

CURRENT STATUS OF THE WITCH FISHERY IN THE GULF OF ST. LAWRENCE
(ICNAF DIVISIONS 4RS)

by

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Landings

Fishing for witch in the Gulf region was a direct result of low catches by Danish Seiners in the Fortune Bay area in the early 1950's. These vessels moved to the St. George's Bay area where the bottom was suitable for Danish seining and the catches were quite substantial. More recently, there has been a directed fishery for witch outside St. George's Bay in the Esquiman Channel area by offshore otter trawlers. In a fairly localized area here, especially in winter time, these fish form a prespawning concentration for a few months and CPUE at this time in this area is profitable. This fishery usually occurs after the cod quota in the same area has been taken. The total landings have been on a general upswing since 1973 (Fig.1) from 887 tons to a high of 5341 tons in 1976. Since then, catches have decreased but during 1977 and 1978 were still over 4000 tons each year. Recent statistics have shown that in the first three (3) months of 1979 almost 2,000 tons have been taken offshore. It is likely that the total catch for 1979 will probably exceed 4,000 tons by the end of the year.

A precautionery quota of 3,500 tons was placed upon this stock for 1977 and 1978 based upon catch statistics. An analytical assessment presented at the assessments meeting during 1978 indicated that landings primarily comprised very old fish over the past few years and it was the advice of the subcommittee to fish this stock a little harder in order to reduce the numbers of old fish and allow for increased growth rate and general improvement of fish condition. The TAC for 1979 was subsequently increased to 5,000 tons from 3,500 tons. This document will attempt to review the most recent developments in this population.

Catch and Effort

The only reliable effort data available for this stock has been from the Newfoundland side and stern trawlers which have had a small directed fishery, as previously explained, over the last few years. Since this fishery is prosecuted during the winter-spring time, much depends upon the ice conditions in the Gulf

of St. Lawrence during this time of year. The available catch and effort data from Newfoundland Stern and Side trawlers from 1974 are tabled separately (Table 1) for the first five (5) months of each year and the values only reflect catches where witch was the main species. The catch per unit effort for the month with highest effort in each year is presented as well as the average CPUE over the months where witch were caught as main species.

Very little directed effort by side or stern trawlers occurred in 1974 and 1975, however, a considerable amount of effort was placed on this concentrated stock in 1976, 1977 and 1978 especially by the more efficient stern trawlers. The trend in CPUE for the side trawlers was much the same as that of the stern trawlers over the five year period. The straight line relationship between the two yielded a correlation coefficient of 0.82. Except for 1977 with a CPUE of 0.20 tons per hour the CPUE since 1975 has been over 0.40 tons/hour with a preliminary value of 0.40 tons per hour in the same period for 1979.

Commercial Age Composition and Mortality

The age composition of male witch in ICNAF Divisions 4RS (Fig. 2) ranged from 8-18 years in 1976, from 6-18 years in 1977 and from 5-18 years in 1978. The catches indicate a reduction in numbers of the older age groups, with a shift to higher numbers of younger fish. During 1976 most males caught were 12+ years and in 1978 most were less than 12 years old.

For the females the trend is much the same (Fig. 3). During 1976 female witch in the catches ranged from 8-26 years, 7-21 years in 1977 and 6-20 years in 1978. The tendency towards reduction of the older age groups is very noticeable in the females.

Using the CPUE of the Newfoundland stern trawlers in Table 1 as a standard and the commercial age composition in Figures 2 and 3, the CPUE at age for 1976-78 was calculated for males and females separately (Tables 2 and 3). Total mortality values were then calculated between 1976 and 1977 and also between 1977 and 1978 over what appeared to be the fully recruited age groups. The Z value for 1976-77 males (Table 2) is 0.96 for ages 13+ and $Z = 0.75$ for 1977-78 for ages 14+. The Z value for females for 1976-77 was 0.98 for ages 13+ (Table 3) and 0.69 for ages 17+ for 1977-78. The value of 13 or 14 years for full recruitment appears realistic, however, age 17 years for the females in the 1977-78 calculation is probably an overestimate. This could be caused by a change in the partial recruitment pattern from 1977 to 1978. This mortality value although it is presented, is probably not very meaningful when it reflects mortality on such a minor proportion of the population. The other mortality values seem to be reasonable since the age groups concerned

comprise a high proportion of the catch.

These values are placed upon yield per recruit curves as derived by Bowering (1978), (Fig. 4). All values are beyond $F_{0.1}$, however, the 1977-78 mortality values are less than the 1976-77 values which is also reflected in the landings (Fig. 1). High values in the earlier years would be expected because of the high mortality on old fish but would reduce where age composition stabilize from year to year.

Estimates of Trawlable Biomass from Research Surveys

During January of 1978 and 1979 biomass surveys were carried out in ICNAF Divisions 4R and 4S according to a random stratified survey design. The whole of Division 4R was surveyed in 1978 and again in 1979. Division 4S, with the exception of 2 strata was completely surveyed in 1978, with only 5 strata in Division 4S being surveyed in 1979. The average numbers per set and average weights per set for each stratum fished in 1978 and 1979 for Divisions 4RS are presented in Table 4.

While the average numbers fluctuate from stratum to stratum between 1978 and 1979 in Division 4R there does not appear to be very much difference between the means. The mean trawlable biomass for 1978 for Division 4R was 5873 metric tons and 6608 metric tons for 1979 which indicates a slight increase in 1979. Considering each stratum separately in Divisions 4S indications are that for the same strata fished in 1978 and 1979, all but one stratum showed consistent decline from 1978 to 1979 in the mean numbers caught. Of the five strata compared however, only one or two would be considered significant strata for witch. Because of the lack of coverage in 1979 it wasn't possible to obtain an estimate of mean trawlable biomass for ICNAF Division 4S.

Age Composition and mortality estimates from Research Surveys in Divisions 4RS.

The age composition of the witch catches in Divisions 4RS for males and females are plotted separately for the January 1978 survey and the January 1979 survey (Fig. 5 & 6). The males (Fig. 5) in 1978 ranged from 3 years to 15 years with most in the 8-12 year old range. The 1979 survey ranged from 4-13 year old with most fish occurring in the 8-12 year old range as well.

The female (Fig. 6) ranged from 3-18 years in the 1978 survey

with most occurring at 10-14 years old. The 1979 survey yielded females from 3-16 years with most in the 10-13 year old range.

While the surveys do not show the same upper ranges as seen in the commercial catches for 1978, they do tend to follow the same pattern from one year to the next and that is a reduction in older ages with higher catches of younger age groups. The scarcity of very young fish in the surveys is probably not a result of poor recruitment but rather a result of being inaccessible to the fishing gear. It has been well documented that the juveniles occupy deep muddy holes on the banks which cannot be surveyed properly.

Using the average numbers at age per 30 minute set from the eight strata where witch occurred in Division 4R a mean number per set at age by sex was obtained for the Division weighted by stratum area. These mean numbers per set were calculated for both the 1978 and the 1979 surveys (Tables 5 & 6). Estimates of total mortality were obtained for ages 11+ in the males and ages 12+ in the females. For the males $Z = 0.62$ and for the females $Z = 0.72$. These values were then plotted on the yield per recruit curves (Fig. 4). During the 1978 survey 50% of the total catch was males and 50% females. During the 1979 survey, 43% was males and 57% females. This may explain the slightly higher mortality in the females since the age composition is not all that different in the important age groups.

These mortality values are lower than the 1976-77 values and the 1977-78 values from the commercial statistics which is not too surprising since the difference between 1978 and 1979 in the numbers of old fish is not as great. All values are above the $F_{0.1}$ level of fishing, however, this is to be expected until all the old fish have been taken and there is a consistency between age composition from year to year.

Summary

It appears from these data that the attempt to reduce the numbers of old fish in the population is working. During 1976 fish were taken up to age 26 years and the survey in January 1979 caught few fish over age 15 years. The estimates of fishing mortality over the past couple of years has been relatively stable for the females and somewhat lower in 1978-79 for the males. It does appear that there is a higher proportion of younger fish into the fishery as the older ones are fished out which would keep the total mortality relatively stable. The estimates of mean trawlable biomass over the last couple of years also indicates stability for

Division 4R at least. Whether these indications are real or there is immigration into fishing area from other sectors of the population is difficult to determine precisely at present.

The TAC for 1979 is unlikely to be taken since the trawler fishery has only taken 1700 out of a possible 3300 tons and this part of the fishery is essentially over. This was not due to a scarcity of fish, however, but a diversion of the fishing effort to Greenland halibut which produced higher catch rates and as yet there is no quota on Greenland halibut in the Gulf of St. Lawrence. While this stock still appears to be in good condition and the fishing out of the old fish will help to improve the quality of fish it must be treated with caution since the spawning concentration that is heavily fished in winter-spring time is probably the total spawning stock in ICNAF Divisions 4RS.

REFERENCES

- Bowering, W.R. 1978. An analytical assessment of the wtch flounder stock in the Gulf of St. Lawrence (ICNAF Divisions 4RS). CAFSAC Res. Doc. 78/7

Table 1. Catch and effort data for Canadian otter trawlers fishing with in first 5 months of 1978 and 1979, ICNAF Division 4R

Side OT

<u>MONTH</u>	<u>1974</u>		<u>1975</u>		<u>1976</u>		<u>1977</u>		<u>1978</u>	
	<u>CATCH (mt)</u>	<u>EFFORT(hrs)</u>	<u>CATCH</u>	<u>EFFORT</u>	<u>CATCH</u>	<u>EFFORT</u>	<u>CATCH</u>	<u>EFFORT</u>	<u>CATCH</u>	<u>EFFORT</u>
Feb.					309	774	3	24	104	75
Mar.					41	144	191	1222		
April	5	15	40	139	51	248	32	168	4	12
May			73	306					9	24
c/f (highest mo.)	0.333		0.239		0.399		0.156		0.219	
- c/f =	0.333		0.254		0.344		0.160		0.229	

Stern OT

Jan.									354	622
Feb.					1338	2313			1132	2721
Mar.					368	987	132	810		
April	167	342			156	559	217	923		
May			43	167						
c/f (highest mo.)	0.488		0.257		0.578		0.235		0.416	
c/f	0.488		0.257		0.483		0.201		0.455	

Table 2.

ICNAF Divisions 4RS - Commercial Witch (Male)						
Numbers caught (all gears)						
AGE	1976		1977		1978	
	TOTAL '000's	c/1000 hr '000's	TOTAL '000's	c/1000 hr '000's	TOTAL '000's	c/1000 hr '000's
5					8	0.94
6			3	0.14	15	1.77
7			57	2.69	53	6.26
8	27	2.44	110	5.19	234	27.63
9	79	7.14	283	13.34	325	38.38
10	107	9.68	389	18.34	793	93.65
11	247	22.34	454	21.41	521	61.52
12	576	52.09	489	23.06	672	79.36
13	560	50.64	541	25.51	596	70.38
14	318	28.76	648	30.55	264	31.18
15	293	26.50	186	8.77	120	14.17
16	71	6.42	64	3.02	30	3.54
17	10	0.90	7	0.33	15	1.77
18	19	1.72	10	0.47	7	0.83

$$z_{13-18} = 0.96$$

$$z_{14-18} = 0.75$$

Total catch = 5341 mt	4263 mt	3853 mt
Total effort = 11058 hrs	21209	8468
CPUE		
Stern (OT) = 0.483 mt/hr	= 0.201 mt/hr	= 0.455 mt/hr.

Table 3.

ICNAF Divisions 4RS - Commercial Witch (Female)
Numbers caught (All gears)

AGE	<u>1976</u>		<u>1977</u>		<u>1978</u>	
	NO. CAUGHT ' 000's	C/1000 hr. ' 000's	NO. CAUGHT ' 000's	C/1000 hr. ' 000's	NO. CAUGHT ' 000's	C/1000 hr. ' 000's
6					30	3.54
7			2	0.09	98	11.57
8	34	3.07	75	3.54	227	26.81
9	24	2.17	234	11.03	234	27.63
10	114	10.31	470	22.16	280	33.07
11	290	26.23	837	39.46	567	66.96
12	280	25.32	879	41.44	559	66.01
13	495	44.76	842	39.70	544	64.24
14	618	55.89	657	30.98	620	73.22
15	295	26.68	390	18.39	325	38.38
16	404	36.53	262	12.35	212	25.04
17	197	17.82	157	7.40	121	14.29
18	134	12.12	76	3.58	45	5.31
19	55	4.97	25	1.18	8	0.94
20	41	3.71	34	1.60	8	0.94
21	47	4.25	13	0.61		
22	13	1.18				
23	3	0.27				
24	2	0.18				
25	4	0.36				
26	4	0.36				

$Z_{13-20} = 0.98$

$Z_{17-20} = 0.69$

Stern trawl.

Table 4.

Average number and weight per standard set for witch caught on groundfish biomass surveys in Division 4R and 4S, 1978 and 1979.

ICNAF DIV.	STRATA	GADUS 4, 1978		GADUS 16, 1979	
		AV. NO./SET	AV. WT./SET	AV. NO./SET	AV. WT./SET
4R	801	73.67	33.14	3.67	1.36
	802	63.33	38.67	175.00	77.63
	809	114.67	54.96	162.67	85.20
	810	30.00	19.82	12.67	8.17
	811	5.40	4.27	7.00	3.04
	812	20.80	8.90	13.60	5.45
	813	22.00	5.60	2.75	0.80
	814	5.00	1.63	2.00	0.53
	820	2.50	2.50	13.00	10.67
	821	0.00	0.00	1.25	0.57
	822	0.00	0.00	4.25	2.19
	823	0.00	0.00	0.67	0.23
	824			0.00	0.00
	825	0.00	0.00	0.00	0.00
	826				
4S	803	47.33	24.44		
	804	18.00	10.44		
	805				
	806	4.00	2.12		
	807	3.67	1.29	3.00	1.59
	808	65.67	31.84	29.07	12.56
	815	15.67	5.60	3.75	0.67
	816	7.40	1.23	5.67	1.13
	817				
	818	2.00	0.45		
	819	0.00	0.00	1.50	0.45
	827	0.00	0.00		
	828	0.00	0.00		

Table 4. - continued

ICNAF DIV.	STRATA	AV.NO./SET	AV.WT./SET	AV. NO./SET	AV. WT./SET
4S	829	0.00	0.00	0.00	0.00
	830	0.00	0.00		
	831	0.00	0.00		
	832				
	833	0.00	0.00		
	834	0.00	0.00		

TABLE 5

WITCH (MALE) ESTIMATES OF MINIMUM TRAWLABLE BIOMASS

ICNAF DIVISION 4R-GADUS 4, JANUARY 1978

ICNAF DIVISION 4R-GADUS 16, JANUARY 1979

ICNAF DIVISION 4R-GADUS 4, JANUARY 1978								ICNAF DIVISION 4R-GADUS 16, JANUARY 1979									
Weighted								Weighted									
AGE	801	802	809	810	811	812	813	MEAN NO./SET	AGE	801	802	809	810	811	812	813	Weighted Mean No./Set
AREA → 354 399 451 223 439 1355 1154									AREA → 354 399 451 223 439 1355 1154								
(sq. nautical miles)									(sq. nautical miles)								
3			0.17				0.33	0.10	3								
4	0.67		0.17				0.67	0.25	4	0.33							0.03
5	0.48		0.35			0.57	1.40	0.62	5		1.37	0.93			0.03	0.38	0.33
6	1.82	0.42	3.90	0.18	0.07	1.43	2.34	1.66	6		1.80	0.96	0.04		0.10	0.19	0.35
7	3.15	1.58	6.37	0.81	0.13	1.36	0.80	1.74	7	0.17	6.18	3.37	0.11	0.10	0.45	0.19	1.13
8	3.95	1.96	6.41	0.77	0.37	0.69	0.55	1.59	8	0.17	6.76	6.28	0.21	0.49	0.86		1.60
9	5.74	3.43	11.66	1.42	0.27	1.17	1.01	2.71	9		6.40	7.20	0.21	0.39	0.70		1.59
10	8.47	4.89	14.74	1.37	0.30	1.85	1.14	3.62	10	0.34	13.96	20.91	0.84	0.82	1.93	0.02	4.18
11	3.69	3.63	7.12	1.27	0.17	0.97	0.44	1.86	11	0.49	14.31	21.18	0.75	0.72	1.43	0.14	4.12
12	6.12	8.79	12.22	2.50	0.42	1.55	0.85	3.43	12	0.17	9.60	15.67	0.82	0.36	0.77	0.09	2.84
13	1.57	3.76	3.56	0.77	0.21	0.35	0.13	1.04	13		2.12	4.51	0.36	0.13	0.13		0.73
14	0.15	1.40	0.49	0.14	0.04	0.04		0.21	14								
15	0.20	0.13	0.23	0.10	0.02	0.02		0.07	15								

WITCH (FEMALE) ESTIMATES OF MINIMUM TRAWLABLE BIOMASS

TABLE 6

ICNAF DIVISION 4R-GADUS 4, JANUARY 1978

ICNAF DIVISION 4R-GADUS 16, JANUARY 1979

ICNAF DIVISION 4R-GADUS 4, JANUARY 1978								ICNAF DIVISION 4R-GADUS 16, JANUARY 1979									
WEIGHTED								WEIGHTED									
AGE	801	802	809	810	811	812	813	MEAN NO./SET	AGE	801	802	809	810	811	812	813	MEAN NO./SET
AREA → 354 399 451 223 439 1355 1154									AREA → 354 399 451 223 439 1355 1154								
(sq. nautical miles)									(sq. nautical miles)								
3	0.67					0.27	0.56	0.29	3								0.05
4	1.51	0.05	0.21			0.16	1.12	0.49	4							0.25	0.07
5	0.64	0.05	0.32			0.21	0.60	0.31	5		1.21	0.95		0.11	0.66	0.25	0.49
6	3.76	1.24	2.69	0.12	0.06	1.44	2.87	1.91	6		2.54	1.05	0.13	0.31	0.22		0.45
7	2.28	1.79	2.51	0.29	0.13	0.70	1.84	1.34	7	0.05	6.97	3.08	0.32	0.16	0.44		1.13
8	1.22	1.40	2.10	0.52	0.05	0.22	0.20	0.60	8	0.15	8.97	3.56	0.29	0.18	0.30	0.01	1.33
9	2.89	2.50	3.00	0.75	0.22	0.82	0.38	1.19	9	0.25	13.02	5.80	0.42	0.30	0.34	0.11	1.99
10	3.76	2.83	4.64	1.51	0.22	1.07	1.09	1.76	10	0.23	13.37	7.88	0.50	0.34	0.54	0.18	2.32
11	4.19	4.11	5.83	2.23	0.22	1.20	0.90	2.06	11	0.27	21.17	13.72	1.21	0.65	1.12	0.35	3.93
12	5.79	6.94	8.17	4.16	0.46	1.56	1.28	3.02	12	0.61	30.91	24.29	3.55	1.02	1.93	0.31	6.34
13	4.88	6.01	9.13	5.45	0.65	1.21	0.64	2.77	13	0.29	9.04	13.55	1.99	0.58	1.10	0.03	2.75
14	3.01	3.83	6.17	3.21	0.59	0.79	0.32	1.78	14	0.04	2.43	4.21	0.60	0.18	0.35		0.82
15	1.46	1.63	2.98	1.17	0.36	0.48	0.14	0.86	15	0.10	1.88	3.24	0.32	0.17	0.21		0.61
16	0.86	0.77	1.63	0.50	0.18	0.24	0.40	0.18	16		0.05	0.33					0.04
17	0.09	0.18	0.04	0.42	0.05	0.03		0.06									
18			0.17					0.02									

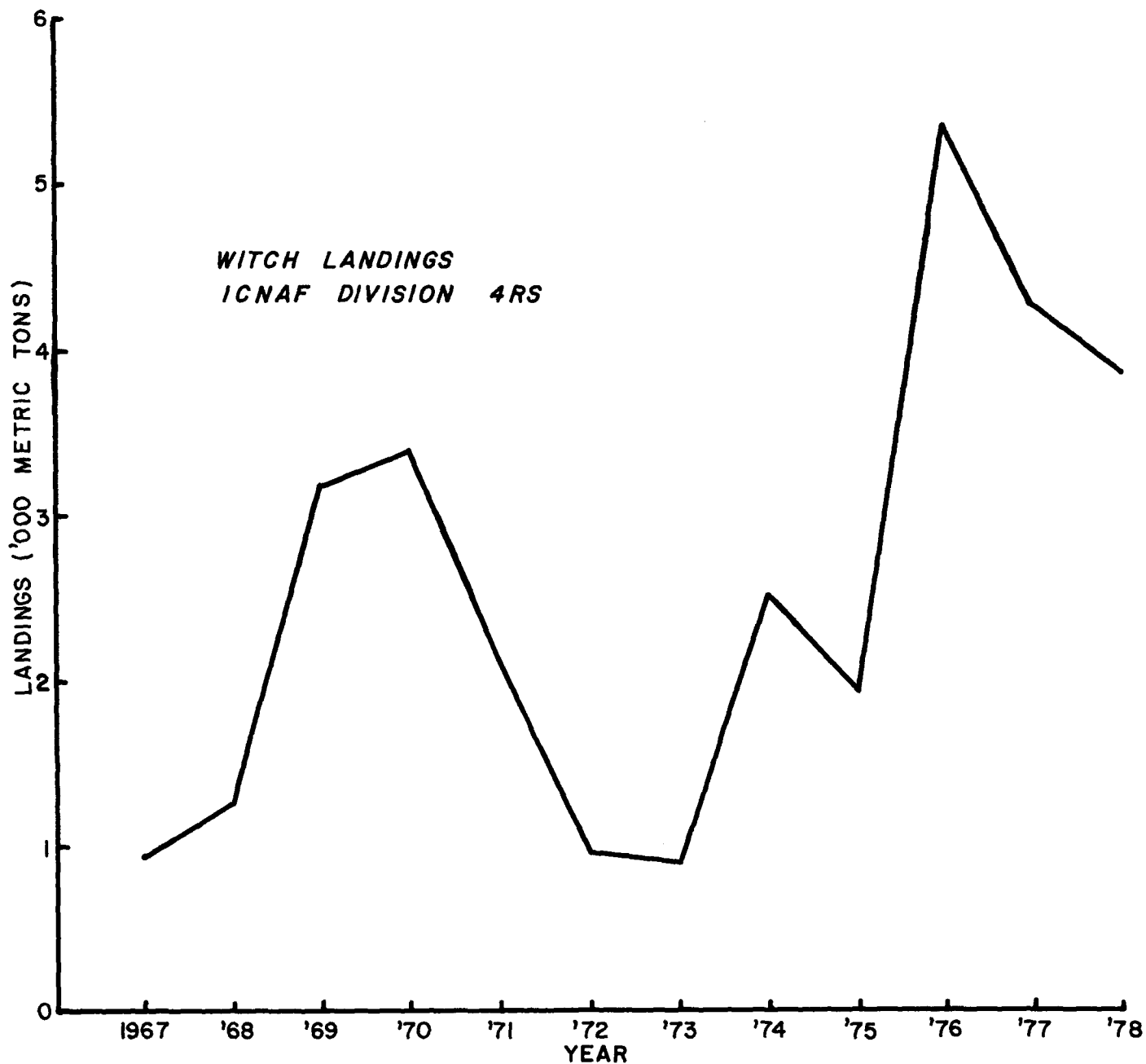


Fig. 1. Witch total landings 1967-78 from ICNAF Divisions 4RS.

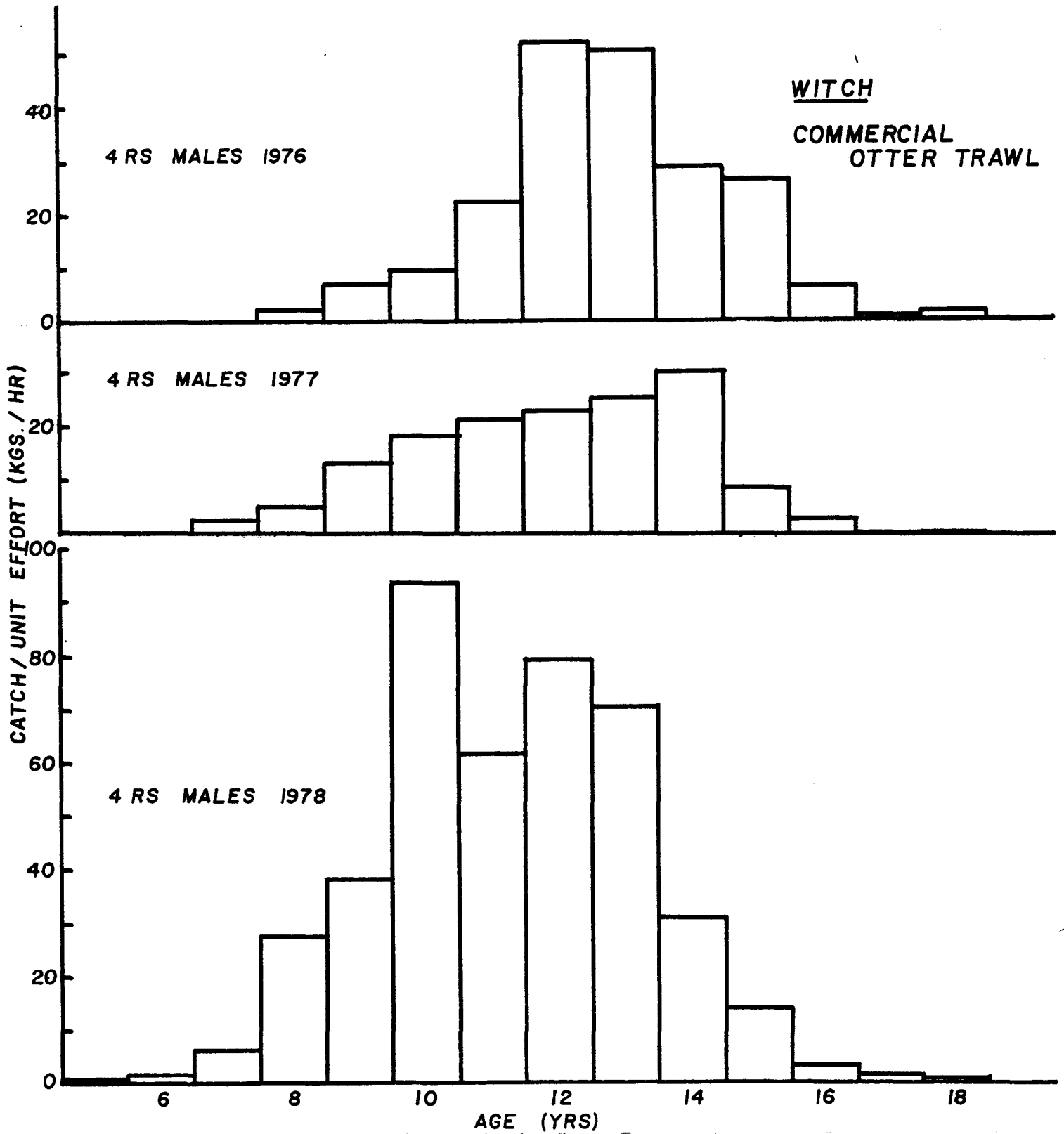


Fig. 2. Catch/hour at age of commercial otter trawl male witch 1976-78, from ICNAF Divisions 4RS.

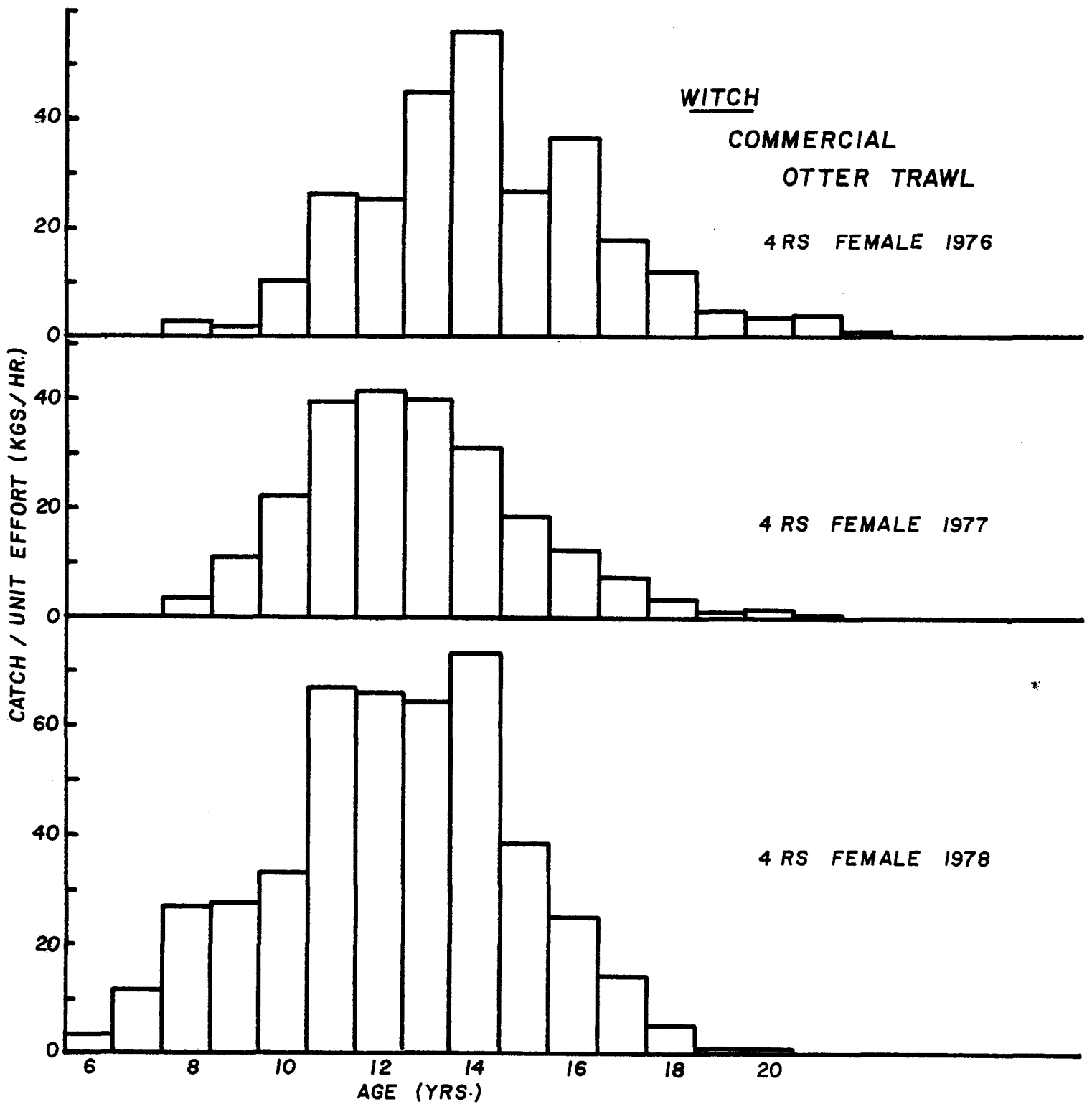


Fig. 3. Catch/hour at age of commercial otter trawl female witch 1976-78, from ICNAF Divisions 4RS.

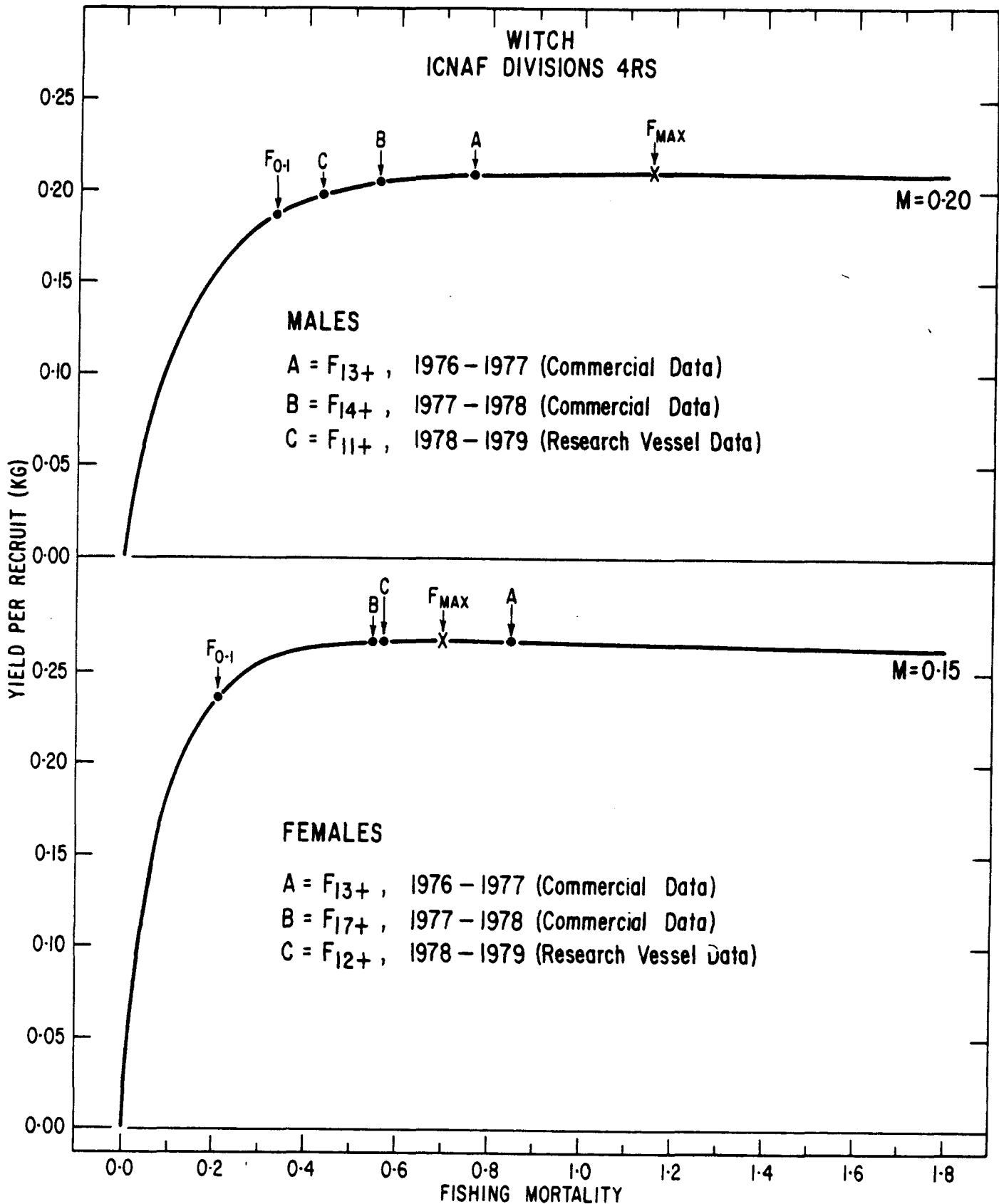


Fig. 4. Yield per recruit curves for male and female witch from ICNAF Divisions 4RS.

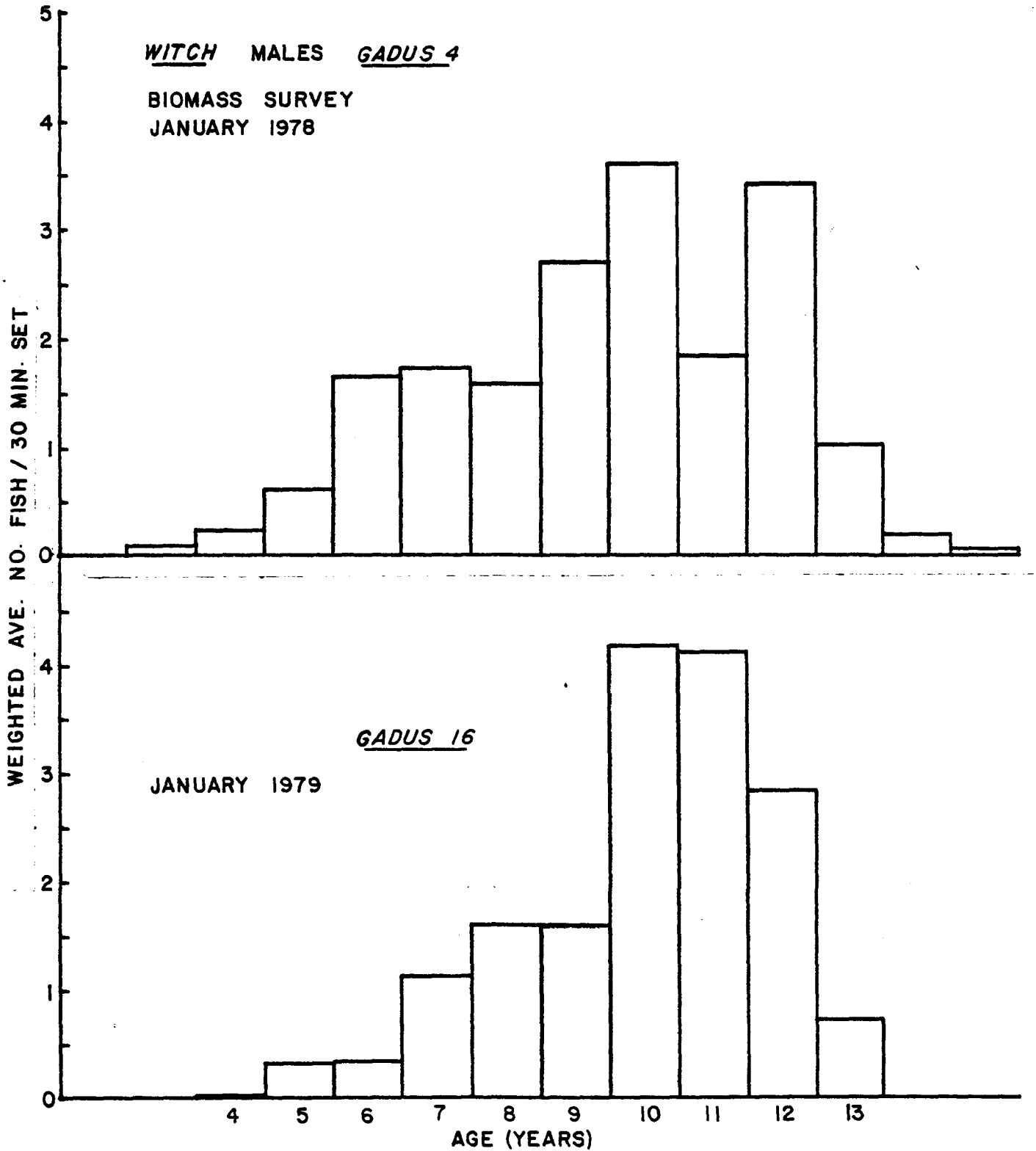


Fig. 5. Age composition of male witch from research surveys in ICNAF Divisions 4RS during January, 1978 and 1979.

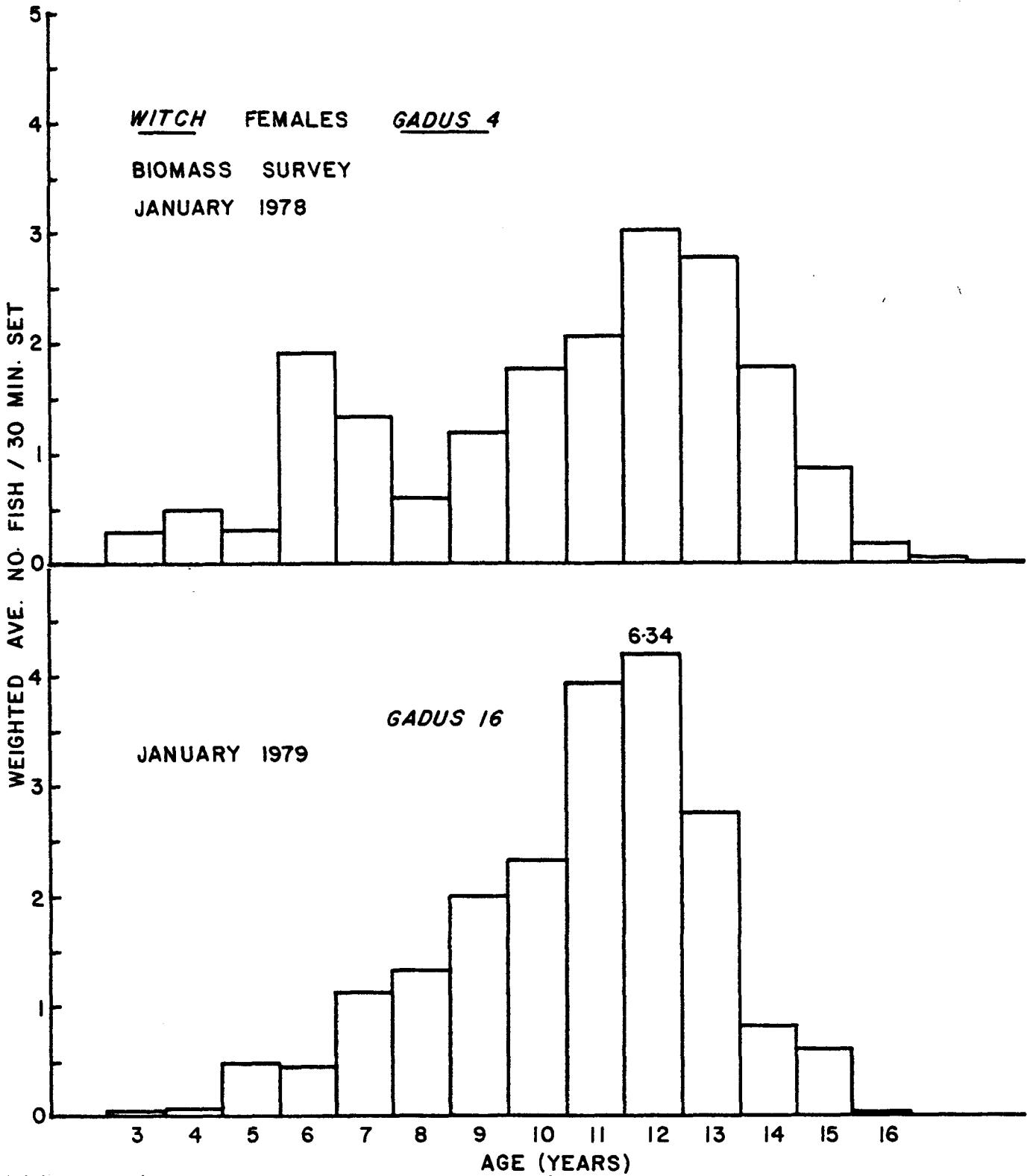


Fig. 6. Age composition of female witch from research surveys in ICNAF Divisions, 4RS during January, 1978 and 1979.