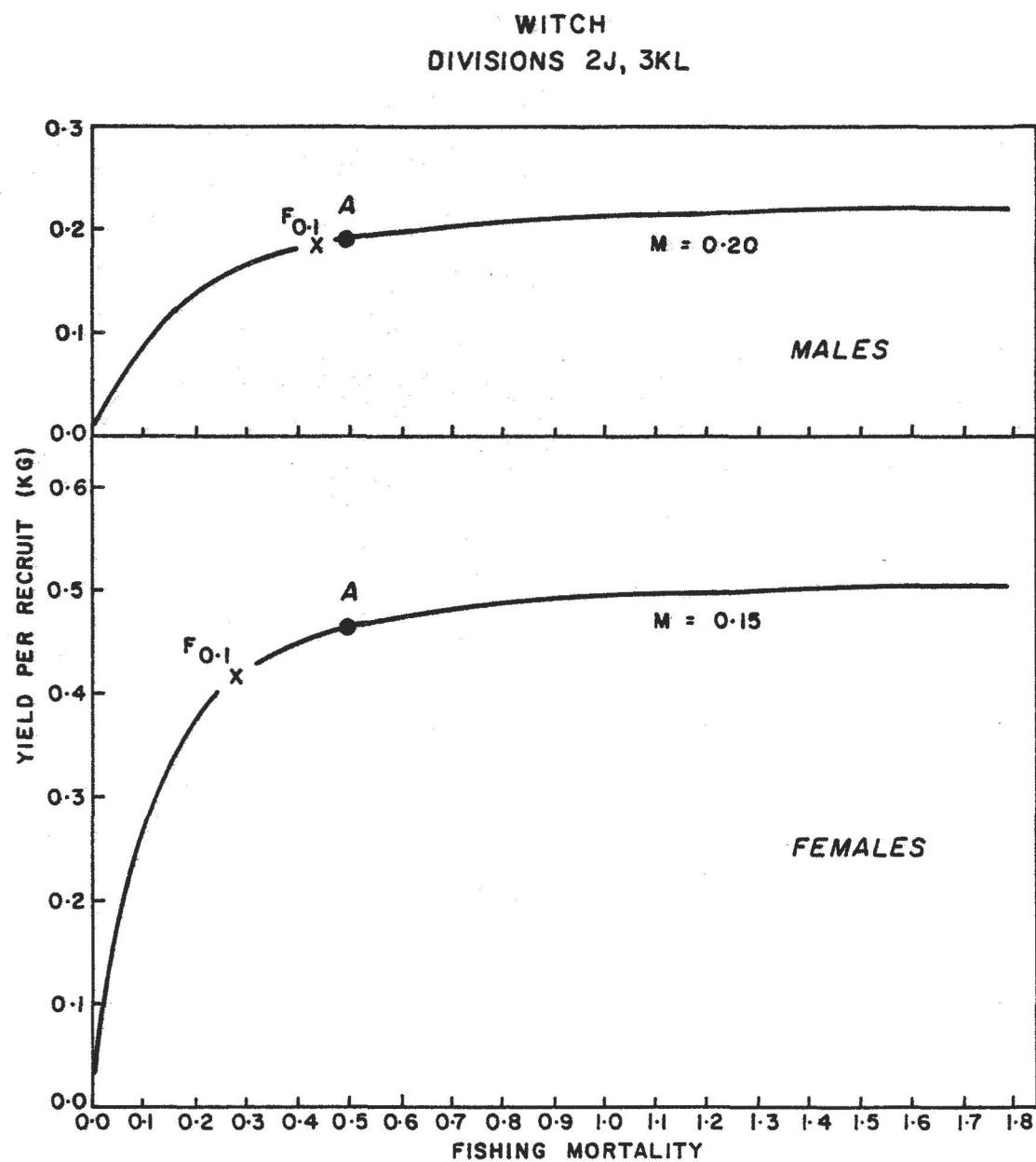


Figure 6. Yield per recruit curves from Bowering and Baird, 1980.
A=F value from catch curves.