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American Plaice in ICNAF Divisions 3L, 3N, and 30: a Stock Assessment Update

by

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INTRODUCTION

The highest recorded catches from this stock were 95,000 tons taken in 1967 and 79,000 tons in 1969. In recent years catches have fluctuated around forty and fifty thousand tons annually (Table 1). The stock has been under quota regulation since 1973 with TACS at 60,000 tons 1973-75 and at 47,000 tons since then.

The assessment was done separately for Divisions 3LN and 30. The reason for this is that numbers at age data were only available from Division 30 since 1973, whereas for Divisions 3L and 3N this information is available from 1955. Generally speaking Division 30 normally contributes less than 10% of the total catch from this stock.

MATERIALS AND METHODS

Sampling. Otolith samples and measurements from the Canadian (N) offshore fleet by the commercial sampling Group of the St. John's Research and Resource Services Branch were as follows during 1978:

Quarter	No. Measured			Otolith Samples			No. Samples
	3L	3N	30	3L	3N	30	
1	370	3049	2145	49	589	352	12
2	5296	2239	3099	676	554	570	28
3	7431	2314	1837	820	427	247	26
4	5889	3990	3170	523	548	707	31
TOTAL:	18,986	11,572	10,251	2,068	2,118	1,876	97
	40,809			6,062			

Measurements and samples were taken in each month except February and March in Division 3L, except September and October in Division 3N and each month except January and August in Division 30.

Partial recruitment was determined from a preliminary cohort run using numbers at age data for 1975-78. This run calculated average F_s across years to give the starting values for each cohort in 1978 (Table 2).

Average weights at age (Table 2) were calculated from average lengths at age from the monthly samples to give average size for the year. Average lengths were converted to average weight at age by the following relationship.

$$W = 0.0000285L^{3.096}$$

(x0.454 to convert lbs. to kgs.)

Terminal fishing mortality (F_t) for 1978 that was used to initiate the cohort analysis was obtained from the regression of weighted F^S of fully recruited age groups on total fishing effort (Fig. 1). This gives an average value of 0.56 and 0.50 for males and females respectively in the fully recruited age group. For Division 30 F_t was 0.63 and 0.60 for males and females respectively.

Recruitment for stock projections were average values for the two years preceeding the current year (1976-77) and were as follows:

3LN Male 91 million fish
 3LN Female 215 million fish
 30 Male 5.9 million fish
 30 Female 9.0 million fish

RESULTS AND DISCUSSION

Abundance indices

Research vessel surveys

Average number and weight from Canada (N) research vessel surveys (Fig. 2) indicate a slight increase over 1977. However, a very large increase since the mid 1970's is quite evident, especially in Division 3L, where there has been a very substantial increase especially in the average number caught. That this increase in numbers caught is a reflection of an increase in abundance of the younger (mostly prerecruited) age groups is further illustrated in Figs 3-6. Fig. 3 gives a comparison 1972, 1977 and 1978 of the occurrence of plaice in three different size ranges in research vessel catches. Similar indications are shown in Fig. 4 where the more recent length frequencies show a trend towards smaller fish in more recent years. The shift to younger age groups in the survey data is indicated in the age frequencies (Figs. 5 & 6) with an increase in the numbers of fish 5 years and under in the more recent years is evident. At the same time there has been a reduction in the proportion of older age groups.

Catch per hour from the commercial fleet

Catch per hour for the total stock (Table 1) indicates that catch rates were at their highest levels in early and mid 1960's and gradually declined reaching a low point in 1975, since then there has been a very gradual recovery. The main contribution to the fishery is from Division 3L and 3N with catch rates in Division 30 generally at lower levels than in Divisions 3L and 3N.

Spawning population and biomass

The relationship between spawning population and biomass from cohort analysis and average number and weight per research vessel survey set for Divisions 3L and 3N are shown in Fig. 7. For both numbers and biomass the relationships are good except for the biomass value for 1976. Generally speaking spawning population and biomass decreased from 1971 to 1974. This is perhaps better illustrated in the following text table:

Divisions 3L and 3N

1964	1966	1968	1970	1972	1973	1974	1975	1976
<u>SPAWNING POPULATION (10^{-6})</u>								
355	349	325	262	188	163	168	210	292
<u>SPAWNING BIOMASS (Tons $\times 10^{-3}$)</u>								
269	268	242	194	139	116	111	134	181

Both population numbers and biomass declined from 1964 to 1974, but the 1976 estimate is possibly biased by the input terminal F and partial recruitment values used in 1978.

Catch projections

The results of cohort analysis for Divisions 3L plus 3N and Division 3O are shown in Tables 3-6. For the catch and stock projections for 1979 and 1980 (Tables 7-10). The stock sizes at the beginning of 1979 were calculated from the 1978 population from cohort analysis using the average recruitment values indicated at the younger age. The projections for 1979 were made on the assumption that the 1979 TAC of 47,000 tons would be taken. For 1980 the projections were made at $F_{0.1}$ (0.45 for males and 0.40 for females, Fig.8). A summary of the results of the projections are shown in Table 11 and would indicate a continuation of the 1980 TAC at 47,000 tons.

It should be pointed out that the fishing effort generated in taking the 1978 catch was higher than the $F_{0.1}$ in both Divisions 3LN and Division 3O, however, for 1978 at least for Divisions 3LN the predicted fishing mortality level was not too different from $F_{0.1}$.

Future prospects for this stock appears encouraging since there appears to be good recruitment prospects. Since the growth rate of this species in this area is rather low it might be a few years before the removal levels of the early 1970's of around 60,000 tons can be achieved.

Table 1. Catch, effort (Canada N Stern trawler units), and catch per hour for plaice in ICNAF Divisions 3L, 3N and 3O, 1960-1978

YEAR	DIVISION 3L		DIVISION 3N		DIVISION 3O		TOTAL	
	CATCH '000 TONS	EFFORT (000 HRS)	CATCH '000 TONS	EFFORT (000 HRS)	CATCH '000 TONS	EFFORT (000 HRS)	CATCH '000 TONS	EFFORT (000 HRS)
1960	19.38	18.80	3.91	7.82	0.74	12.26	24.03	38.88
1961	13.40	14.59	3.50	5.64	1.02	9.27	17.92	29.50
1962	13.58	16.94	3.92	7.85	0.70	11.05	18.20	35.84
1963	16.51	18.33	7.47	10.38	1.74	15.11	25.72	43.82
1964	21.19	26.90	14.59	15.19	2.59	11.31	38.37	53.40
1965	25.03	29.21	26.27	31.09	1.96	4.89	53.26	65.19
1966	18.57	26.12	34.70	42.11	11.74	21.70	65.01	89.93
1967	39.52	54.95	24.36	30.65	31.53	54.46	95.41	140.06
1968	39.12	68.76	20.04	35.28	14.00	27.08	73.16	131.12
1969	52.88	102.08	14.44	32.09	12.12	29.05	79.44	163.22
1970	39.35	87.83	21.03	61.32	6.27	11.17	66.65	160.32
1971	37.85	88.03	22.87	81.11	7.16	14.86	67.88	184.00
1972	33.33	74.40	17.39	57.96	6.54	29.32	57.26	161.68
1973	20.10	41.28	20.88	64.45	11.86	32.48	52.84	138.21
1974	16.61	41.32	21.12	75.96	8.56	24.04	46.29	141.32
1975	16.14	44.71	22.35	75.01	4.40	17.52	42.89	137.24
1976	25.12	58.29	18.62	54.29	8.08	32.07	51.82	144.65
1977	23.96	65.12	15.62	42.57	3.50	16.58	43.08	124.27
* 1978	30.10	65.08	13.50	41.40	6.50	20.20	50.10	126.68

* Provisstona1

Table 2. Average weights at age and partial recruitment rates for the 1979 assessment.

AGE	<u>Div. 3L</u>		<u>Div. 30</u>		AGE	<u>Div. 3L</u>		<u>Div. 30</u>	
	<u>W (kg)</u>	<u>% Rec</u>	<u>W(kg)</u>	<u>% Rec.</u>		<u>W(kg)</u>	<u>% Rec.</u>	<u>W(kg)</u>	<u>% Rec.</u>
5	0.200	0.02	-	-	5	-	-	-	-
6	0.240	0.08	0.290	0.05	6	0.268	0.01	0.286	0.05
7	0.310	0.21	0.313	0.21	7	0.291	0.05	0.291	0.19
8	0.350	0.44	0.390	0.44	8	0.320	0.11	0.416	0.
9	0.440	0.52	0.492	0.54	9	0.435	0.15	0.512	0.22
10	0.500	0.69	0.576	0.71	10	0.524	0.19	0.574	0.34
11	0.703	1.00	0.713	1.00	11	0.675	0.26	0.702	0.37
12	0.755	1.53	0.816	1.09	12	0.845	0.33	0.847	0.45
13	0.838	1.71	0.838	1.50	13	1.021	0.41	1.121	0.65
14	1.007	2.03	0.947	1.00	14	1.217	0.64	1.247	0.66
15	1.151	1.40			15	1.400	1.00	1.458	1.00
16	1.211	1.00			16	1.699	1.01	1.699	1.06
17					17	1.751	1.18	1.751	1.20
18					18	1.900	1.41	1.900	1.00
19					19	2.234	1.83		
20					20	2.300	1.00		

Table 3.

JLN PLAICE MALE 1964-78

NATURAL MORTALITY= 0.25		PARTIAL RECRUITMENT MULTIPLIER															
0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000	
AGE	YEAR	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978		
5	121487	129596	115163	102341	70699	62549	61848	80306	104658	136480	87520	87329	106631	86883	103659		
6	84471	94445	100562	88554	79532	54873	48279	47930	62092	81335	105981	58038	67793	78042	57534		
7	60821	64620	71710	67059	67868	61607	42308	37000	36705	47382	62771	79431	51672	51125	35658		
8	53846	43394	46961	51483	55106	50238	32483	31513	25281	27823	34366	45180	58753	36699	35658		
9	42670	40689	37268	31687	37255	37683	32492	28855	15774	17711	17080	22961	31682	39022	23580		
10	24941	29964	27892	20977	20813	23189	19747	19263	15509	9711	8090	10244	14619	19105	25644		
11	15813	18121	19557	16658	10640	10775	11857	10868	19431	5909	4139	14162	5479	7775	11624		
12	9892	10925	8847	8408	9758	5154	4508	4933	5444	2730	1470	1511	1744	2433	4035		
13	8613	5842	5513	4834	5834	3344	1534	1701	1856	1757	289	478	363	517	1160		
14	7128	2859	2412	2300	2300	2064	1144	592	663	459	16	20	110	49	10		
15	2388	429	287	228	964	736	351	373	254	89	16	2	21	49	10		
16	2388	429	287	228	964	736	351	373	254	89	16	2	21	49	10		

KNOWN CATCHES		ESTIMATE FISHING MORTALITY															
0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000	
AGE	YEAR	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	
5	192	416	1241	129	213	492	289	510	192	351	116	248	373	396	731		
6	1322	2089	2560	1279	377	484	650	709	1105	849	3521	1509	1895	3655	1871		
7	1412	4629	5509	3159	2967	4574	1687	4005	484	2850	4200	3222	4015	4714	4110		
8	3702	4302	3903	3379	5930	7516	6083	4732	438	4326	4200	3222	4015	5667	5110		
9	4912	4282	3506	6394	6601	10878	6871	7890	6970	4784	3502	3691	4571	5378	2934		
10	2708	3319	3076	5382	3549	4814	5112	6312	6991	4784	1941	2802	4571	3858	3504		
11	2450	319	2015	4435	4822	2511	1962	2221	5230	3549	1941	1692	2078	2299	1683		
12	1928	1653	2150	1903	2810	1655	1484	2750	1118	1884	186	297	533	979	1683		
13	1366	1192	1647	1036	1196	1424	587	234	484	386	186	30	42	275	80		
14	1033	192	1163	423	439	447	250	202	129	55	12	2	10	57	80		
15	551	113	580	287	92	180	92	29	160	45	10	1	6	13	8		

POPULATION WTS AND NOS		ESTIMATE FISHING MORTALITY															
0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000	
WT	NOS	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	
WT	162923	162577	159775	150228	132689	116262	98632	94439	95656	102789	90489	102459	109609	188196	113087		
NOS	431922	433590	434979	411431	360997	312575	268089	263385	282368	329533	321826	319406	332881	521735	330310		

POPULATION WTS AND NOS AGE 8 TO 16		ESTIMATE FISHING MORTALITY															
0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000		0.0200 0.0800 0.2100 0.4400 0.5200 0.6900 1.0000 1.5300 1.7100 2.0300 1.4000 1.0000	
WT	NOS	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	
WT	90473	84316	81642	77073	72821	66581	56856	49494	40823	31346	29276	37269	49719	49663	50635		
NOS	165142	154829	147543	144437	142898	133546	115654	98150	78917	64336	65554	84588	112785	105686	101772		

Table 5

PLAICE MALE 30 1973-1974

NATURAL MORTALITY* 0.25

PARTIAL RECRUITMENT MULTIPLIER

0.0500 0.2100 0.4400 0.5400 0.7100 1.0000 1.0900

1.5000 1.0000

ASSUMED FISHING MORTALITY FOR LAST AGES

1.5000 0.3800 1.3000 0.5000 1.1500 0.5500

ESTIMATED POPULATION

AGE	YEAR	1973	1974	1975	1976	1977	1978
6		8564.	9723.	6366.	5728.	9020.	17989.
7		7542.	6626.	7173.	4935.	4292.	6905.
8		7036.	5326.	4053.	5411.	3491.	2998.
9		6351.	3680.	3160.	2779.	3363.	2273.
10		3311.	1972.	2276.	2083.	1543.	2213.
11		1311.	588.	1195.	1381.	1028.	996.
12		575.	156.	291.	644.	544.	639.
13		243.	24.	85.	60.	292.	297.
14		28.	4.	18.	17.	2.	190.

KNOWN CATCHES

AGE	YEAR	1973	1974	1975	1976	1977	1978
6		50.	452.	26.	191.	136.	432.
7		620.	1255.	199.	399.	391.	668.
8		2040.	1120.	428.	964.	505.	573.
9		3370.	668.	428.	704.	461.	520.
10		2256.	387.	444.	674.	233.	638.
11		980.	189.	324.	602.	183.	377.
12		480.	41.	189.	238.	144.	258.
13		210.	1.	56.	51.	42.	150.
14		20.	1.	12.	6.	1.	72.

ESTIMATE FISHING MORTALITY

AGE	YEAR	1973	1974	1975	1976	1977	1978
6		0.0066	0.0541	0.0046	0.0385	0.0172	0.0
7		0.0978	0.2416	0.0319	0.0961	0.1089	0.0
8		0.3983	0.2722	0.1275	0.2255	0.1790	0.0
9		0.9194	0.2303	0.1666	0.3384	0.1688	0.0
10		1.4786	0.2515	0.2498	0.4567	0.1877	0.0
11		1.8782	0.4530	0.3672	0.6812	0.2254	0.0
12		2.9081	0.3534	1.3313	0.5422	0.3565	0.0
13		3.9750	0.0474	1.3603	3.3622	0.1781	0.0
14		1.5000	0.3800	1.3000	0.5000	1.1500	0.5500

POPULATION WTS AND NOS

	1973	1974	1975	1976	1977	1978
WT	14255.	10488.	9715.	9459.	9287.	12600.
NO	34962.	28099.	24617.	23037.	23574.	34499.

POPULATION WTS AND NOS AGE

	1973	1974	1975	1976	1977	1978
WT	9410.	5594.	5624.	6254.	5328.	5222.
NO	18856.	11750.	11078.	12375.	10262.	9605.

Table 6.

PLATICE FFM 30 1973-78

NATURAL MORTALITY		0.20					
PARTIAL RECRUITMENT MULTIPLIER		0.0500 0.1900 0.4500 0.2200 0.3400 0.3700 0.4700 0.6500					
		0.6600 1.0000 1.0600 1.2000 1.0000					
ASSUMED FISHING MORTALITY FOR LAST AGES		0.7400 0.6900 0.6300 0.5000 0.3900 0.5500					
ESTIMATED POPULATION							
AGE	YEAR	1973	1974	1975	1976	1977	1978
6		16695.	17760.	13205.	5053.	9024.	21020.
7		14391.	13658.	14220.	10737.	3897.	7348.
8		10022.	11626.	9803.	11533.	7900.	2952.
9		9795.	7384.	8684.	7773.	7454.	6213.
10		8487.	6734.	5451.	6677.	5884.	5733.
11		6139.	4037.	4501.	4025.	4910.	4288.
12		3779.	3111.	2574.	3284.	2781.	3699.
13		3189.	1832.	1721.	1769.	2265.	1978.
14		1287.	1383.	811.	1056.	1056.	1589.
15		476.	544.	705.	404.	632.	711.
16		381.	214.	227.	358.	206.	411.
17		80.	187.	118.	80.	197.	140.
18		96.	26.	75.	44.	27.	142.
KNOWN CATCHES							
AGE	YEAR	1973	1974	1975	1976	1977	1978
6		12.	354.	82.	265.	44.	517.
7		173.	1525.	121.	885.	264.	662.
8		908.	922.	279.	2197.	364.	589.
9		1420.	657.	478.	531.	409.	643.
10		3217.	1119.	484.	615.	585.	889.
11		2117.	808.	443.	568.	355.	718.
12		1395.	913.	374.	468.	331.	767.
13		1357.	761.	390.	434.	294.	542.
14		563.	472.	288.	257.	170.	441.
15		194.	242.	243.	137.	118.	275.
16		138.	63.	117.	106.	32.	166.
17		43.	87.	58.	42.	21.	62.
18		46.	12.	32.	16.	8.	55.
ESTIMATE FISHING MORTALITY							
AGE	YEAR	1973	1974	1975	1976	1977	1978
6		0.0008	0.0223	0.0069	0.0597	0.0054	0.0
7		0.0134	0.1317	0.0094	0.0955	0.0778	0.0
8		0.1055	0.0917	0.0320	0.2364	0.0517	0.0
9		0.1746	0.1035	0.0628	0.0785	0.0626	0.0
10		0.5429	0.2029	0.1033	0.1073	0.1164	0.0
11		0.4798	0.2500	0.1152	0.1696	0.0833	0.0
12		0.5242	0.3921	0.1750	0.1714	0.1410	0.0
13		0.6354	0.6146	0.2883	0.3162	0.1548	0.0
14		0.6608	0.4735	0.4982	0.3133	0.1959	0.0
15		0.5984	0.6764	0.4793	0.4703	0.2311	0.0
16		0.5105	0.3929	0.8460	0.3970	0.1879	0.0
17		0.9088	0.7193	0.7791	0.8752	0.1255	0.0
18		0.7400	0.6900	0.6300	0.5000	0.3900	0.5500
POPULATION WTS AND NOS							
	1973	1974	1975	1976	1977	1978	
WT	37368.	32316.	29608.	27504.	25558.	28436.	
NO	74817.	68497.	62095.	52793.	46325.	56222.	
POPULATION WTS AND NOS AGE 8 TO 18							
	1973	1974	1975	1976	1977	1978	
WT	28406.	23262.	21694.	22934.	21843.	20287.	
NO	43731.	37079.	34670.	37003.	33404.	27854.	

Table 7. Stock projection for male plaice in Division 3LN 1979 and 1980

AGE	POPULATION NUMBERS	RESULTS FOR YEAR		1979 CATCH NUMBERS	CATCH WEIGHTS
		POPULATION WEIGHTS	FISHING MORTALITY		
5	91000.0	18200.0	0.0073	585.6	117.1
6	70223.1	16853.5	0.0292	1788.7	429.3
7	50774.4	15740.1	0.0766	3319.3	1029.0
8	41212.3	14424.3	0.1606	5426.9	1899.4
9	23287.7	10246.6	0.1897	3575.3	1573.1
10	14915.5	7457.8	0.2518	2952.9	1476.5
11	15154.6	10653.7	0.3649	4130.6	2903.8
12	6084.6	4593.9	0.5583	2329.9	1759.1
13	1704.0	1421.1	0.6240	708.9	591.2
14	406.8	409.7	0.7407	191.2	192.6
15	55.4	64.0	0.5109	19.8	22.9
16	18.4	22.2	0.3649	5.0	6.1
TOTAL	314837.	100087.		25034.	12000.

AGE	POPULATION NUMBERS	RESULTS FOR YEAR		1980 CATCH NUMBERS	CATCH WEIGHTS
		POPULATION WEIGHTS	FISHING MORTALITY		
5	91000.0	18200.0	0.0058	465.7	93.1
6	70355.5	16885.3	0.0232	1428.3	342.8
7	53116.3	16466.1	0.0609	2780.2	861.9
8	36626.2	12819.2	0.1276	3892.5	1362.4
9	27335.3	12027.5	0.1508	3396.2	1494.3
10	15001.9	7500.9	0.2001	2417.2	1208.6
11	9030.6	6348.5	0.2900	2023.6	1422.6
12	8194.0	6186.5	0.4437	2622.0	1979.6
13	2711.4	2261.3	0.4959	947.6	790.3
14	711.0	716.0	0.5887	283.3	285.3
15	151.1	174.8	0.4060	45.0	52.0
16	35.8	43.3	0.2900	8.0	9.7
TOTAL	314269.	99629.		20310.	9903.

Table 8. Stock projection for female plaice in Division 3LN 1979, 1980.

AGE	RESULTS FOR YEAR			1979	
	POPULATION NUMBERS	POPULATION WEIGHTS	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHTS
6	215000.0	57620.0	0.0033	636.0	170.4
7	174519.2	50785.1	0.0163	2564.9	746.4
8	169274.8	54167.9	0.0360	5421.9	1735.0
9	87614.0	38112.1	0.0490	3802.8	1654.2
10	93386.5	48934.5	0.0621	5102.2	2673.6
11	96866.1	65384.6	0.0850	7163.5	4835.3
12	63840.1	53944.9	0.1079	5927.4	5008.6
13	38434.6	39241.7	0.1340	4379.1	4471.1
14	15957.4	19420.1	0.2092	2739.7	3334.2
15	7203.6	10085.0	0.3269	1830.4	2562.5
16	2381.1	4045.5	0.3302	610.2	1036.7
17	965.6	1690.8	0.3857	281.9	493.6
18	306.9	583.1	0.4609	103.5	196.7
19	72.3	161.5	0.5982	29.8	66.6
20	25.8	59.2	0.3269	6.5	15.1
TOTAL	965848.	444236.		40600.	29000.

AGE	RESULTS FOR YEAR			1980	
	POPULATION NUMBERS	POPULATION WEIGHTS	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHTS
6	215000.0	57620.0	0.0032	622.6	166.9
7	175452.6	51056.7	0.0160	2524.8	734.7
8	140567.9	44981.7	0.0352	4409.2	1410.9
9	133695.7	58157.6	0.0480	5683.5	2472.3
10	68299.9	35789.1	0.0608	3655.3	1915.4
11	71854.2	48501.6	0.0832	5206.3	3514.3
12	72845.4	61554.4	0.1056	6628.2	5600.8
13	46923.1	47908.5	0.1312	5240.6	5350.7
14	27520.6	33492.5	0.2048	4635.0	5640.8
15	10598.5	14837.9	0.3200	2644.6	3702.4
16	4253.3	7226.3	0.3232	1070.4	1818.5
17	1401.3	2453.7	0.3776	401.9	703.8
18	537.6	1021.4	0.4512	178.3	338.7
19	158.5	354.0	0.5856	64.3	143.6
20	47.8	109.8	0.3200	11.9	27.4
TOTAL	969156.	465065.		42977.	33541.

Table 9. Stock projection for male plaice in Division 30 1979-1980.

AGE	RESULTS FOR YEAR			1979	
	POPULATION NUMBERS	POPULATION WEIGHTS	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHTS
6	5900.0	1711.0	0.0319	164.0	47.6
7	4217.2	1320.0	0.1340	469.1	146.8
8	4791.1	1868.5	0.2807	1043.5	407.0
9	1833.0	901.8	0.3445	476.0	234.2
10	1315.3	757.6	0.4529	427.9	246.5
11	1166.4	831.7	0.6379	493.2	351.6
12	447.6	365.2	0.6953	201.3	164.3
13	273.3	229.1	0.9569	151.9	127.3
14	186.8	176.9	0.6379	79.0	74.8
TOTAL	20131.	8162.		3506.	1800.

AGE	RESULTS FOR YEAR			1980	
	POPULATION NUMBERS	POPULATION WEIGHTS	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHTS
6	5900.0	1711.0	0.0200	103.4	30.0
7	4450.7	1393.1	0.0840	317.8	99.5
8	2872.5	1120.3	0.1760	411.7	160.6
9	2818.1	1386.5	0.2160	486.6	239.4
10	1011.6	582.7	0.2840	222.6	128.2
11	651.3	464.3	0.4000	191.6	136.6
12	480.0	391.7	0.4360	151.4	123.6
13	173.9	145.7	0.6000	70.3	58.9
14	158.6	150.2	0.4000	46.7	44.2
TOTAL	18517.	7346.		2002.	1021.

Fig. 10. Stock projection for female plaice in Division 30.

AGE	RESULTS FOR YEAR			1979	
	POPULATION NUMBERS	POPULATION WEIGHTS	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHTS
6	9000.0	2574.0	0.0276	222.0	63.5
7	6902.1	2008.5	0.1048	623.5	181.4
8	5419.1	2254.3	0.1103	514.0	213.8
9	1887.0	966.2	0.1214	195.8	100.3
10	4507.1	2587.1	0.1875	700.8	402.2
11	3893.2	2733.0	0.2041	653.6	458.9
12	2864.3	2423.2	0.2482	573.0	484.8
13	2338.6	2621.6	0.3585	642.5	720.2
14	1132.7	1412.5	0.3641	315.2	393.0
15	904.8	1319.3	0.5516	350.9	511.6
16	335.9	570.8	0.5847	136.1	231.2
17	188.0	329.1	0.6619	83.4	146.0
18	126.2	239.9	0.5516	49.0	93.0
TOTAL	39499.	22040.		5060.	4000.

AGE	RESULTS FOR YEAR			1980	
	POPULATION NUMBERS	POPULATION WEIGHTS	FISHING MORTALITY	CATCH NUMBERS	CATCH WEIGHTS
6	9000.0	2574.0	0.0175	141.5	40.5
7	7168.1	2085.9	0.0665	418.4	121.8
8	5088.7	2116.9	0.0700	312.2	129.9
9	3973.3	2034.4	0.0770	267.2	136.8
10	1368.4	785.5	0.1190	139.4	80.0
11	3059.1	2147.5	0.1295	337.5	230.9
12	2599.0	2198.8	0.1575	344.2	291.2
13	1829.6	2051.0	0.2275	338.7	379.7
14	1337.8	1668.2	0.2310	251.1	313.1
15	644.4	939.5	0.3500	173.5	252.9
16	426.7	725.0	0.3710	120.6	204.9
17	153.3	268.4	0.4200	48.0	84.0
18	138.9	264.0	0.3500	37.4	71.1
TOTAL	36787.	19859.		2930.	2343.

Table 11. A summary of projected catches and fishing mortalities in 3LNO American plaice TAC's and catches in thousands of tons.

DIVISION	<u>1978</u>				<u>1979</u>				<u>1980</u>			
	3LN	F ⁽¹⁾	30	F ⁽¹⁾	3LN	F ⁽¹⁾	30	F ⁽¹⁾	3LN	F ⁽¹⁾	30	F ⁽¹⁾
MALE	12.3	0.55	1.8	0.63	12.2	0.53	1.7	0.73	9.9	0.45	1.0	0.45
FEMALE	30.8	0.50	4.6	0.60	29.2	0.40	3.9	0.59	33.5	0.40	2.3	0.37
TOTAL (calc ²)	42.1		6.4		41.4		5.6		43.4		3.3	
" actual ³	43.6		6.5									
TOTAL 3LNO		51.1				46.5				46.5		
TAC 3LNO		47.0				47.0						

- (1) Average for fully recruited.
- (2) From estimated numbers at age.
- (3) Provisional catches for 1978.

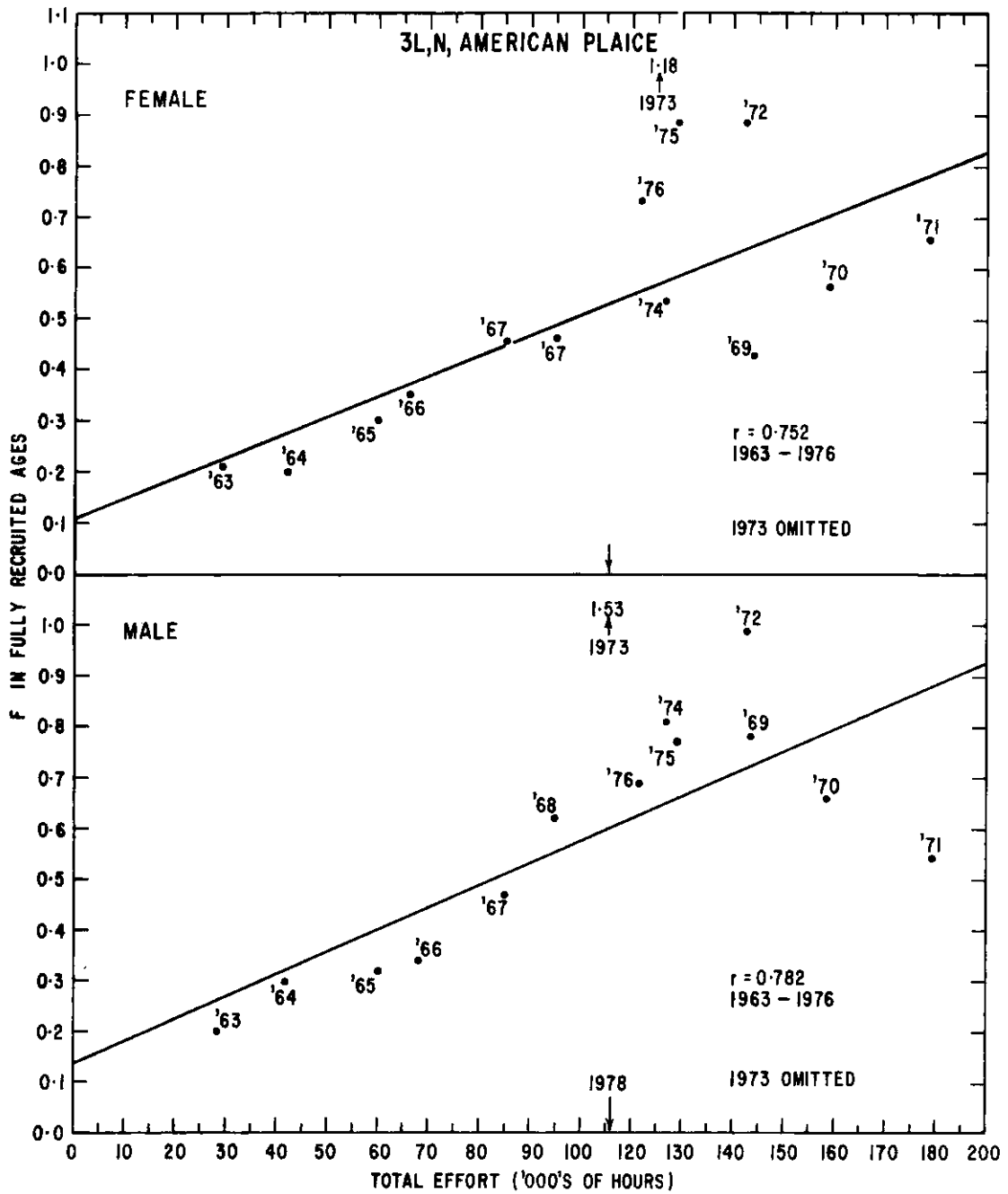


Fig. 1. Regression of Fishing mortality on fishing effort for plaice-Divs. 3L and 3N.

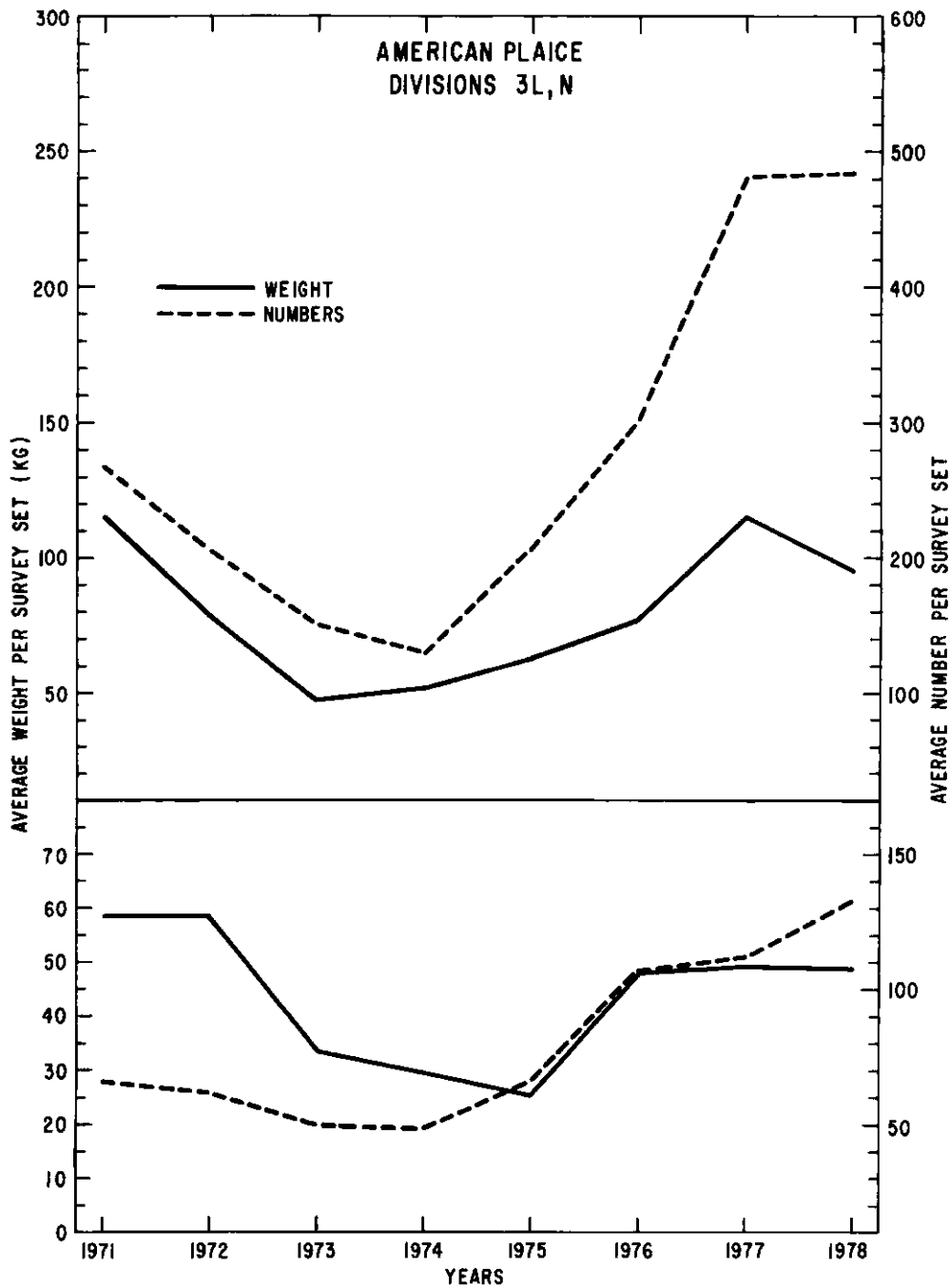


Fig. 2. Average number and weight per set from stratified random surveys in Divisions 3L and 3N.

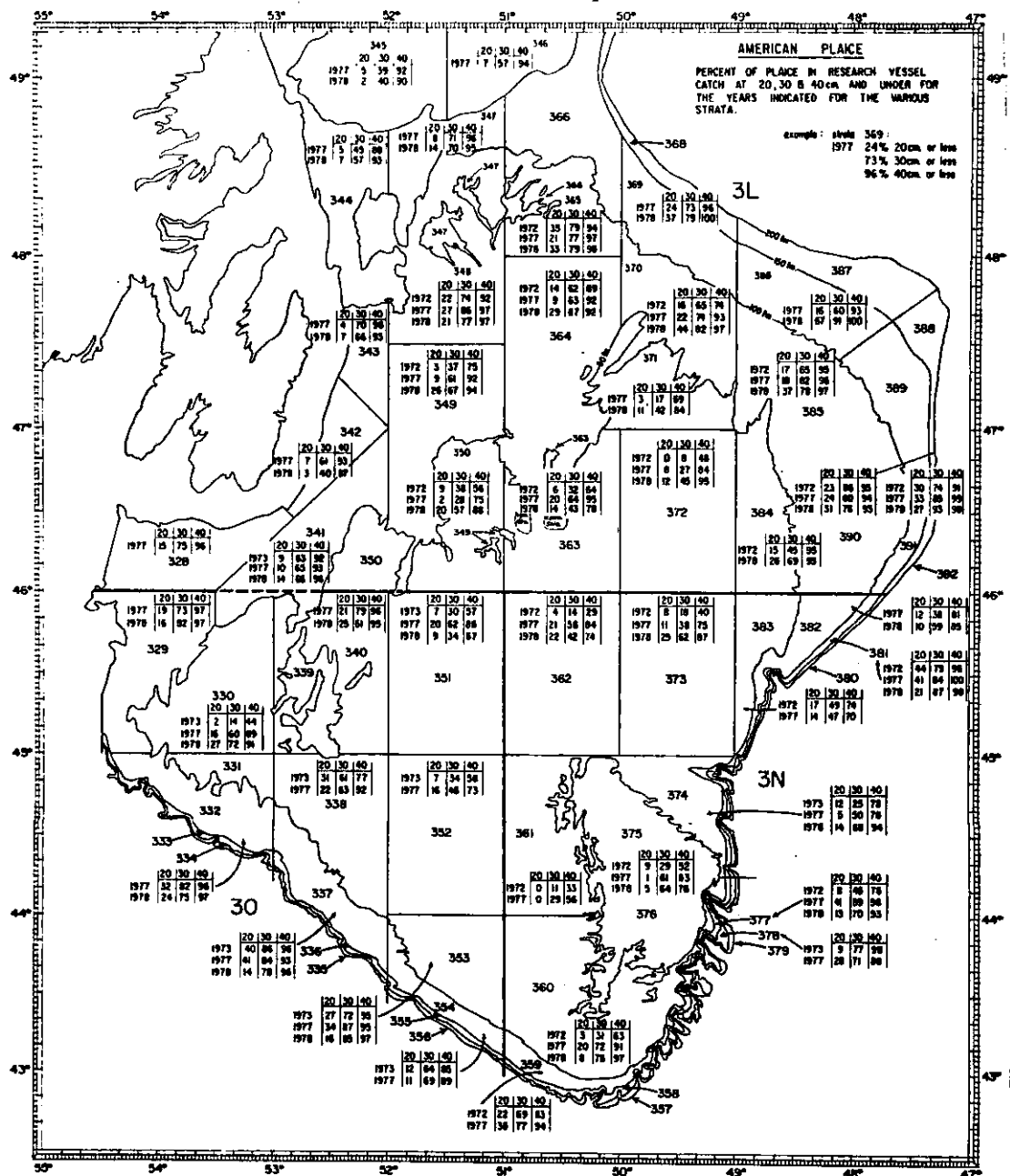


Fig. 3 Stratification scheme of the Grand Bank also showing comparative size of plaice for various strata 1972 or 73 and 1977-78.

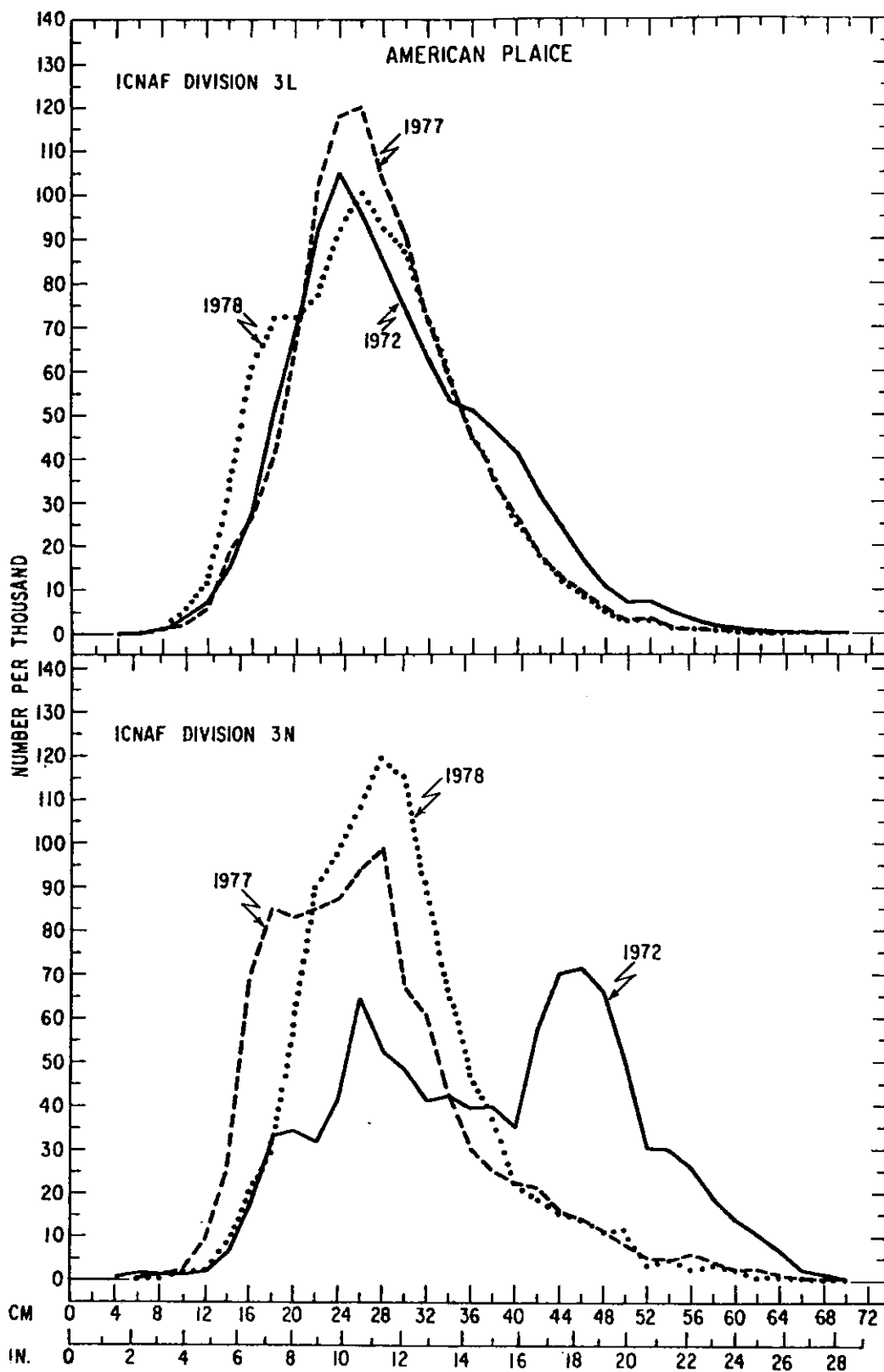


Fig. 4. Length frequencies of plaice from research vessel catches from Divisions 3L and 3N, 1972, 1977 and 1978.

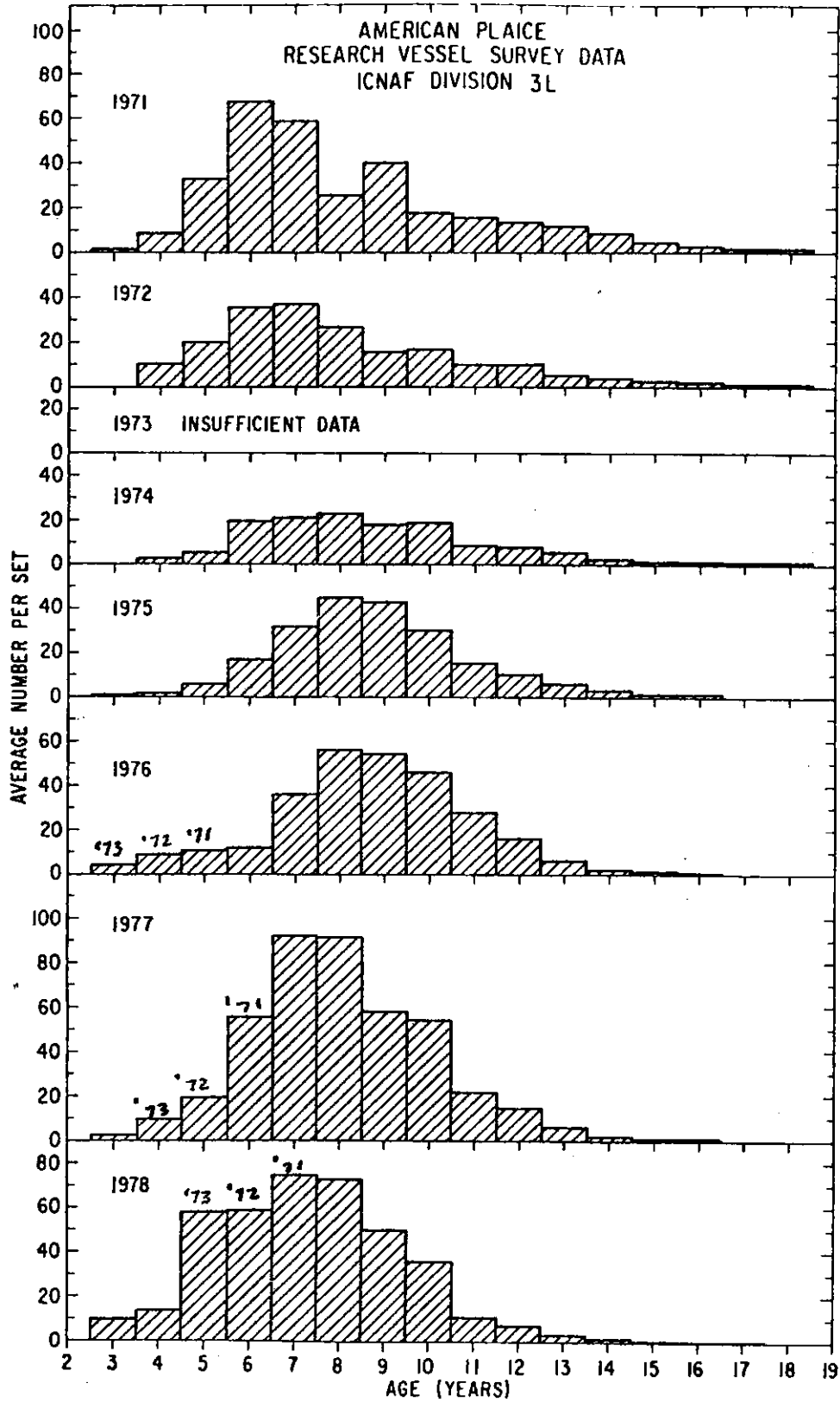


Fig. 5. Average number per set of plaice at various age groups from research vessel catches from ICNAF Division 3L.

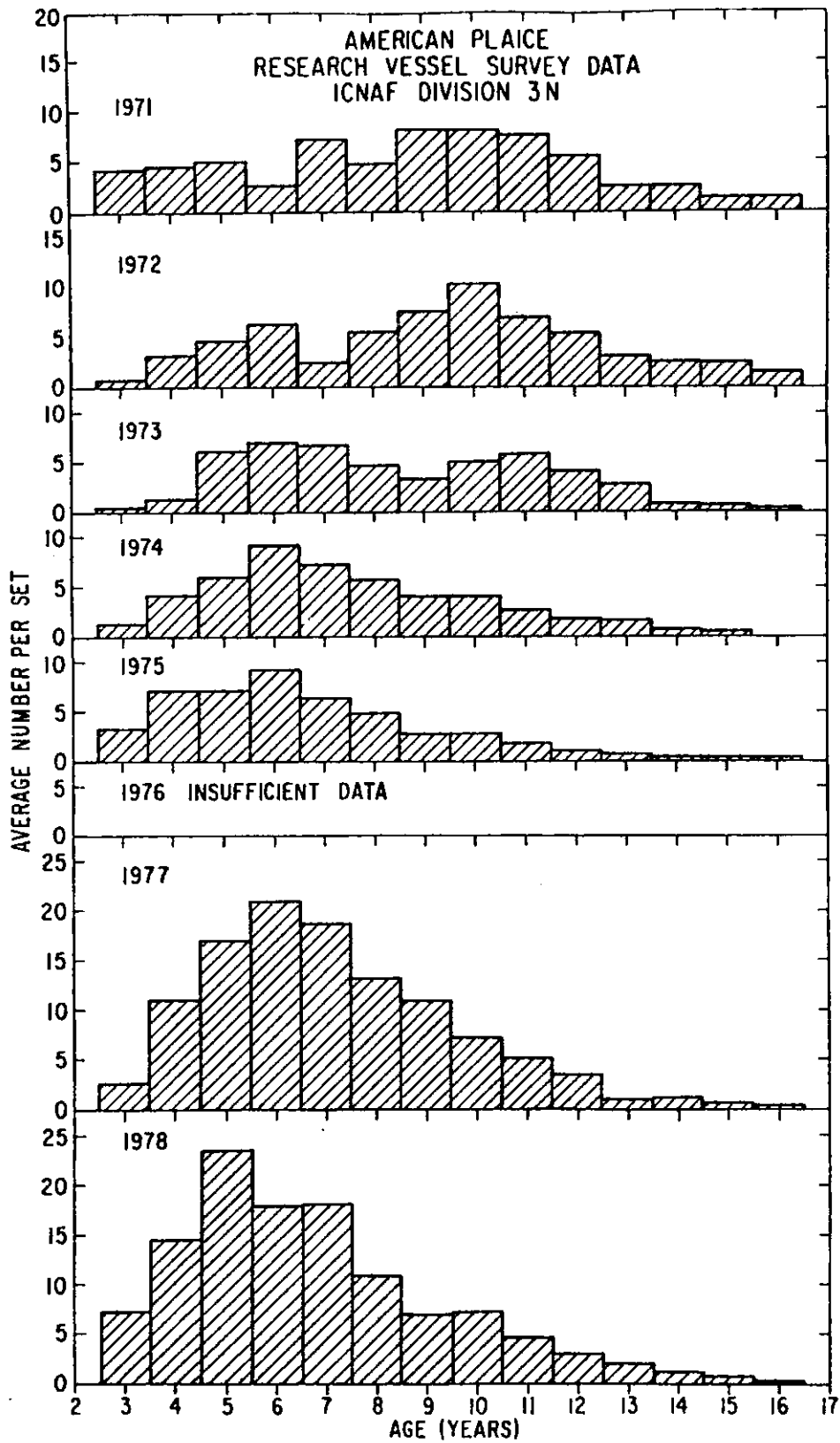


Fig. 6. Average number per set of plaice at various age groups from research vessel catches from ICNAF Division 3N.

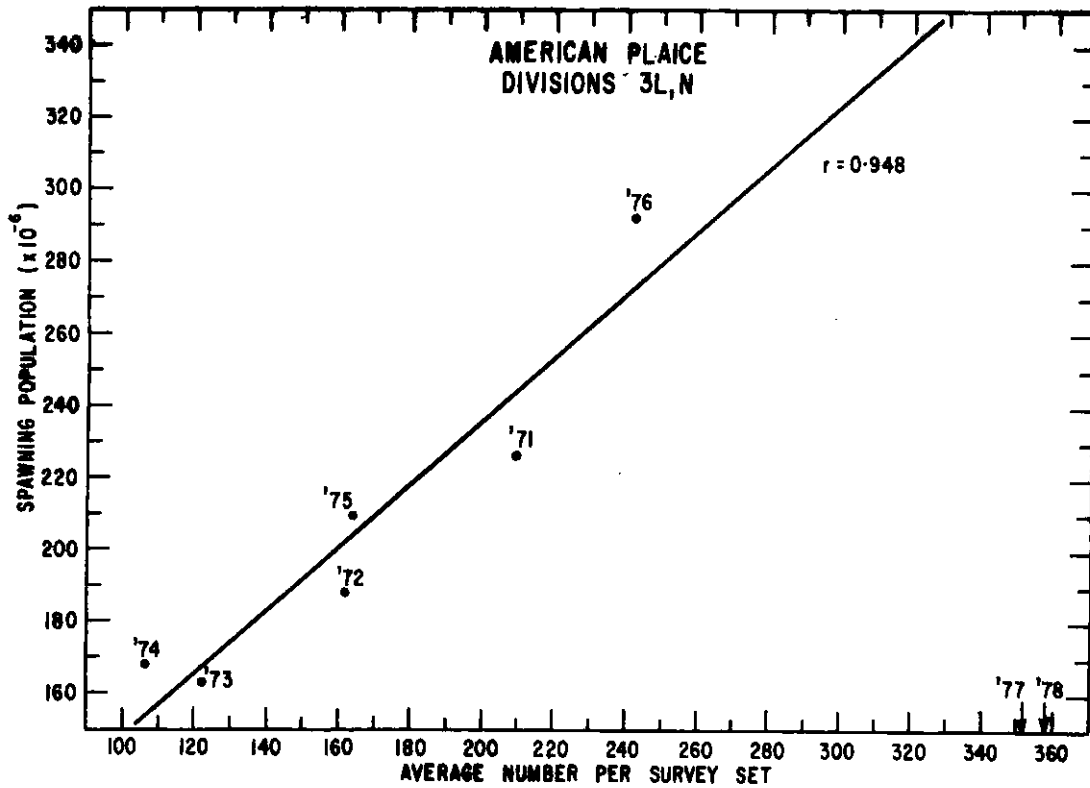
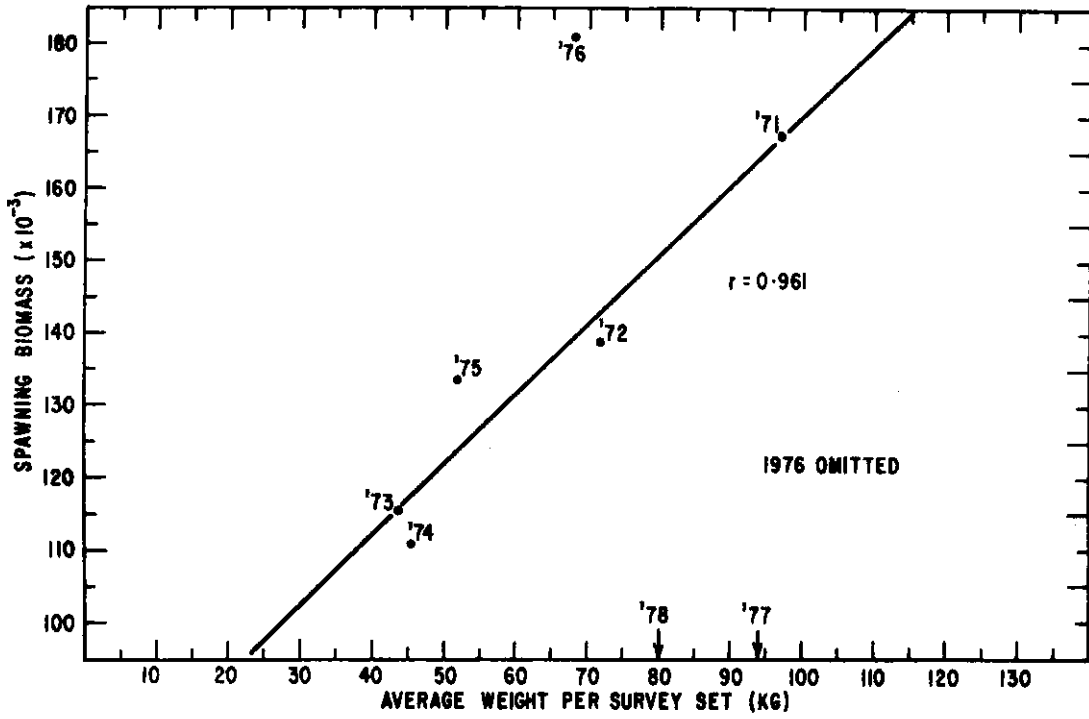


Fig. 7. Spawning biomass and numbers of plaice from Cohort Analyses plotted on average number and weight per set.

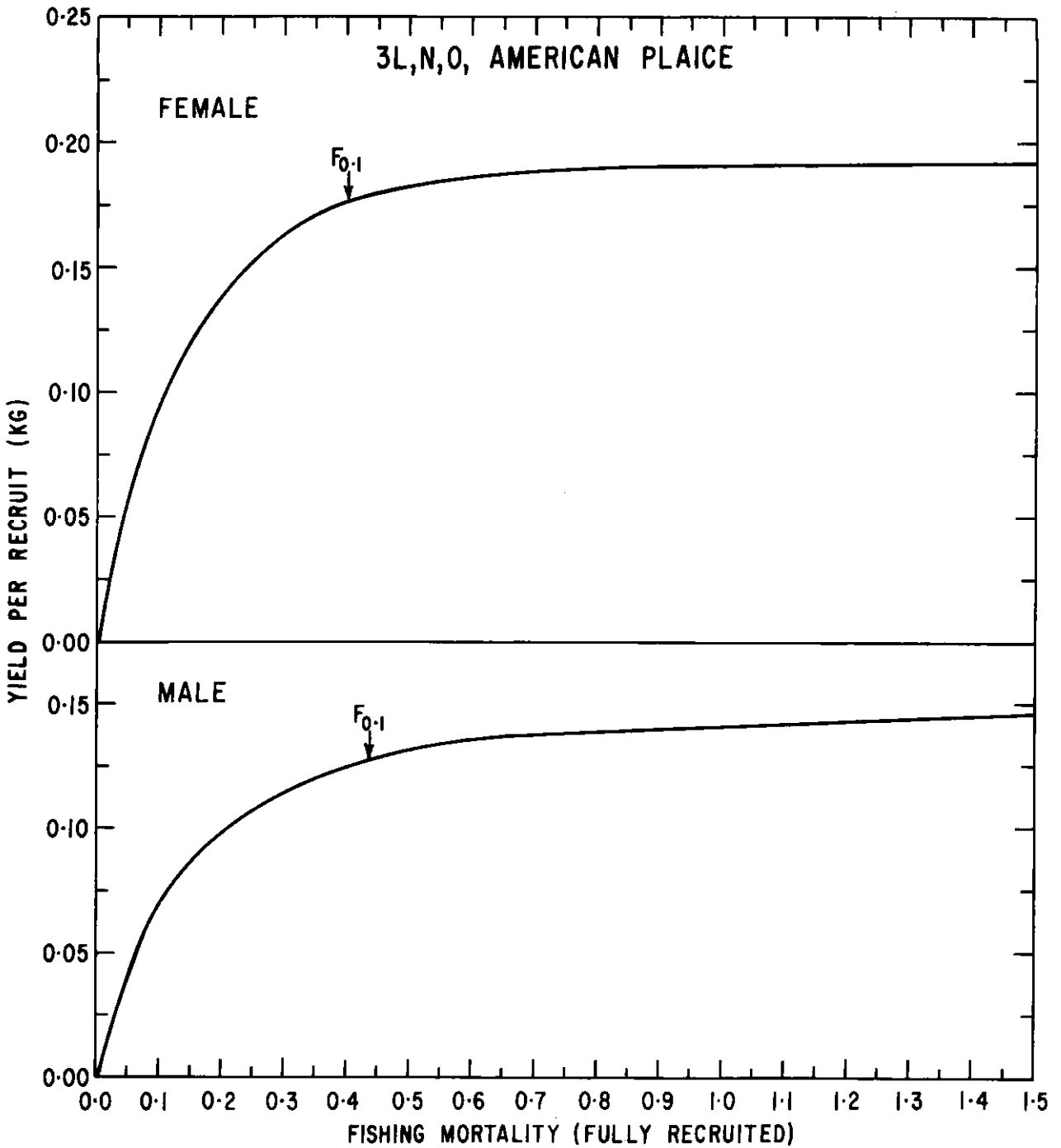


Fig. 8. Yield per recruit curves for plaice in ICNAF Divisions 3L and 3N.