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American plaice in ICNAF Subdivision 3Ps - stock assessment update

BY

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INTRODUCTION

This stock has been under quota regulation since 1973 when the TAC was set at 11,000 tons on the basis of average catch in the previous 8-10 years. TAC's and catches from 1967 are shown in Table 1. The highest catch was recorded in 1968 when approximately 14,300 tons were reported, however, there was some question concerning the species and division breakdown of the USSR. Canadian catches however exceeded the 11,000 ton level in 1970 and in 1973. In the past 5 years catches have averaged around 5,000 tons. The fishery for plaice in this locality is in part, at least, a by-catch fishery, but as the effort data in Table 2 indicates there is a directed fishery also.

ASSESSMENTS

Numbers at age for 1978 were derived from sampling data collected by the St. John's Station, Commercial Groundfish Sampling Group as follows:

Quarter	1	2	3
Measured	691	1014	1651
Otoliths	191	193	304
No. Samples	2	3	2

Partial Recruitment was obtained from a preliminary cohort run using 1976-78 data. The average fishing mortality at age for 1976 and 1977 gave an estimate for the partial recruitment vector as follows:

MALE

Age	6	7	8	9	10	11	12	13	14	15	16	17	18	19
%	.04	.08	.16	.34	.49	1.0	1.57	2.0	1.0					

FEMALE

%	.01	.04	.08	.16	.21	.26	.31	.46	.58	.61	1.00	1.08	1.76	1.0

Average weight at age was calculated from the average length at age for the monthly commercial samples and converted to weights using the following:

$$W = 0.0000285\ L^{3.096} \qquad \text{(X0.454 to convert lbs. to kg.)}$$

Age										
$\bar{W}$ (kg)	.200	.250	.395	.479	.600	.801	.868	1.165	1.214	(Males)

$\bar{W}$ (kg)	.200	.272	.375	.480	.575	.808	1.001	1.142	1.598	1.632	2.327	2.501	2.520	2.600 (Females)

Terminal F. An attempt was made to correlate weighted Fs from cohort runs with directed fishing effort. Significant correlations were found with weighted Fs from cohort analysis using a wide range of F_T for 1978 (Table 2). However, all regressions produced substantial negative intercepts and very low predicted estimates of F for 1978 presumably because of the vast range of effort data. Thus to derive some idea of a possible value for F_T in 1978 the weighted Fs from the cohort run giving the highest r^2 was used and a line constructed through the origin using 1973-77 data (Fig. 1). Since the weighted F for 1973, especially for the males, was very high the 1974-77 line is also shown. Using the complete data; values were read off the line indicating Fs in the recruited age group were 0.30 for males (ages 10-14) and 0.29 for females (ages 13-19).

Recruitment values were averages for 1975-1977 from cohort analyses, (Tables 3 & 4). Catch projections were done for 1979 and 1980 using the population sizes at the beginning of 1978 from cohort runs (a) using F_T = 0.30 and 0.29 for males and females respectively (Tables 5 & 6) and use F_T = 0.42 for males and 0.40 for females, the approximate values used in the 1978 assessment (Tables 7 & 8).

In all projections it was assumed that the 1979 TAC of 4000 tons would be taken. The 1980 projection was at the $F_{0.1}$ level i.e. 0.4 for males and 0.35 for females (Fig. 2) (average values for age 10+ males and 13+ females).

The first projection (a) using the higher stock sizes (Tables 5 & 6) indicate that the 1979 TAC could be removed at a fishing level somewhat below $F_{0.1}$ and the projected TAC for 1980 under these circumstances would be 6700 tons (2250 tons males and 4450 tons females).

Assuming the higher F_T in 1978 would indicate a projected F in 1979 close to the $F_{0.1}$ level and a projected TAC for 1980 of approximately 4600 tons.

Since we do not have a good fix on F_T the above projections are meant only to show the possible levels of removals for 1980.

Abundance indices. Except for the relatively high values recorded in 1973 and 1974 the average weight and number per set in stratified random survey data has remained relatively stable (Fig. 4). The high values in 1973 and 1974 were the result of one or two relatively large catches in particular sets and are perhaps anomalous. At least these points probably should not necessarily be used to indicate a very sharp decline in 1975, however, somewhat the same trends are indicated in the catch per hour in the commercial plaice fishery in this subdivision with a catch per hour in the directed fishery at about 300 kg per hour since 1974 (Fig. 5).

Table 1. Catch for plaice in Subdivision 3Ps

YEAR:	CANADA (TONS)	ALL COUNTRIES (TONS)	TAC (TONS)
1967	3,275	4,494	
1968	5,523	14,280	
1969	4,066	6,491	
1970	11,545	12,328	
1971	5,953	7,182	
1972	5,922	6,538	
1973	12,812	13,360	
1974	6,330	6,598	11.0
1975	3,813	4,211	1.0
1976	5,383	5,428	8.0
1977	4,605	4,605	6.0
1978	3,641	3,641	4.0
1979			4.0

Table 2. Weighted fishing mortality from cohort runs and directed effort.

A. MALE

Year \ F_T (ave)	Effort '000 hrs.	0.18	.24	0.36		0.48
		Weighted F $\frac{\Sigma 11-13}{\Sigma 10-12}$				
1973	26.4	1.06	1.06	1.06		1.06
1974	19.9	0.40	0.42	0.44		0.44
1975	13.7	0.23	0.24	0.28		0.30
1976	16.4	0.28	0.33	0.40		0.46
1977	14.1	0.12	0.15	0.21		0.26
1978	11.8	(-0.13)	(0.02)	(0.09)		(0.14)
1973-77						
r^2		0.929	0.936	0.926		0.905
a		-0.820	-0.763	-0.643		0.553
b		0.024	0.067	0.061		0.055
1974-77						
r^2		0.780	0.832	0.778		0.616
a		-0.436	-0.312	-0.196		-0.087
b		0.037	0.037	0.033		0.028
1978		(0.03)	(0.13)	(0.19)		(0.25)

B. FEMALE

Year \ F_T	Effort	0.22	0.32	0.43
		Weighted F $\frac{\Sigma 14-18}{\Sigma 13-17}$		
1973	26.4	0.77	.77	.77
1974	19.9	0.46	.48	.48
1975	13.7	0.20	.23	.23
1976	16.4	0.20	.26	.29
1977	14.1	0.15	.24	.31
1978	11.8	(0.05)	(0.12)	(.16)
1973-77				
r^2		0.966	0.977	0.964
a		-0.529	-0.398	-0.325
b		0.042	0.044	0.041
1974-78				
		0.849	0.896	0.808
		-0.476	-0.332	-0.215
		0.045	0.040	0.035
1978		(0.06)	(0.14)	(0.18)

Table 3

PLAICE 3PS MALE 1973-78

NATURAL MORTALITY= 0.25

PARTIAL RECRUITMENT MULTIPLIER

0.0200	0.0800	0.1600	0.3400	0.4900	1.0000	1.5700	2.0000	1.000

ASSUMED FISHING MORTALITY FOR LAST AGES

1.2000	0.5700	0.4500	0.8000	0.4000	0.2500

ESTIMATED POPULATION

AGE YEAR	1973	1974	1975	1976	1977	1978
6	10806.	13694.	12904.	11552.	7565.	7477.
7	6778.	8386.	10598.	9966.	8917.	5877.
8	3358.	4941.	6285.	8076.	7555.	6912.
9	2511.	2282.	3557.	4712.	5776.	5773.
10	1433.	1407.	1416.	2648.	3018.	4244.
11	2102.	694.	783.	925.	1612.	2069.
12	1152.	451.	349.	465.	388.	936.
13	448.	117.	161.	132.	154.	233.
14	2.	18.	37.	38.	41.	71.

KNOWN CATCHES

AGE YEAR	1973	1974	1975	1976	1977	1978
6	34.	76.	95.	90.	17.	33.
7	382.	278.	201.	234.	37.	103.
8	377.	330.	207.	582.	125.	240.
9	621.	410.	139.	739.	289.	417.
10	478.	355.	201.	510.	319.	434.
11	1344.	217.	164.	377.	362.	407.
12	884.	215.	159.	236.	78.	271.
13	375.	61.	99.	70.	55.	82.
14	1.	7.	12.	19.	12.	14.

ESTIMATE FISHING MORTALITY

AGE YEAR	1973	1974	1975	1976	1977	1978
6	0.0036	0.0063	0.0084	0.0089	0.0025	0.0
7	0.0660	0.0383	0.0217	0.0270	0.0047	0.0
8	0.1361	0.0787	0.0380	0.0852	0.0189	0.0
9	0.3289	0.2276	0.0453	0.1957	0.0584	0.0
10	0.4747	0.3367	0.1754	0.2463	0.1276	0.0
11	1.2893	0.4371	0.2711	0.6196	0.2937	0.0
12	2.0390	0.7772	0.7253	0.8566	0.2587	0.0
13	2.9647	0.8968	1.1871	0.9219	0.5200	0.0
14	1.2000	0.5700	0.4500	0.8000	0.4000	0.2500

POPULATION WTS AND NOS

	1973	1974	1975	1976	1977	1978
WT	10451.	9830.	11429.	13182.	13160.	13834.
NO	28588.	31991.	36090.	38514.	35025.	33592.

POPULATION WTS AND NOS AGE 8 TO 14

	1973	1974	1975	1976	1977	1978
WT	6596.	4995.	6199.	8380.	9418.	10869.
NO	11004.	9911.	12588.	16996.	18543.	20238.

Table 4

PLAICE 3PS FEMALE 1973-78

NATURAL MORTALITY= 0.20

PARTIAL RECRUITMENT MULTIPLIER

0.0100	0.0400	0.0800	0.1600	0.2100	0.2600	0.3100
0.4600	0.5800	0.6100	1.0000	1.0800	1.7600	1.0000

ASSUMED FISHING MORTALITY FOR LAST AGES

1.0000	0.6000	0.8000	0.5000	0.5000	0.3000

ESTIMATED POPULATION

AGE YEAR	1973	1974	1975	1976	1977	1978
6	18816.	26983.	25603.	18087.	11642.	7366.
7	20264.	15394.	21878.	20809.	14780.	9525.
8	9543.	16422.	12147.	17534.	16849.	11999.
9	7675.	7410.	12969.	9578.	13878.	13573.
10	5299.	5787.	5383.	10228.	7154.	10813.
11	3871.	3919.	3954.	4207.	7705.	5316.
12	3004.	2573.	2702.	3021.	2915.	5681.
13	2445.	2043.	1505.	1922.	2049.	2109.
14	2201.	1190.	965.	959.	1226.	1474.
15	1743.	772.	537.	584.	604.	789.
16	1164.	546.	433.	370.	333.	322.
17	844.	205.	290.	264.	188.	83.
18	597.	305.	81.	152.	126.	29.
19	410.	148.	119.	8.	86.	21.

KNOWN CATCHES

AGE YEAR	1973	1974	1975	1976	1977	1978
6	12.	236.	169.	31.	7.	20.
7	186.	505.	418.	208.	113.	103.
8	446.	527.	406.	528.	245.	258.
9	549.	755.	431.	760.	607.	577.
10	463.	866.	221.	739.	598.	599.
11	659.	560.	239.	586.	693.	362.
12	460.	665.	321.	469.	306.	458.
13	897.	783.	302.	384.	225.	247.
14	1139.	483.	227.	200.	237.	214.
15	974.	220.	77.	161.	191.	120.
16	827.	173.	100.	127.	209.	76.
17	426.	96.	95.	99.	138.	21.
18	377.	145.	64.	42.	91.	11.
19	239.	61.	60.	3.	31.	5.

ESTIMATE FISHING MORTALITY

AGE YEAR	1973	1974	1975	1976	1977	1978
6	0.0007	0.0097	0.0073	0.0019	0.0007	0.0
7	0.0102	0.0369	0.0213	0.0111	0.0085	0.0
8	0.0530	0.0361	0.0376	0.0338	0.0162	0.0
9	0.0824	0.1195	0.0374	0.0918	0.0495	0.0
10	0.1016	0.1808	0.0464	0.0832	0.0969	0.0
11	0.2084	0.1719	0.0691	0.1671	0.1047	0.0
12	0.1854	0.3363	0.1407	0.1882	0.1233	0.0
13	0.5199	0.5507	0.2507	0.2495	0.1294	0.0
14	0.8482	0.5950	0.3012	0.2620	0.2403	0.0
15	0.9612	0.3784	0.1724	0.3632	0.4297	0.0
16	1.5372	0.4313	0.2949	0.4763	1.1851	0.0
17	0.8167	0.7292	0.4489	0.5356	1.6597	0.0
18	1.1968	0.7447	2.0720	0.3652	1.5867	0.0
19	1.0000	0.6000	0.8000	0.5000	0.5000	0.3000

POPULATION WTS AND NOS

	1973	1974	1975	1976	1977	1978
WT	42263.	36799.	37229.	39361.	39658.	38417.
NO	77876.	83697.	88566.	87723.	79536.	69102.

POPULATION WTS AND NOS AGE 11 TO 19

	1973	1974	1975	1976	1977	1978
WT	22679.	14173.	12282.	13030.	16216.	17121.
NO	16281.	11702.	10586.	11488.	15233.	15826.

Table 5

3PS PLAICE MALE

NATURAL MORTALITY# 0.2500 YEAR 1978

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	10700.	33.	0.004	0.200	2140.0	6.6	8299.9
7	5877.	103.	0.020	0.250	1469.2	25.8	4486.4
8	6912.	240.	0.041	0.395	2730.2	94.8	5166.8
9	5773.	417.	0.086	0.479	2765.3	199.7	4125.5
10	4244.	434.	0.123	0.600	2546.4	260.4	2922.7
11	2069.	407.	0.250	0.801	1657.3	326.0	1254.9
12	936.	271.	0.393	0.868	812.4	235.2	492.1
13	233.	82.	0.501	1.165	271.4	95.5	110.0
14	71.	14.	0.251	1.214	86.2	17.0	43.0
TOTAL	36815.	2001.	$\bar{F}_{10+}$ 0.304		14478.5	1261.1	26901.3

NATURAL MORTALITY# 0.2500 YEAR 1979

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	10700.	75.	0.008	0.200	2140.0	15.1	8266.8
7	8300.	117.	0.016	0.250	2075.0	29.2	6361.4
8	4486.	125.	0.032	0.395	1772.1	49.4	3384.0
9	5167.	301.	0.068	0.479	2474.9	144.2	3759.4
10	4126.	341.	0.098	0.600	2475.3	204.9	2913.0
11	2923.	471.	0.200	0.801	2341.1	377.0	1863.6
12	1255.	301.	0.314	0.868	1089.3	261.4	714.0
13	492.	145.	0.400	1.165	573.3	168.6	256.9
14	110.	18.	0.200	1.214	133.5	21.5	70.1
TOTAL	37558.	1894.	$\bar{F}_{10+}$ 0.242		15074.4	1271.2	27589.1

YEAR 1980

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	10700.	122.	0.013	0.200	2140.0	24.5	8225.5
7	8267.	188.	0.026	0.250	2066.7	47.0	6272.9
8	6361.	291.	0.053	0.395	2512.7	114.9	4698.5
9	3384.	318.	0.112	0.479	1620.9	152.3	2356.2
10	3759.	499.	0.162	0.600	2255.6	299.5	2489.9
11	2913.	731.	0.331	0.801	2333.3	585.8	1629.4
12	1864.	675.	0.519	0.868	1617.6	585.7	863.7
13	714.	310.	0.662	1.165	831.8	361.2	286.8
14	257.	64.	0.331	1.214	311.9	78.3	143.7
TOTAL	38219.	3199.			15690.5	2249.1	26966.7

3PS PLAICE FEMALE *Table 6*

NATURAL MORTALITY# 0.2000 YEAR 1978

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	18000.	20.	0.002	0.200	3600.0	4.0	14707.7
7	9525.	103.	0.013	0.272	2590.8	28.0	7697.7
8	11999.	258.	0.024	0.375	4499.6	96.8	9591.0
9	13573.	577.	0.048	0.480	6515.0	277.0	10591.8
10	10813.	599.	0.063	0.575	6217.5	344.4	8312.4
11	5316.	362.	0.079	0.808	4295.3	292.5	4021.8
12	5681.	458.	0.094	1.001	5686.7	458.5	4233.9
13	2109.	247.	0.139	1.142	2408.5	282.1	1502.6
14	1474.	214.	0.175	1.598	2355.5	342.0	1013.1
15	789.	120.	0.184	1.631	1286.9	195.7	537.4
16	322.	70.	0.273	2.327	749.3	162.9	200.6
17	83.	21.	0.326	2.501	207.6	52.5	49.1
18	29.	11.	0.536	2.520	73.1	27.7	13.9
19	21.	5.	0.303	2.600	54.6	13.0	12.7
TOTAL	79734.	3065.	$\bar{F}_{13}$ 0.29		40540.3	2577.0	62485.7

NATURAL MORTALITY# 0.2000 YEAR 1979

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	18000.	49.	0.003	0.200	3600.0	9.8	14693.0
7	14708.	146.	0.011	0.272	4000.5	39.7	11909.9
8	7698.	152.	0.022	0.375	2886.6	57.0	6165.2
9	9591.	366.	0.043	0.480	4603.7	175.7	7521.9
10	10592.	532.	0.057	0.575	6090.3	306.1	8191.4
11	6312.	510.	0.070	0.808	6716.4	412.0	6385.5
12	4022.	294.	0.084	1.001	4025.8	294.4	3027.5
13	4234.	448.	0.124	1.142	4835.1	512.1	3002.2
14	1503.	198.	0.157	1.598	2401.2	317.0	1051.5
15	1013.	140.	0.165	1.631	1652.3	228.4	703.3
16	537.	116.	0.270	2.327	1250.6	269.4	335.9
17	201.	46.	0.292	2.501	501.8	115.7	122.7
18	49.	17.	0.475	2.520	123.6	42.7	25.0
19	14.	3.	0.270	2.600	36.1	7.8	8.7
TOTAL	80473.	3018.	$\bar{F}_{13}$ 0.250		42724.0	2787.9	63163.6

YEAR 1980

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	18000.	65.	0.004	0.200	3600.0	13.0	14678.3
7	14693.	198.	0.015	0.272	3996.5	53.9	11850.5
8	11910.	319.	0.030	0.375	4465.2	119.7	9462.8
9	6165.	331.	0.061	0.480	2959.3	158.9	4748.9
10	7522.	525.	0.080	0.575	4325.1	301.8	5634.9
11	8191.	701.	0.099	0.808	6618.6	566.4	6674.4
12	6346.	641.	0.116	1.001	6351.9	642.0	4817.0
13	3027.	442.	0.175	1.142	3457.4	504.5	2000.7
14	3062.	550.	0.220	1.598	4893.4	879.1	2012.0
15	1051.	198.	0.232	1.631	1715.0	323.1	682.6
16	703.	203.	0.380	2.327	1636.5	471.9	393.8
17	338.	103.	0.410	2.501	840.0	257.6	182.5
18	123.	55.	0.669	2.520	309.1	138.2	51.4
19	25.	7.	0.380	2.600	64.9	18.7	14.0
TOTAL	81155.	4339.	$\bar{F}$ 0.35		45233.9	4449.0	62534.0

Table 7

3PS PLAICE MALE

NATURAL MORTALITY# 0.2500 YEAR 1978

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	6800.	33.	0.006	0.200	1360.0	6.6	5264.2
7	4214.	103.	0.028	0.250	1053.5	25.8	3191.2
8	4975.	240.	0.056	0.395	1965.1	94.8	3663.5
9	4190.	417.	0.120	0.479	2007.0	199.7	2894.2
10	3101.	434.	0.172	0.600	1860.6	260.4	2033.4
11	1546.	407.	0.351	0.801	1238.3	326.0	847.6
12	716.	271.	0.550	0.868	621.5	235.2	321.7
13	181.	82.	0.703	1.165	210.9	95.5	69.8
14	53.	14.	0.352	1.214	64.3	17.0	29.0
TOTAL	25776.	2001.	$\bar{F}_{10+}$ 0.426		10381.3	1261.1	18314.7

NATURAL MORTALITY# 0.2500 YEAR 1979

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	6800.	36.	0.006	0.200	1360.0	7.2	5264.2
7	5264.	120.	0.026	0.250	1316.0	29.9	3994.5
8	3191.	141.	0.051	0.395	1260.5	55.5	2361.8
9	3664.	336.	0.109	0.479	1754.8	160.7	2558.5
10	2894.	373.	0.157	0.600	1736.5	224.0	1926.5
11	2033.	496.	0.320	0.801	1628.8	397.3	1150.0
12	848.	300.	0.503	0.868	735.7	260.0	399.2
13	322.	136.	0.640	1.165	374.8	158.8	132.1
14	70.	17.	0.320	1.214	84.7	20.7	39.5
TOTAL	25086.	1954.	$\bar{F}_{10+}$ 0.388		10251.9	1314.1	17826.2

NATURAL MORTALITY# 0.2500 YEAR 1980

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	6800.	78.	0.013	0.200	1360.0	15.5	5227.4
7	5264.	120.	0.026	0.250	1316.0	29.9	3994.5
8	3995.	183.	0.053	0.395	1577.8	72.1	2950.3
9	2362.	222.	0.112	0.479	1131.3	106.3	1644.5
10	2559.	340.	0.162	0.600	1535.1	203.8	1694.6
11	1926.	484.	0.331	0.801	1543.1	387.4	1077.6
12	1150.	416.	0.519	0.868	998.2	361.4	533.0
13	399.	173.	0.662	1.165	465.1	202.0	160.4
14	132.	33.	0.331	1.214	160.4	40.3	73.9
TOTAL	24587.	2048.	$\bar{F}_{10+}$ .40		10087.0	1418.8	17356.1

Table 8

3PS PLAICE FEMALE

NATURAL MORTALITY# 0.2000 YEAR 1978

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	14000.	20.	0.002	0.200	2800.0	4.0	11439.3
7	7158.	103.	0.016	0.272	1947.0	28.0	5767.5
8	9034.	258.	0.032	0.375	3387.7	96.6	7163.5
9	10258.	577.	0.065	0.480	4923.8	277.0	7870.0
10	8191.	599.	0.085	0.575	4709.8	344.4	6159.7
11	4037.	362.	0.104	0.808	3261.9	292.5	2978.7
12	4324.	458.	0.125	1.001	4328.3	458.5	3124.2
13	1617.	247.	0.184	1.142	1846.6	282.1	1101.4
14	1136.	214.	0.232	1.598	1815.3	342.0	737.5
15	609.	120.	0.245	1.631	993.3	195.7	390.3
16	253.	70.	0.362	2.327	588.7	162.9	144.2
17	66.	21.	0.429	2.501	165.1	52.5	35.2
18	24.	11.	0.694	2.520	60.5	27.7	9.8
19	17.	5.	0.390	2.600	44.2	13.0	9.4
TOTAL	60724.	3065.			30872.3	2577.0	46930.6

$\bar{F}$ 13+ 0.362

NATURAL MORTALITY# 0.2000 YEAR 1979

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	14000.	51.	0.004	0.200	2800.0	10.1	11416.5
7	11439.	154.	0.015	0.272	3111.5	42.0	9226.3
8	5767.	155.	0.030	0.375	2162.8	58.0	4582.4
9	7163.	372.	0.059	0.480	3438.5	178.7	5528.9
10	7870.	536.	0.078	0.575	4525.2	306.2	5959.9
11	6160.	507.	0.095	0.808	4977.1	409.5	4586.1
12	2979.	294.	0.115	1.001	2981.7	294.1	2173.9
13	3124.	432.	0.168	1.142	3567.6	501.5	2162.3
14	1101.	193.	0.214	1.598	1760.0	308.4	728.0
15	738.	135.	0.225	1.631	1202.9	220.5	462.2
16	390.	110.	0.368	2.327	908.1	255.0	221.1
17	144.	43.	0.397	2.501	360.7	107.6	79.4
18	35.	15.	0.648	2.520	88.7	38.7	15.1
19	10.	3.	0.368	2.600	25.5	7.2	5.6
TOTAL	60921.	3007.	$\bar{F}$ 0.341		31910.6	2739.7	47167.7

NATURAL MORTALITY# 0.2000 YEAR 1980

AGE	POP. NO. %X10-3<	CATCH NO. %X10-3<	FISHING MORT.	MEAN WT. KG.	POP. WT. %METRIC TONS<	CATCH WT. %METRIC TONS<	RESIDUAL POP. NOS.
6	14000.	51.	0.004	0.200	2800.0	10.1	11416.5
7	11416.	154.	0.015	0.272	3105.3	41.9	9207.9
8	9226.	247.	0.030	0.375	3459.9	92.7	7330.5
9	4582.	246.	0.061	0.480	2199.6	118.1	3529.8
10	5529.	386.	0.080	0.575	3179.1	221.8	4178.7
11	5960.	510.	0.099	0.808	4815.6	412.1	4419.6
12	4586.	464.	0.116	1.001	4590.7	464.0	3336.9
13	2174.	317.	0.175	1.142	2482.5	362.3	1494.1
14	2162.	388.	0.220	1.598	3455.4	620.7	1420.7
15	726.	137.	0.232	1.631	1187.4	223.7	472.6
16	482.	139.	0.360	2.327	1122.0	323.5	270.0
17	221.	68.	0.410	2.501	553.1	169.8	120.2
18	79.	35.	0.669	2.520	200.1	89.4	33.3
19	15.	4.	0.380	2.600	39.2	11.3	8.4
TOTAL	61162.	3147.	0.35		33189.8	3161.5	47239.1

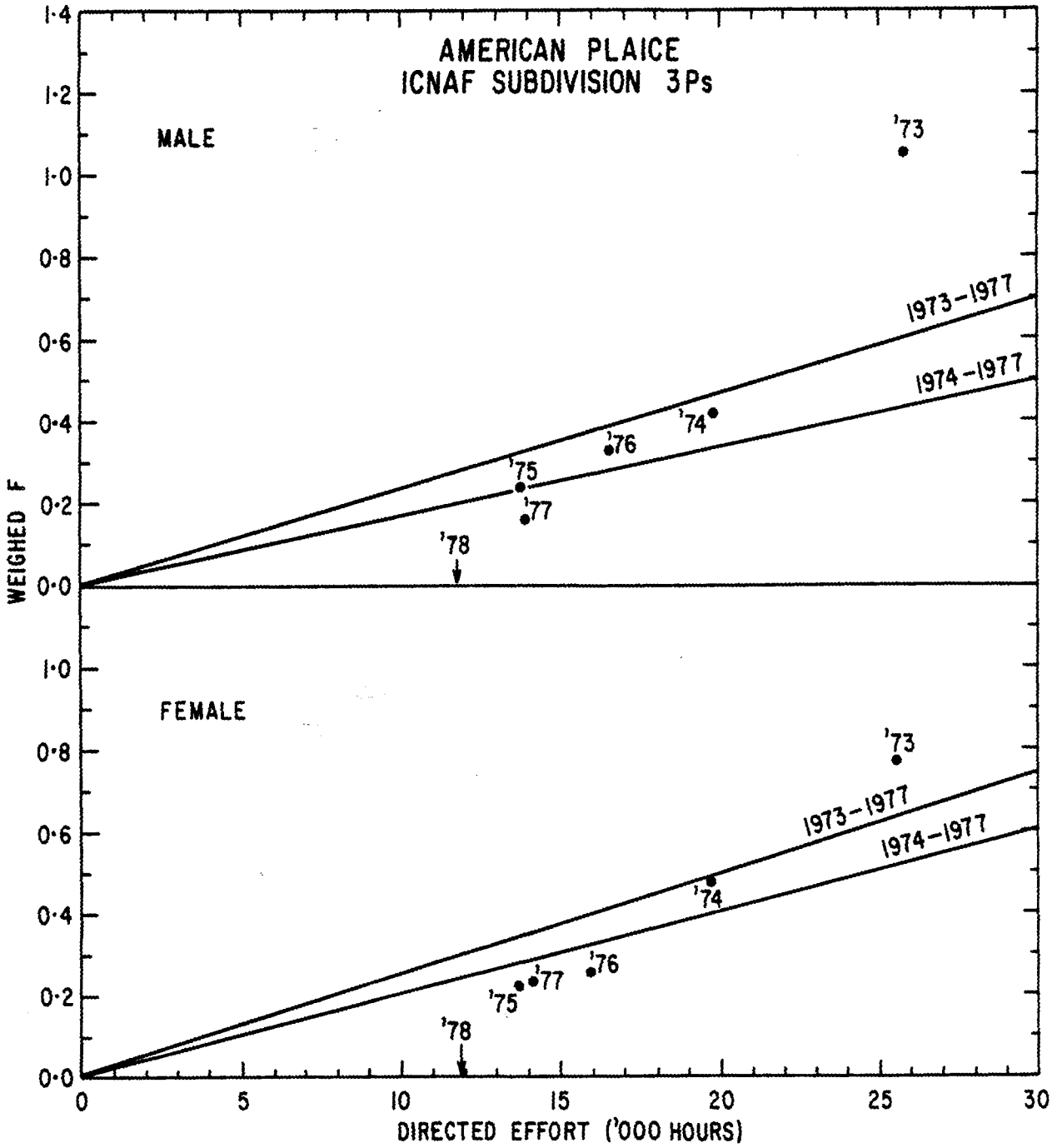

Fig. 1. Plot of weighted F on directed effort for 3Ps plaice. Points came from weighted F from cohort runs using average F_T = .30 for males and average F_T for females = 0.32. Lines were drawn through origin.

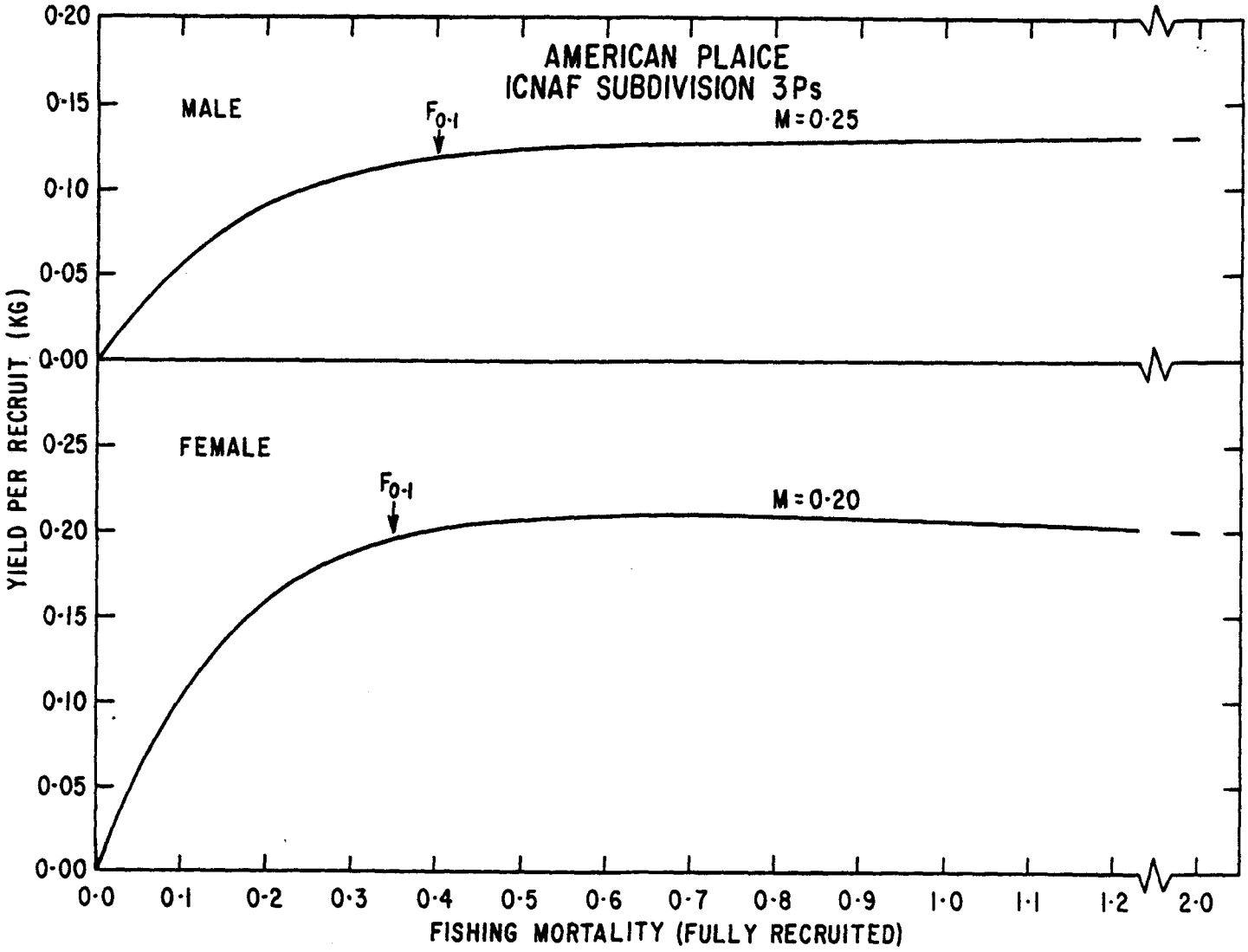

Fig. 2. Yield/recruit of plaice for ICNAF Subdivision 3Ps.

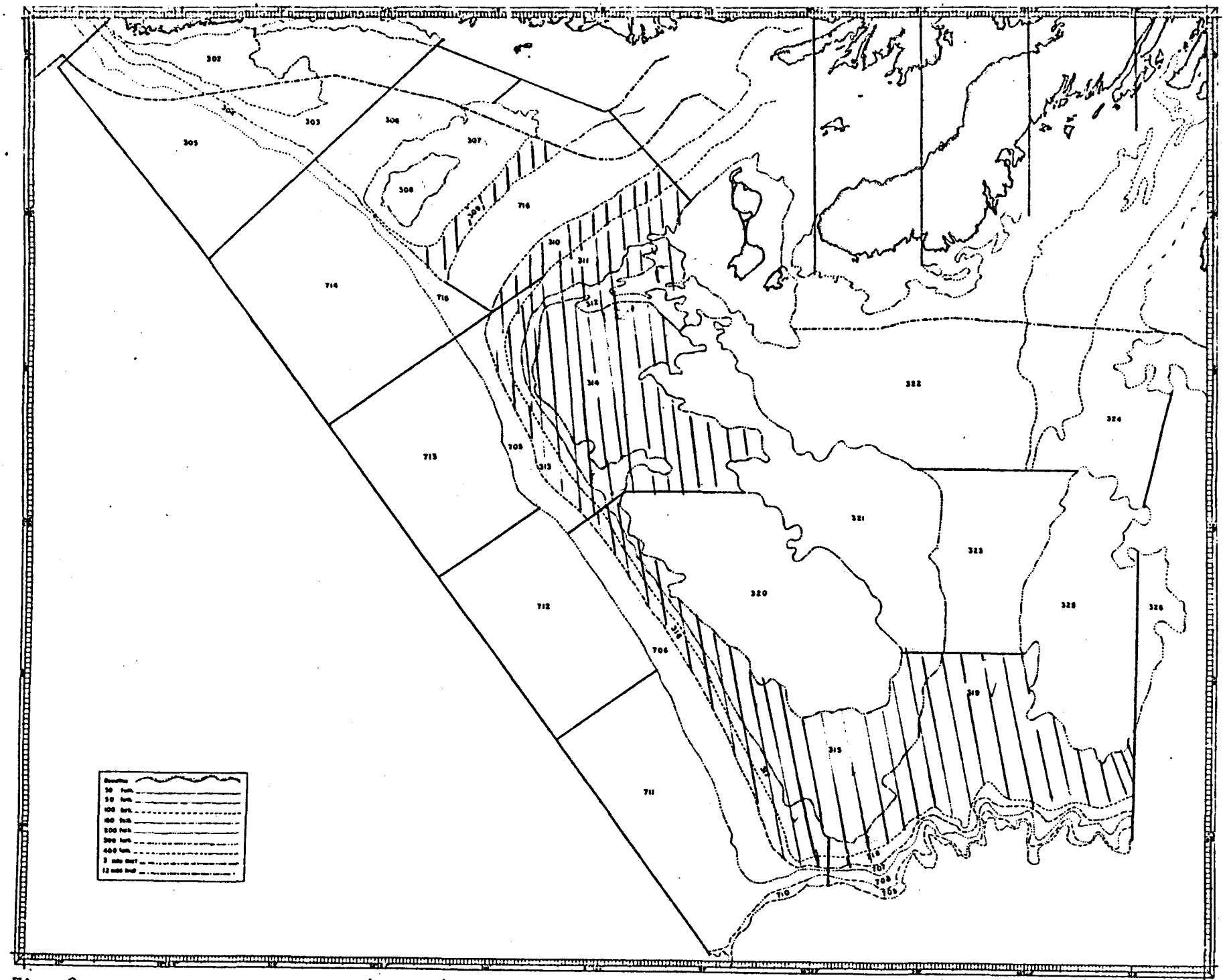

Fig. 3. Map showing the strata (shaded) used to calculate the average number and weight per set in Fig. 3.

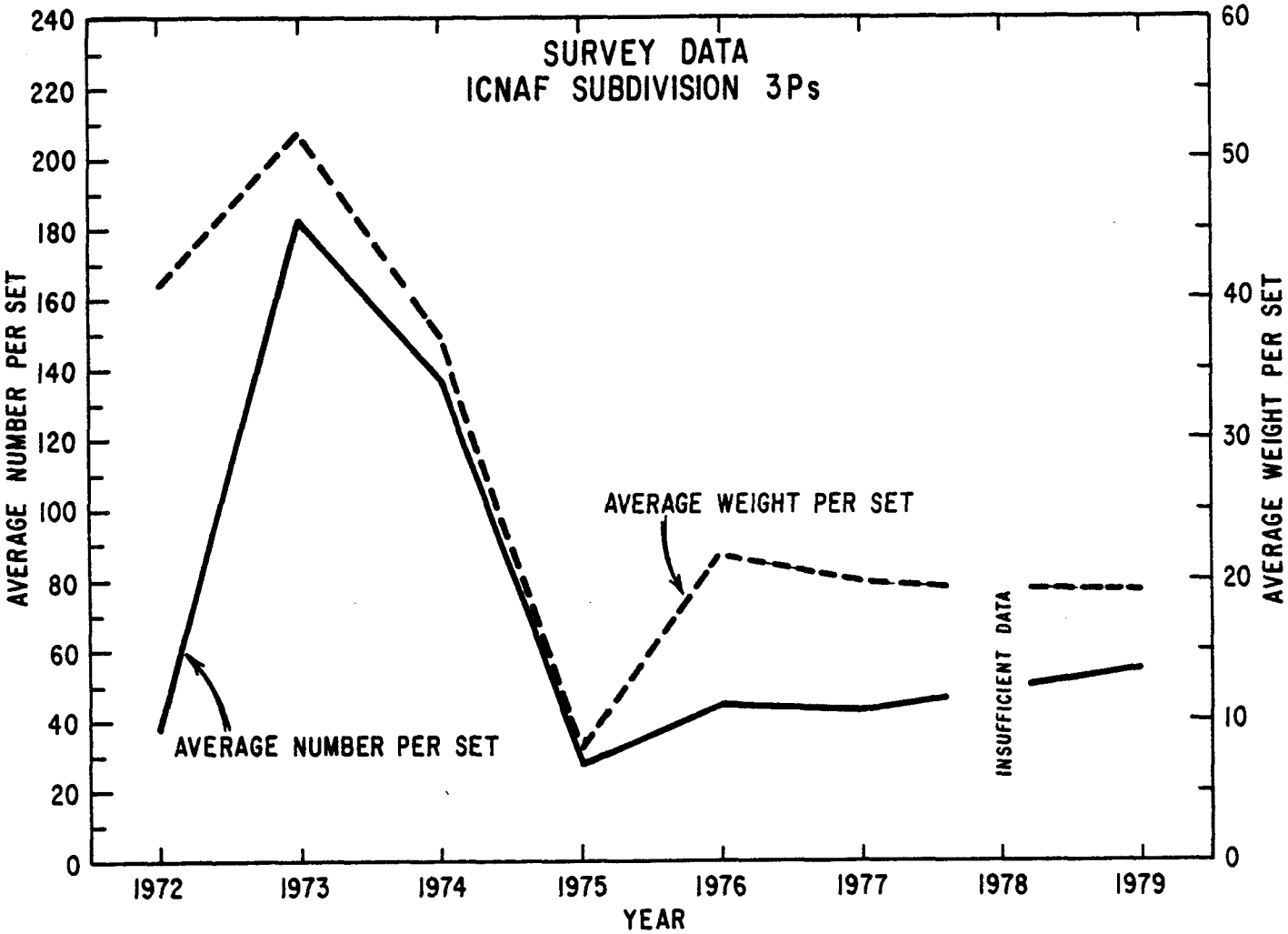

Fig. 4. Average number and weight per set of American Plaice from survey data for Subdivision 3Ps.

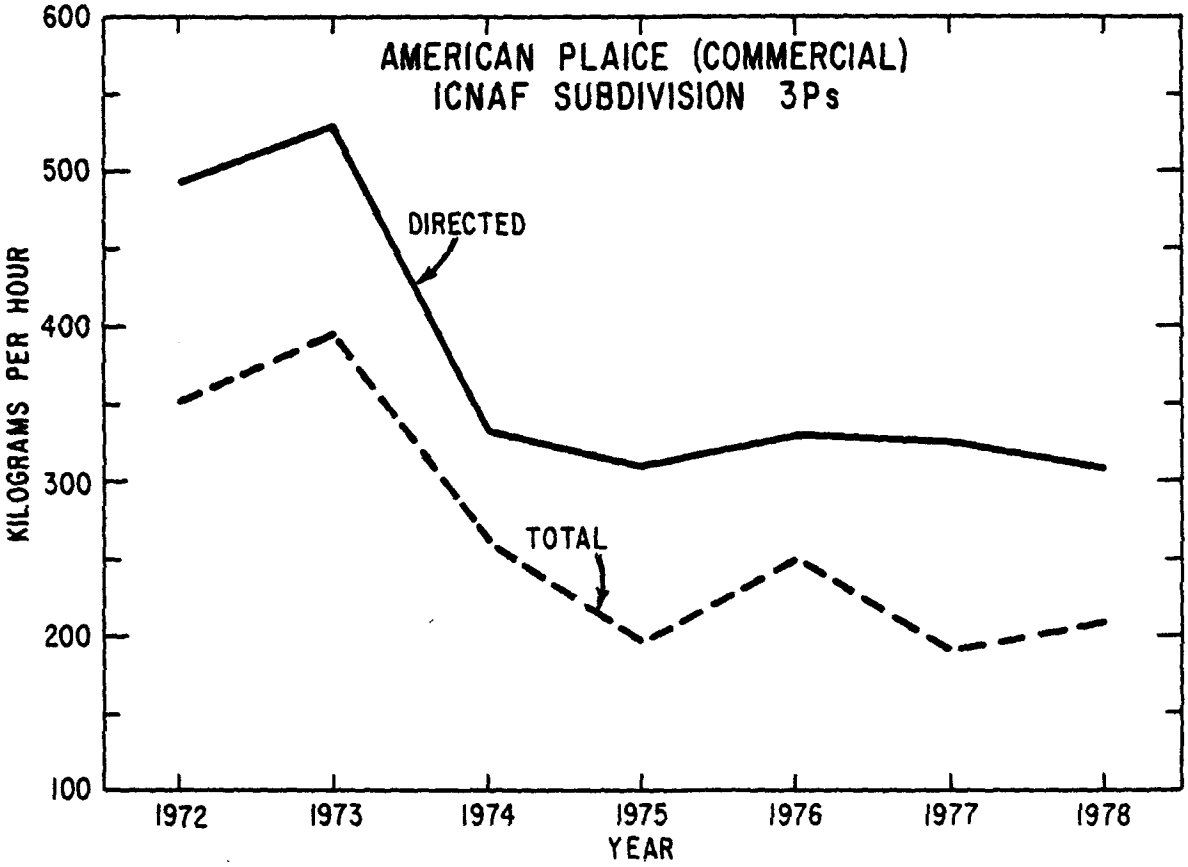

Fig. 5. Catch per unit effort for Canadian commercial otter trawlers, TC 5.