

The population structure of witch flounder  
in ICNAF Subdivision 3Ps

by

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Landings and Effort

The main fishery for witch in Subdivision 3Ps is on the southwest slope of St. Pierre Bank generally as a by-catch of directed fisheries for cod, redfish and, to a lesser extent, American plaice. There is a more directed fishery for witch in Fortune Bay by Danish and Scottish Seiners fishing in the deep muddy bottom at the mouth of the bay. Although this is usually a small portion of the total catch, it usually contributes substantially when total landings for the year are less than 1000 tons.

The landings from this stock have been primarily by Canadian trawlers since the fishery began except for 1967-69 when the Soviet Union took high proportions of the total landings (Table 1). Landings have fluctuated from 500 tons in 1965 to almost 5000 tons in 1967. The landings from 1967 were declining steadily (except for 1973) until 1977 when the catch increased sharply to 4200 tons. The catch for 1978 was once again less than 1000 tons. Indications from early 1979 are that this year's catch may also be less than 1000 tons. Fluctuations in the landings are not likely the result of instability of the stock but rather the diversion of effort to or from this species depending on the status of other more lucrative fisheries such as cod and redfish in the Gulf of St. Lawrence and

flounders on the Grand Bank. When ice conditions or quota constraints on these fisheries cause a surplus of effort, then as a result the fishery for species such as witch on St. Pierre Bank will increase. This can be seen in the landings for 1977. When there is no surplus of effort available then the opposite is the case as shown in landings of 1976 and 1978 and will probably be the case for 1979.

Because of its sporadic nature it has been difficult to attach any confidence to effort data made available from this fishery. Catch per unit effort data were available from 1967 from both side and stern trawlers for effort where witch was the main species. Attempts were made to utilize this data; however regressions of catch per unit effort on effort for both types of trawlers separately and for running averages up to 4 years, yielded  $r^2$  values of less than 0.20 in all cases which were not considered to be very reliable. One other explanation for this could be that there has never been enough pressure on this fishery to cause any great changes in this stock, therefore no appreciable relationship between catch per unit of effort and effort would be found. This explanation may be enhanced by the fact that there was essentially no slope on either of the regression lines (slope  $<0.0008$ ).

#### Age composition on St. Pierre Bank versus Fortune Bay

Due to the low landings in 1978 it was difficult to obtain adequate sampling of the commercial catch. One sample of 292 sexed length measurements from St. Pierre Bank was taken, however, very few otoliths were collected. In this case the length frequency was broken down by a research age-length key constructed from data collected during the same year at approximately the same time of year as the commercial sample. There were no commercial samples taken in the Fortune Bay area, however there was sampling of age and length data available from a random stratified biomass survey from 100-400 fathoms in September-October 1978.

A comparison of the two age compositions is shown in Fig. 1.

The age composition is markedly different for both males and females between the two areas especially in the females. In Fortune Bay the numbers of male witch at 12 + years represents the majority while the numbers below 12 years on St. Pierre Bank represents the majority. The females below 12 years old in Fortune Bay are almost negligible whereas the numbers of females beyond 11 years old on St. Pierre Bank are declining in the distribution (Fig. 1). It should also be noted that those caught in Fortune Bay are taken by lined otter trawl, therefore, if smaller fish were available they should be caught, even pre-recruits. This situation has been documented previously by Bowering (1977) and Bowering (1978). It has been suggested that witch in Fortune Bay may very well be a local stock and may not in fact, be part of the St. Pierre Bank stock. Research into the possible discrimination between the two is now in progress.

Since the two areas are considered as one for management purposes it is obvious that commercial samples from both areas would be a basic requirement for proper assessment of this stock.

#### Trends in average numbers and weights per set from biomass surveys

Stratified-random biomass surveys have been conducted in St. Pierre Bank area since 1972. Unfortunately, it was not always possible to fish all the same strata for each year in which the survey was carried out. For the purpose of this paper only five strata (309, 310, 313, 316, 318) were fished every year since 1972, all within a 101-150 fathom depth range. The average number and average weight caught per stratum were calculated. A mean number and weight per set were computed for the five strata combined, weighted by the area in square nautical miles for each stratum. This was done each year from 1972 to 1979 inclusive. The average numbers and weights per set are presented in Table 2 and the trends from year to year shown in Fig. 2.

For the depth range 151-200 fathoms, three strata (705, 707, 715) were fished each year from 1975-1979 inclusive. Calculations on catches of witch in these strata were performed identical to those described previously on the five strata from 151-200 fathoms. The average numbers and weights per set are presented in Table 3 and the trends from year to year presented in Fig. 3. It must be noted that these estimates do not give consideration to variances. For the five strata from 101-150 fathoms, the trend was increasing steadily from 1972-75 in average numbers per set (Fig. 2) while the average weight per set remained more or less steady. This would indicate that there was an increase in the numbers of small fish in the catches. There was a substantial drop in average number per set in 1976 and also average weight per set, although average weight per set did not drop as dramatically. This may be partially because the increasing number of smaller fish from the few previous years may have reached a stage when they move into deeper water or there was a change in environmental conditions. The 1977-79 surveys indicate a very slight decline and estimates are approximately the same as shown by the 1972-73 levels.

For the three strata from 151-200 fathoms, the unusually high average number per set in 1975 accompanied by a low average weight per set is similar to that shown in the 101-150 fathoms strata also followed by a sharp decrease in 1976. Things would appear to have stabilized since 1976 and from 1977-79 the surveys indicate a general increase in both average numbers per set as well as average weight per set. This feature is opposite to the shallower strata which would suggest a possible movement into the deeper water.

#### Average numbers caught at age per set from biomass surveys

The age compositions of the male and female witch were also available from the biomass surveys for the same two sets of strata separately as discussed in the previous section. The age compositions of the witch from the five strata from 101-150 fathoms are presented in Fig. 4 (males) and Fig. 5 (females) for

for the years 1974-79.

For the three strata from 151-200 fathoms the age compositions are shown in Fig. 6 (males) and Fig. 7 (females) for the years 1975-79. All age compositions were presented as weighted mean numbers per set weighted by stratum area in square nautical miles.

#### Males

Very few fish below 6 years old were caught in either year for the 101-150 fathom strata with few beyond age 15. With the exception of 1974 the age distribution from surveys in these strata has been relatively stable (Fig. 4) with 9-12 year old fish making up most of the catches each year. There were high numbers of younger fish in the 1974 survey which may have been stronger year-classes or simply anomalies in distributions. The 1979 survey indicates that the older fish are disappearing in the surveys, however, the higher proportions are still in the 9-12 year old range. This disappearance may be because of fishing pressure reducing old age groups, however, the sample was small and I would suspect if the sample was larger, there would be higher numbers of older individuals.

The situation in the deeper strata of 151-200 fathoms is very similar to that of the above strata (Fig. 6) with much stability in the age distribution from year to year. In the 1979 survey, however, there seems to be a very slight shift to the younger age groups with few numbers of 13-15 year olds. This also may be the result of a very small sample (168 fish).

#### Females

The age structure of the females is very similar to that of the males for both sets of strata (Fig. 5+7), however, there tends to be more older fish comprising the catch than that of the males. The disappearance of older fish in the 1979 survey is also apparent in the age distributions although the numbers measured are considerable higher than that of the males. This would suggest that there is a reduction of the older individuals. This could be partially as a result of a very high total catch in 1977.

### Summary

Previous assessments done on this stock (Bowering, 1977, 1978) have indicated that under average conditions this stock could sustain removals of 2000-3000 metric tons annually. If this is true, then except for 1977, the pressure on this stock would be from a general view, in a reasonably stable condition.

Many questions have yet to be answered concerning this stock. As with other witch stocks in the Northwest Atlantic Area, little is known about recruitment. In research catches using lined otter trawl, very few fish below 5 years old (30 cm) are taken. The difference between the age composition of the St. Pierre Bank and Fortune Bay could mean, instead of two local stocks, that the older individuals in Fortune Bay Area may be the main spawning stock that supplies the offshore St. Pierre Bank Area. During the late 1950's and early 1960's when many of the mesh selection studies were carried out in Hermitage Bay and the surrounding area, many small witch were caught which would suggest that this may be possible.

It should be mentioned that the age compositions presented in this document are based upon only a few strata. Because of this the age distributions may not be complete for the entire area but are only relative trends for comparison from year to year. Bowering (1978) presented age frequencies from the research cruises for the entire area combined for several years and indicated catches of males up to 18 years and females as high as 24 years old. In summary, it would seem from previous assessments and this review of research surveys that this stock appears to be in relatively stable condition.

REFERENCES

- Bowering, W.R. 1977. The status of the witch flounder fishery in ICNAF Subdivision 3Ps. ICNAF Selected Papers No. 2, pp: 11-14, 1977.
1978. Trends in the witch fishery on St. Pierre Bank. CAFSAC Res. Doc. 78/6, 1978.

Table 1.

Nominal catches of witch flounder,  
ICNAF Division 3Ps 1963-78

YEAR	CAN	FRA	USSR	UK	PORT	TOTAL:
1963	771	131	-	22	-	924
1964	963	-	-	48	-	1011
1965	555	-	-	15	-	570
1966	1344	-	79	21	-	1444
1967	3790	-	982	33	-	4805
1968	2561	106	1464	-	-	4131
1969	2309	95	1691	1	-	4096
1970	2591	111	-	-	-	2702
1971	2193	57	-	-	-	2250
1972	1517	69	8	-	-	1594
1973	2341	112	443	10	-	2906
1974	1699	2	-	-	40	1741
1975	1370	40	4	-	13	1427
1976	866	32	3	-	2	903
1977	4168	-	-	-	-	4168
1978	963	-	-	-	-	963



Table 2.

Witch biomass surveys 1972-79 Subdivision 3Ps

<u>Stratum</u>		<u>309</u>	<u>310</u>	<u>313</u>	<u>316</u>	<u>318</u>	<u>Total Area:</u>	<u>Weighted Mean:</u>
Area (sq. n. miles)		(296)	(170)	(165)	(189)	(123)	943	
1972	* No.	2.43	21.39	17.50	50.56	33.70		22.21
	* Wt.	1.27	9.27	6.40	21.02	12.06		8.98
1973	No.	36.00	13.00	12.25	51.60	40.50		31.41
	Wt.	17.86	6.81	6.19	18.89	25.88		15.08
1974	No.	29.62	14.75	56.60	74.33	54.00		43.80
	Wt.	10.84	6.70	20.43	27.69	25.88		17.11
1975	No.	4.20	3.98	120.67	126.50	4.97		49.15
	Wt.	2.02	1.92	33.29	37.79	1.69		14.60
1976	No.	5.13	5.25	27.17	13.75	6.55		10.92
	Wt.	1.91	2.84	9.88	5.45	1.91		4.18
1977	No.	13.56	13.94	20.73	91.06	14.50		30.54
	Wt.	6.14	6.94	8.32	33.33	6.05		12.10
1978	No.	9.56	16.44	34.20	42.67	16.50		22.65
	Wt.	3.38	6.63	17.07	15.17	5.90		9.05
1979	No.	8.17	8.33	14.40	43.67	37.00		20.16
	Wt.	3.97	4.01	6.17	18.76	14.74		8.73

\* No. = Av. No./Set (Weighted by Stratum area)

\* Wt. = Av. Wt./Set (Weighted by Stratum area)

Table 3.

Witch biomass surveys 1975-1979 - ICNAF Subdivision 3Ps

Stratum		705	707	715	TOTAL AREA:	WEIGHTED MEAN:
Area(Sq.N. Miles)		(195)	(93)	(132)	943	
1975	* No.	25.81	65.25	19.00		32.40
	* Wt.	3.97	20.32	6.65		8.43
1976	No.	18.50	5.50	10.50		13.11
	Wt.	6.13	2.27	5.90		5.20
1977	No.	20.75	4.62	6.25		12.61
	Wt.	7.15	1.29	2.67		4.44
1978	No.	10.80	27.00	15.50		15.86
	Wt.	3.99	10.90	9.08		7.12
1979	No.	33.50	22.50	9.33		23.47
	Wt.	13.39	11.13	4.69		10.16

\* Average number per set (Weighted by Stratum Area)

\* Average Weight per set (Weighted by Stratum Area)

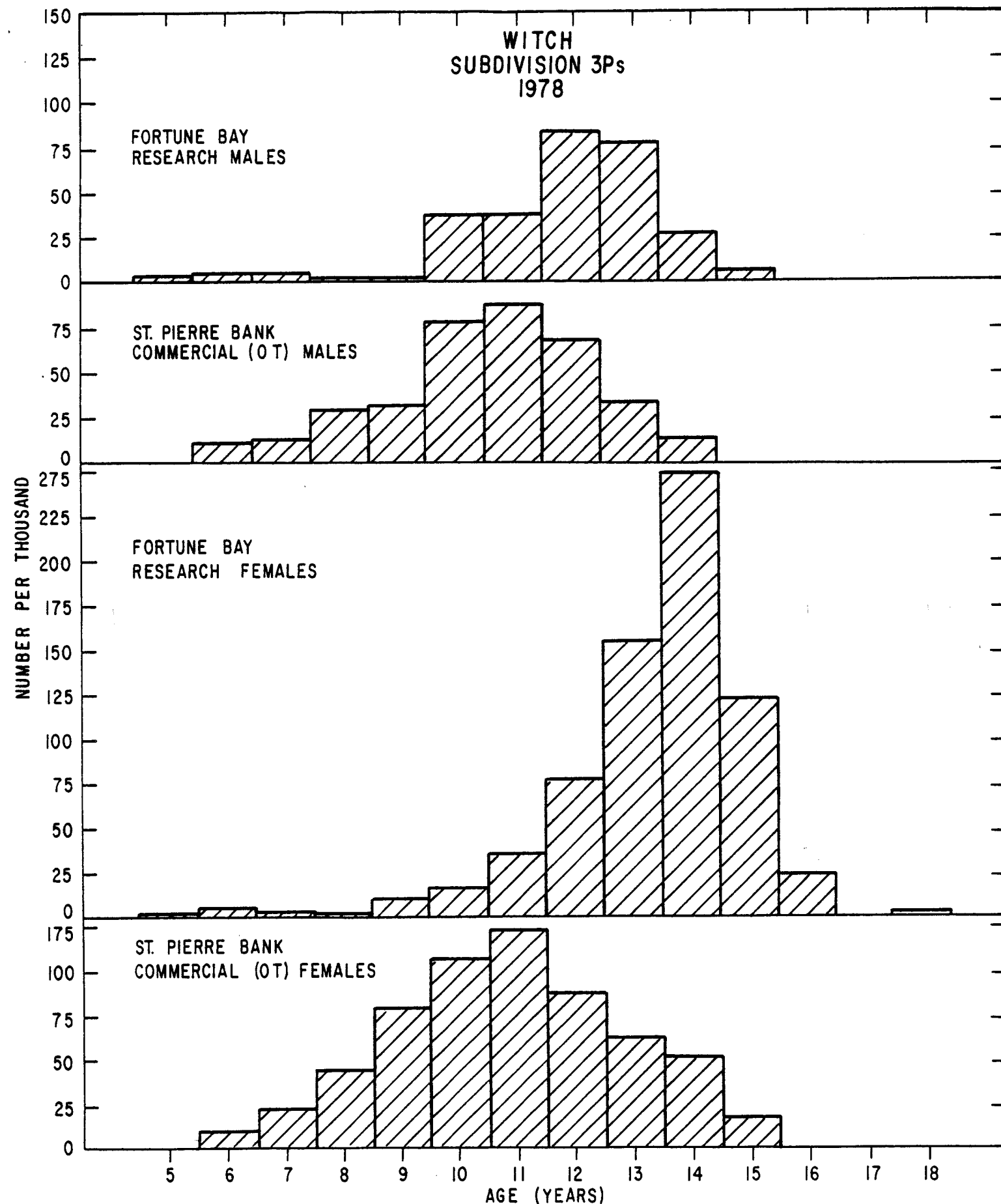


Fig. 1. Age distributions of male and female witch from commercial otter trawl on St. Pierre Banks and research otter trawl in Fortune Bay during 1978.

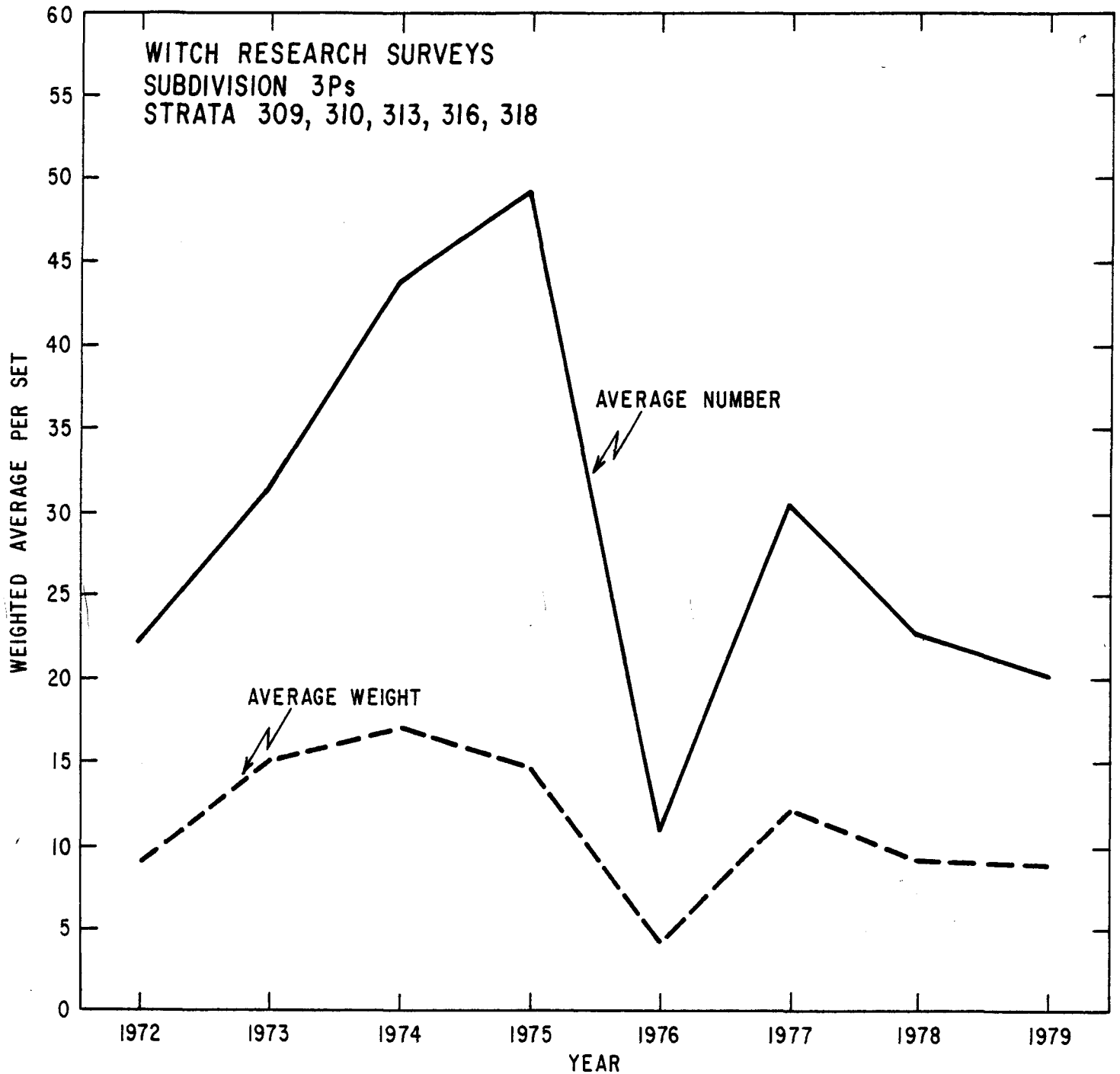


Fig. 2. Average numbers and average weights of witch per 30-minute set of the research vessel A.T. Cameron during random stratified surveys on St. Pierre Bank during 1972-79. Values are based upon 5 strata from 101-150 fathoms.

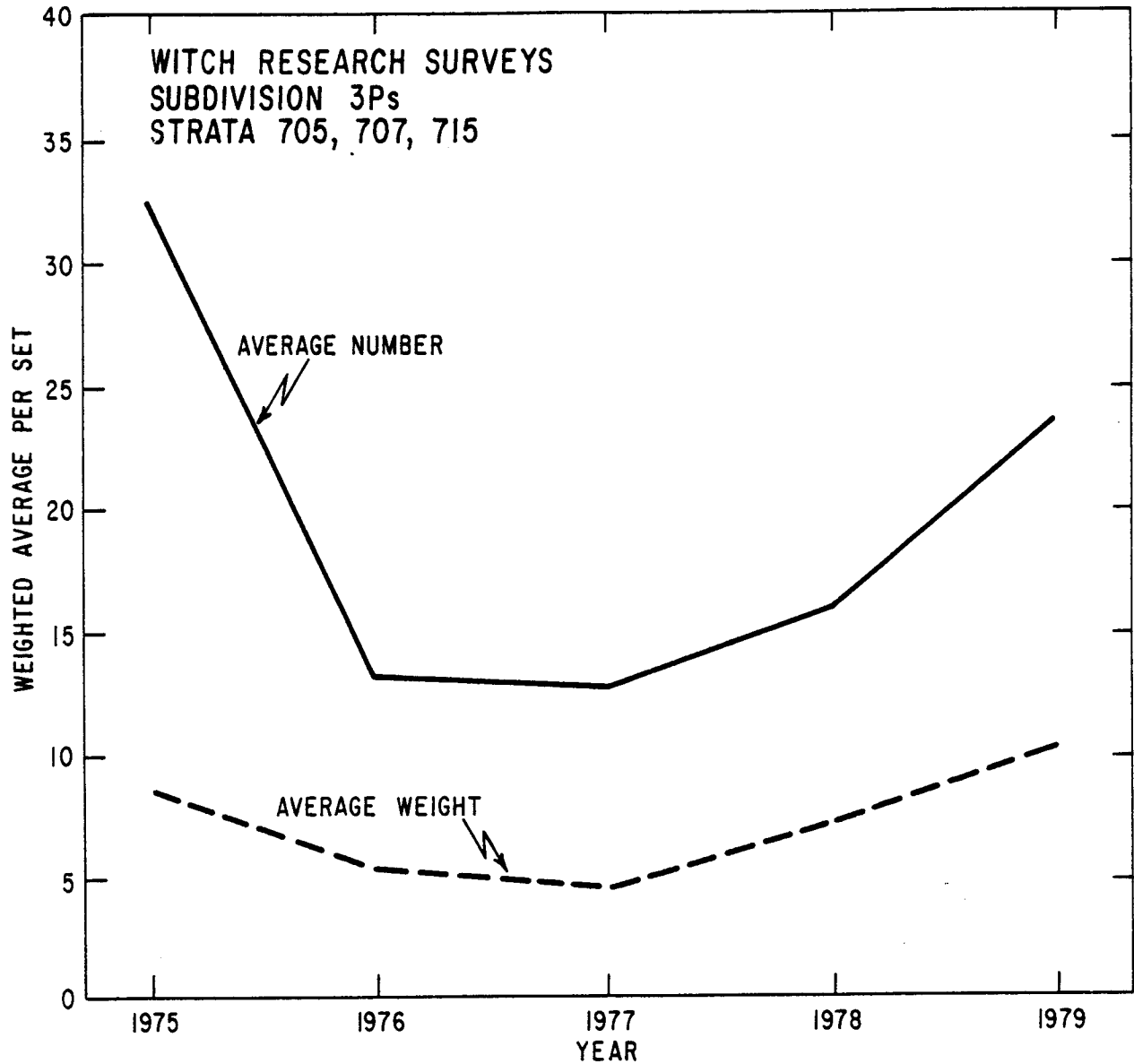


Fig. 3. Average numbers and weights of witch per 30-minute set of the research vessel A.T. Cameron during random stratified surveys on St. Pierre Bank during 1975-79. Values are based upon 3 strata from 151-200 fathoms.

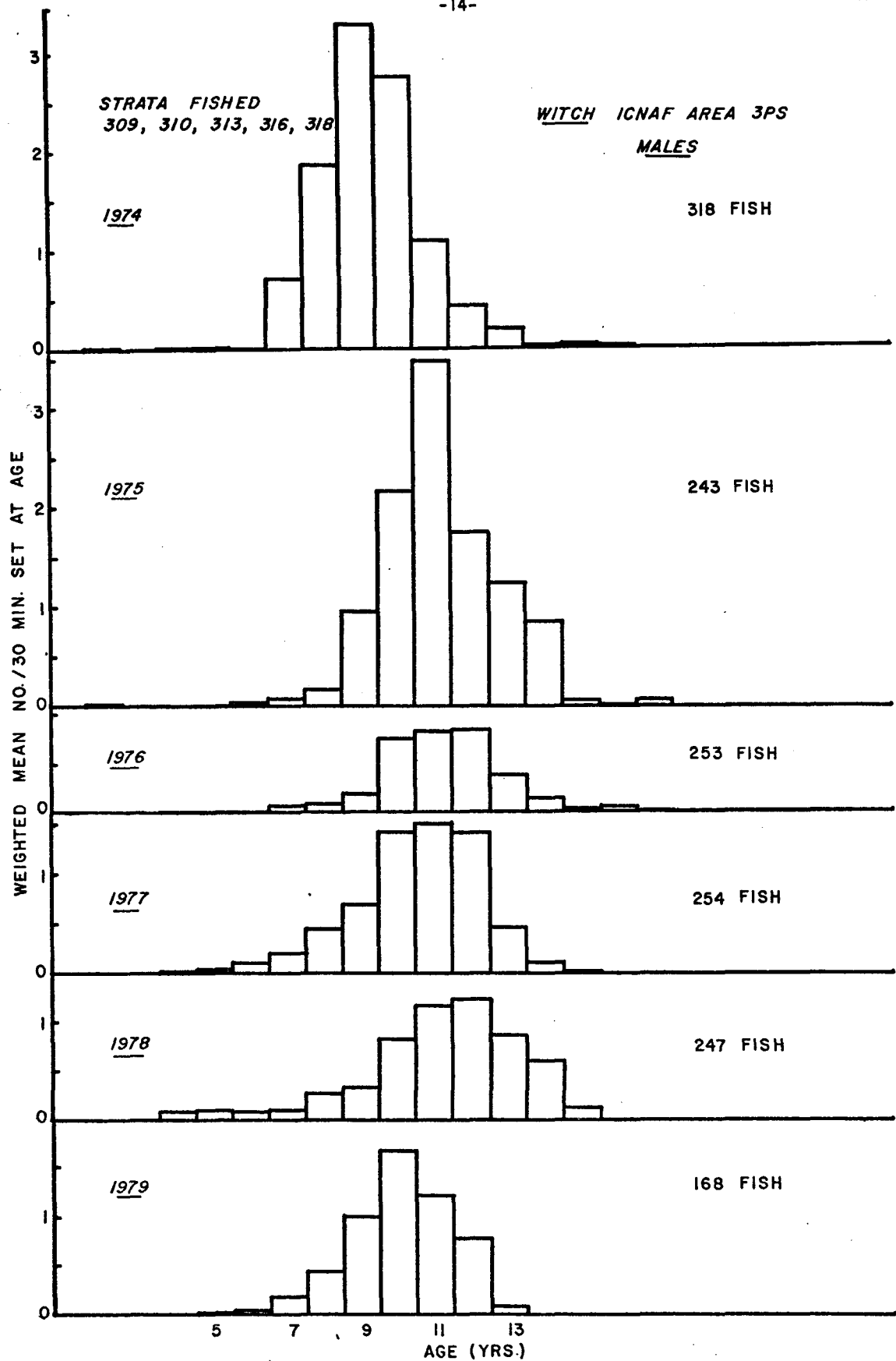


Fig. 4. Weighted average number of male witch per set at age from stratified random surveys on St. Pierre Bank from 1974-79. Values are based upon 5 strata from 101-150 fathoms.

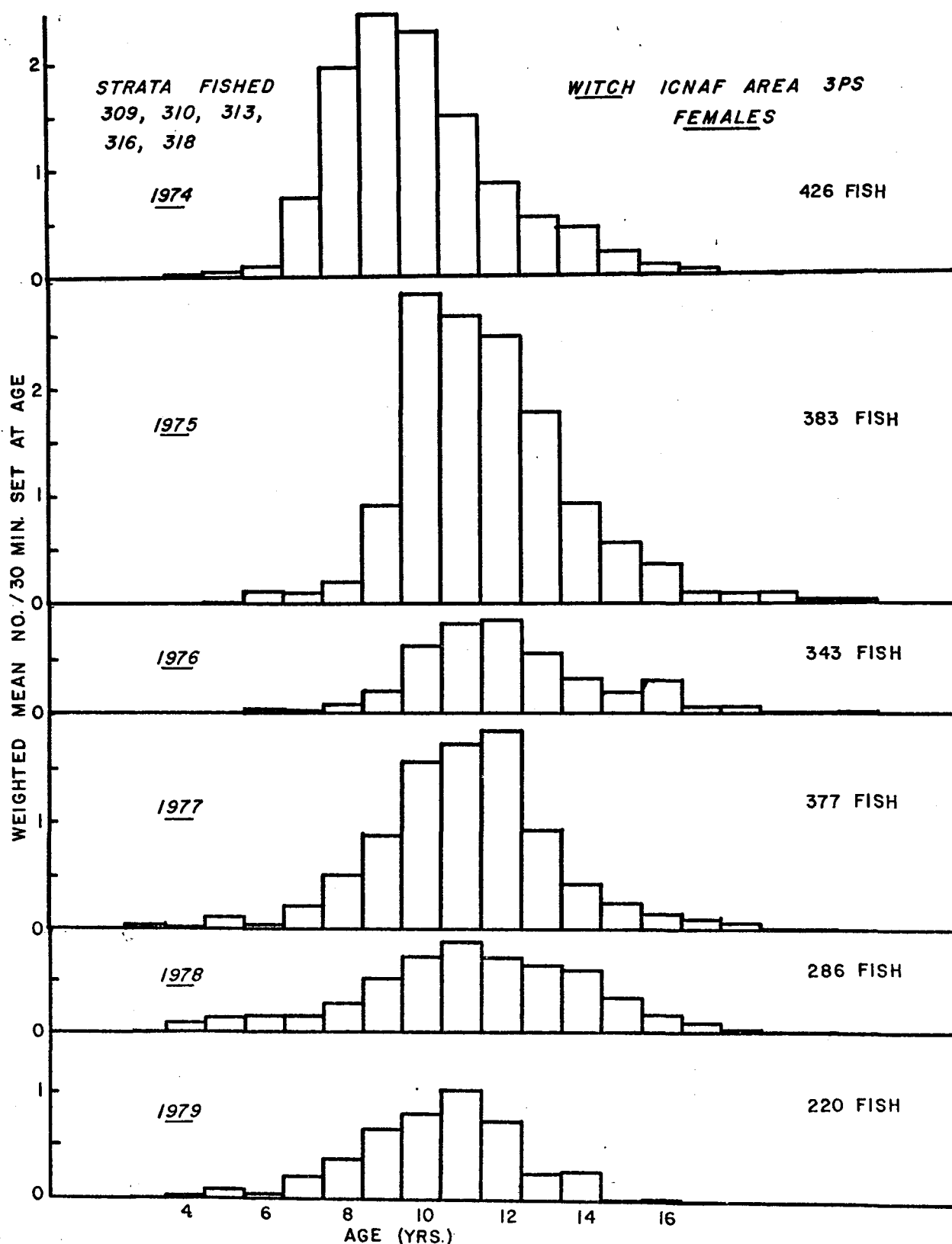


Fig. 5. Weighted average number of female witch per set at age from stratified random surveys in St. Pierre Bank from 1974-79. Values are based upon 5 strata from 101-150 fathoms.

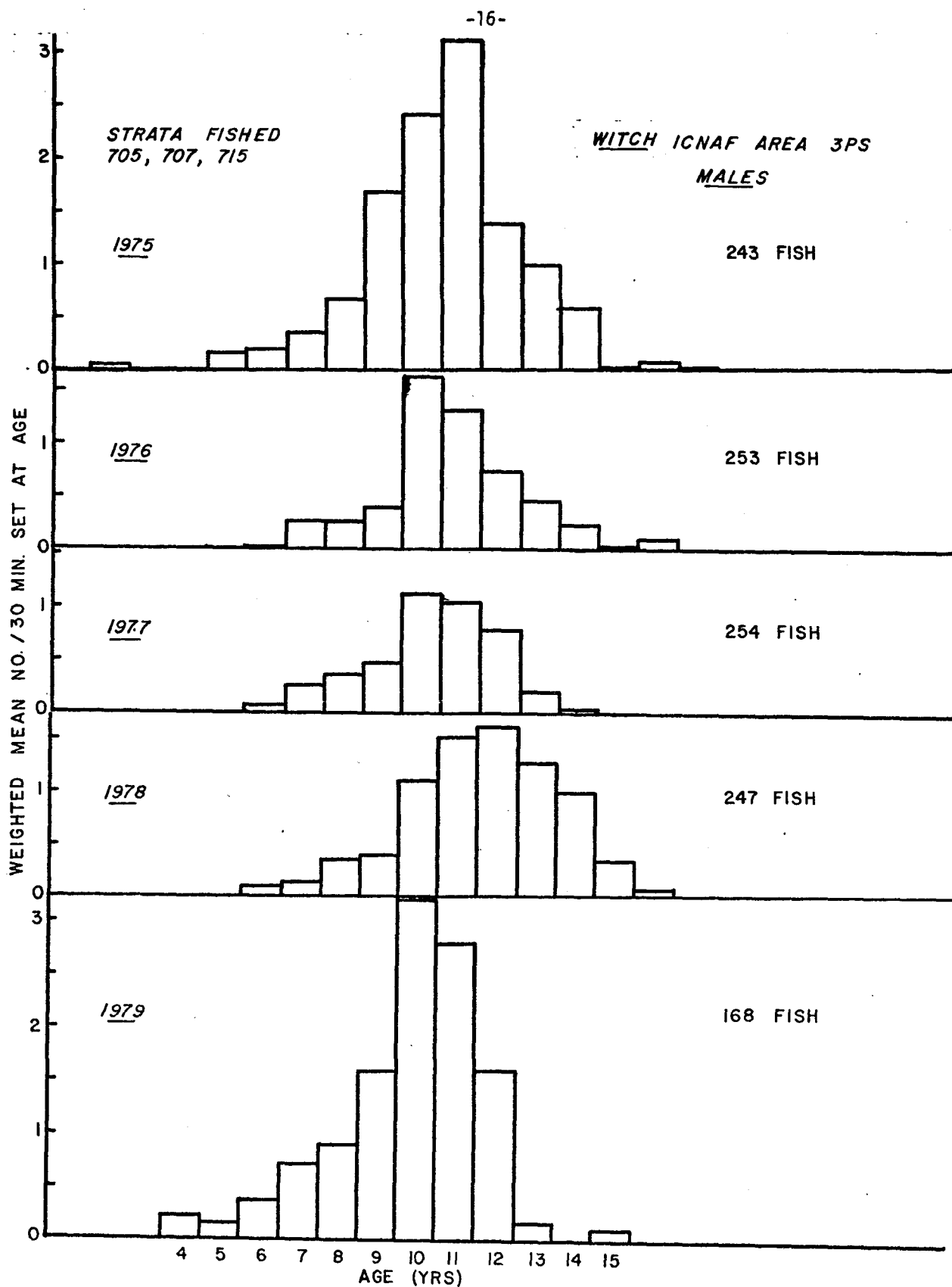


Fig. 6. Weighted average number of male witch per set at age from stratified random surveys on St. Pierre Bank during 1975-79. Values are based upon 3 strata from 151-200 fathoms.



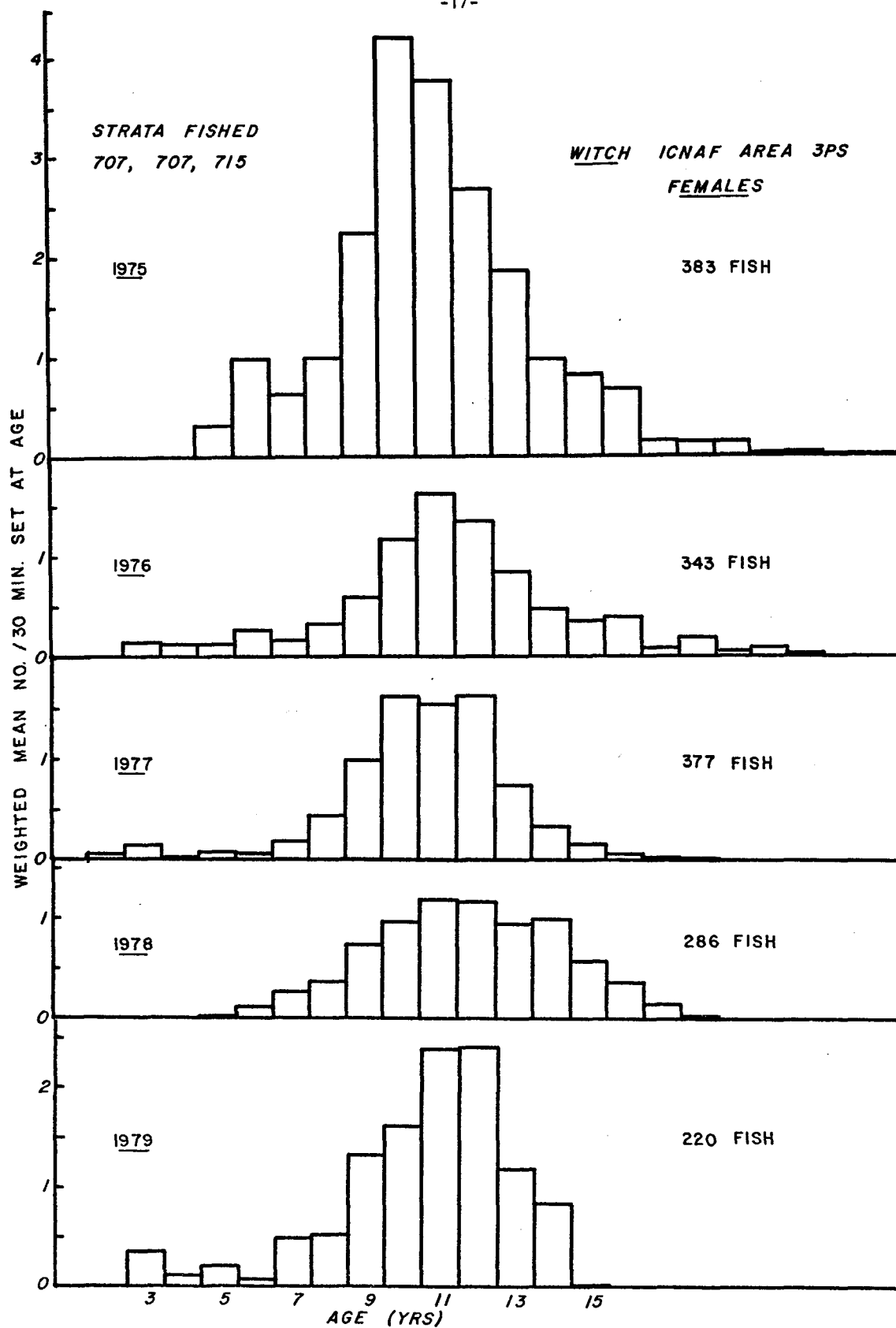


Fig. 7. Weighted average number of female witch per set at age from stratified random surveys on St. Pierre Bank during 1975-79. Values are based upon 3 strata from 151-200 fathoms.