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Assessment of Yellowtail Flounder in Divisions 3LNO

by

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Catch Trends

Nominal catches and TACS are listed in Table 1. Catches peaked in 1972 when 39.3 thousand tons were removed. A precautionary TAC of 50,000 tons was set for 1973, and subsequent TACs were based on analytic assessments, but catches did not reach the reduced TACs for the following 2 years. In 1976 the TAC was drastically reduced mainly because the anticipated recruitment did not materialize and the stocks biomass was apparently greatly reduced (Table 6). Since then TACs and catches have gradually increased.

Stock Assessment Parameters

Sampling by the Commercial Sampling Group of the Research and Resources Services Branch at St. John's, provided length measurements and otolith samples. These are listed in Table 2.

Numbers at age were determined by applying quarterly age-length keys (males and females separately) to monthly length frequencies for each of the 3 NAFO Divisions. The males and females and Divisions were combined for the Virtual Population runs.

Weights-at-age for the current year were calculated from the various monthly length-at-age data weighted by the numbers caught to give average lengths-at-age. These were converted to weight-at-age by the length-weight equation (Tables 3a and 4b). For biomass calculations and for projections, average weights 1975-79 were used.

Partial recruitment (Table 3a) was determined from a cohort run using a matrix of catch at age numbers for 1976-79 with starting F^S for each cohort in 1979 being the average for the 4 years.

Recruitment at age 4, used to make projects for 1980 and 1981 was 120 million fish which was the average population size (at age 4) 1976-78. Because of the possibility of discards at age 4 in 1979, 120 million fish were also used at age 4 in projecting to 1980.

Terminal F was determined from the regression of F calculated from population number for ages 6-10 for 1969-76 on directed fishing effort (Canada(N) OT5) (Fig. 1). This indicates an average F in 1979 for these age groups of 0.55 which is the virtual population run given in Tables 4 and 5. This F value for ages 6-9 is produced where F is 0.45 when the partial recruitment value = 1.0. Regression of biomass on CPUE did not give significant correlations (Fig. 2).

Stock projections (Table 7) were made to 1981 based on the virtual population run with fishing mortality averaging 0.55 for ages 6-9 (0.45 where partial recruitment = 1.0). Assuming that the 1980 TAC will be taken and recruitment is at the estimated average value, the projected removal level for 1981 is 21,000 tons at $F_{0.1} = 0.45$ (Table 3B).

Discussion

There are some indications that this stock is in a fairly healthy condition. Catch per hour on the directed yellowtail fishery increased gradually since 1976 (Fig. 3) also average numbers and weights from the most recent survey in Division 3N (May 1980) indicate a fairly sharp increase. On the other hand

the number of 4 and 5 year olds in the 1979 survey were rather low. An attempt to correlate numbers at age from surveys with biomass (numbers) from the virtual population analysis did not indicate significant correlation (Fig. 4).

Judging from past experience some caution must be exercised in making catch projections for this stock. The numbers of 4 year olds caught in 1979 was rather low, however this could be the result of higher discards at the smaller sizes in 1979 because larger fish were available. We still do not have good estimates of recruitment. The research net apparently does not catch 2 or 3 year old yellowtail and 4 year olds also appear to be inadequately sampled.

The 1979 assessment used 110 million fish as the recruitment estimate and 120 million used in this assessment might be too high.

Table 1. Nominal catches and TAC of Yellowtail-ICNAF Division 3LNO

Year	Canada	France	USSR	Other	Total	TAC
1966	4185	0	2834	7	7026	
1967	2122		6736	20	8878	
1968	4180	14	9146	0	13340	
1969	10494	1	5207	6	15708	
1970	22814	17	3426	169	26426	
1971	24206	49	13087	0	37342	
1972	26939	358	11929	33	39259	
1973	28492	368	3545	410	32815	50000
1974	17053	60	6952	248	24313	40000
1975	18458	15	4076	345	22894	35000
1976	7910	31	57	59	8057	9000
1977	11295	245	97	1	11638	12000
1978	15091	375	-	-	15466	15000
1979*	18573	306	-	-	18879	18000
1980						18000

Table 2. List of commercial samples for 3LNO Yellowtail 1979

Quarter	Number Measured			Otolith Specimens			No. of Samples
	3L	3N	3Ø	3L	3N	3Ø	
1	440	371	-	120	64	-	2
2	2729	6736	626	340	491	142	17
3	1567	9101	566	157	591	90	23
4	-	7425	285	-	509	86	17
TOTAL	4736	23633	1477	617	1655	318	59

TABLE 3

(a)

AGE MEAN WEIGHT PROPORTION RECRUITED

4	247.00	.020
5	299.00	.140
6	406.00	.470
7	524.00	1.000
8	685.00	1.340
9	861.00	1.600
10	965.00	1.000

NATURAL MORTALITY RATE IS .300

(b)

SUMMARY OF YIELD PER RECRUIT CALCULATED FROM
PARTIAL RECRUITMENT AND AVERAGE WEIGHT AT AGE
OVER AGES 4 TO 10

F	Y/R(KG)
.001	.0009
.050	.0417
.100	.0740
.150	.0989
.200	.1183
.250	.1333
.300	.1451
.350	.1543
.400	.1615
.450	.1672
.500	.1718
.550	.1754
.600	.1783
.650	.1807
.700	.1826
.750	.1842
.800	.1856
.850	.1867
.900	.1876
.950	.1884
1.000	.1892
1.050	.1898
1.100	.1903
1.150	.1908
1.200	.1912
1.250	.1916
1.300	.1920
1.350	.1923
1.400	.1926
1.450	.1929
1.500	.1932
1.550	.1935
1.600	.1937
1.650	.1939
1.700	.1941
1.750	.1944
1.800	.1945
1.850	.1947
1.900	.1949
1.950	.1951
2.000	.1953

F0.1 IS .4490

Table 4 (a)

C A T C H M A T R I X

AGE/YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
4	573.	80.	141.	169.	1943.	3734.	1375.	955.	409.
5	6202.	2993.	2776.	7534.	10128.	21280.	19800.	11240.	2529.
6	12483.	15035.	19839.	30365.	22502.	23707.	18100.	20931.	7650.
7	9154.	12076.	20615.	22117.	19416.	17053.	11200.	12737.	5361.
8	1421.	3150.	4557.	5869.	10553.	4713.	2400.	2536.	953.
9	47.	326.	610.	2152.	4206.	862.	850.	372.	74.
10	1.	40.	68.	245.	1110.	300.	130.	23.	15.

AGE/YEAR	1977	1978	1979
4	1391.	691.	34.
5	3211.	3654.	1996.
6	6851.	10979.	11279.
7	7331.	11028.	18421.
8	4078.	3870.	6648.
9	1433.	310.	621.
10	289.	34.	18.

M E A N W E I G H T S

AGE/YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
4	247.000	247.000	247.000	247.000	247.000	247.000	247.000	247.000	247.000
5	299.000	299.000	299.000	299.000	299.000	299.000	299.000	299.000	299.000
6	406.000	406.000	406.000	406.000	406.000	406.000	406.000	406.000	406.000
7	524.000	524.000	524.000	524.000	524.000	524.000	524.000	524.000	524.000
8	685.000	685.000	685.000	685.000	685.000	685.000	685.000	685.000	685.000
9	861.000	861.000	861.000	861.000	861.000	861.000	861.000	861.000	861.000
10	965.000	965.000	965.000	965.000	965.000	965.000	965.000	965.000	965.000

AGE/YEAR	1977	1978	1979
4	214.000	349.000	178.000
5	304.000	315.000	278.000
6	409.000	430.000	378.000
7	512.000	557.000	504.000
8	648.000	740.000	668.000
9	809.000	987.000	787.000
10	905.000	1235.000	756.000

Table 5
FISHING MORTALITIES

AGE/YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
4	.004	.001	.001	.002	.019	.040	.021	.010	.003
5	.070	.031	.031	.107	.159	.333	.343	.267	.038
6	.316	.267	.332	.608	.594	.766	.599	.858	.329
7	.890	.657	.819	.672	1.244	1.663	1.291	1.442	.639
8	1.144	1.089	.641	.672	2.135	1.622	1.671	1.608	.407
9	.462	1.090	.733	.844	2.254	1.765	3.221	2.238	.178
10	1.144	1.090	.819	.878	2.254	1.765	3.221	2.238	.639

AGE/YEAR	1977	1978	1979
4	.012	.016	.009
5	.030	.045	.063
6	.154	.149	.212
7	.691	.444	.450
8	2.185	1.207	.603
9	3.251	1.703	.720
10	3.251	1.703	.450

(b) POPULATION NUMBERS

AGE/YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
4	152260.	142872.	116262.	107669.	118725.	110045.	76175.	106087.	171675.
5	106713.	112305.	105774.	86008.	79818.	86288.	78323.	55254.	77772.
6	52886.	73746.	80633.	75981.	57276.	50332.	45825.	41186.	31356.
7	17592.	28558.	41822.	42861.	30639.	23417.	17336.	18654.	12937.
8	2347.	5352.	10970.	13657.	13191.	6542.	3289.	3533.	3267.
9	145.	554.	1334.	4281.	5168.	1155.	957.	458.	524.
10	2.	68.	138.	475.	1364.	402.	146.	28.	36.

AGE/YEAR	1977	1978	1979
4	131447.	51797.	4391.
5	126829.	96185.	37780.
6	55447.	91206.	68125.
7	16722.	35224.	58187.
8	5059.	6208.	16742.
9	1611.	421.	1376.
10	325.	46.	57.

Table 6

POPULATION BIOMASS AGES 6 TO 10 $R_t = 0.40$

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
BIOMASS	32425.	49114.	63448.	66807.	54110.	38570.	30910.	29350.	22371.
YEAR	1977	1978	1979						
BIOMASS	37732.	64586.	78223.						
TOTAL POPULATION NUMBERS AGES 6 TO 10									
YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL N	72972.	108278.	134898.	137255.	107638.	81850.	67560.	63887.	48453.
YEAR	1977	1978	1979						
TOTAL N	82267.	143297.	159716.						
POPULATION BIOMASS AGES 6 TO 10									
YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
BIOMASS	32425.	49114.	63448.	66807.	54110.	38569.	30908.	29338.	22234.
YEAR	1977	1978	1979						
BIOMASS	36441.	60147.	70857.						
TOTAL POPULATION NUMBERS AGES 6 TO 10									
YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL N	72972.	108278.	134898.	137255.	107638.	81848.	67554.	63860.	48121.
YEAR	1977	1978	1979						
TOTAL N	79165.	133105.	144487.						
POPULATION BIOMASS AGES 6 TO 10									
YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
BIOMASS	32425.	49114.	63448.	66807.	54110.	38569.	30906.	29329.	22124.
YEAR	1977	1978	1979						
BIOMASS	35413.	56608.	64978.						
TOTAL POPULATION NUMBERS AGES 6 TO 10									
YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976
TOTAL N	72972.	108278.	134898.	137255.	107637.	81847.	67550.	63837.	47856.
YEAR	1977	1978	1979						
TOTAL N	76695.	124980.	132330.						

Table 7

CATCH PROJECTION FOR 1980 USING POPULATION ESTIMATES FROM COHORT WITH TERMINAL F OF .450

AGE	POPULATION NUMBERS (000S)	POPULATION WEIGHT (MT)	FISHING MORTALITY	CATCH NUMBERS (000S)	CATCH WEIGHT (MT)	RESIDUAL NUMBERS (000S)	RESIDUAL WEIGHT (MT)
4	120000.	29640.	.007	754.	186.	88252.	21798.
5	98203.	26373.	.051	3801.	1137.	62087.	18564.
6	26492.	10756.	.172	3624.	1471.	16532.	6712.
7	41971.	21993.	.365	11190.	5864.	21584.	11310.
8	29118.	19946.	.489	9850.	6747.	13227.	9060.
9	7332.	6313.	.584	2843.	2448.	3029.	2608.
10	573.	553.	.365	153.	147.	295.	284.
TOTAL	313690.	115573.		32215.	18000.	205005.	70337.

CATCH PROJECTION FOR 1981 USING POPULATION ESTIMATES FROM COHORT WITH TERMINAL F OF .450

AGE	POPULATION NUMBERS (000S)	POPULATION WEIGHT (MT)	FISHING MORTALITY	CATCH NUMBERS (000S)	CATCH WEIGHT (MT)	RESIDUAL NUMBERS (000S)	RESIDUAL WEIGHT (MT)
4	120000.	29640.	.009	929.	229.	88102.	21761.
5	98252.	26387.	.063	4663.	1394.	61387.	18355.
6	62087.	25207.	.211	10279.	4173.	37227.	15114.
7	16532.	8663.	.450	5234.	2742.	7809.	4092.
8	21584.	14785.	.603	8571.	5871.	8749.	5993.
9	13227.	11388.	.720	5970.	5140.	4769.	4107.
10	3323.	3207.	.450	1052.	1015.	1570.	1515.
TOTAL	325005.	119278.		36697.	20566.	209613.	70937.

Table 8. Grand Bank yellowtail average no/set from research vessels.
Strata were primarily in Division 3N.

Ave.	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
4	18.0	40.3	2.5	17.8	10.9	5.1	2.3	6.3	4.4	
5	38.1	78.1	22.1	39.6	44.1	21.2	17.5	22.2	8.4	
6	62.1	80.9	38.3	72.2	49.2	38.5	32.8	38.8	25.2	
7	43.6	39.9	39.7	25.9	50.1	42.7	85.1	43.2	53.0	
8	7.9	15.8	16.6	2.7	13.4	9.1	44.4	24.4	18.2	
9	2.7	1.7	6.5	0.3	1.3	0.4	9.3	2.7	1.7	
10	0	0.1	0.2	0.2	0.2	0.1	0.1	0	0	

(b) Average catch and weight/set

No.	183.2	261.2	124.7	152.1	201.3	168.7	190.1	149.9	111.6	168.6
Wt(kg)	77.2	101.5	56.2	59.4	88.4	93.6	77.5	55.6	53.7	74.2

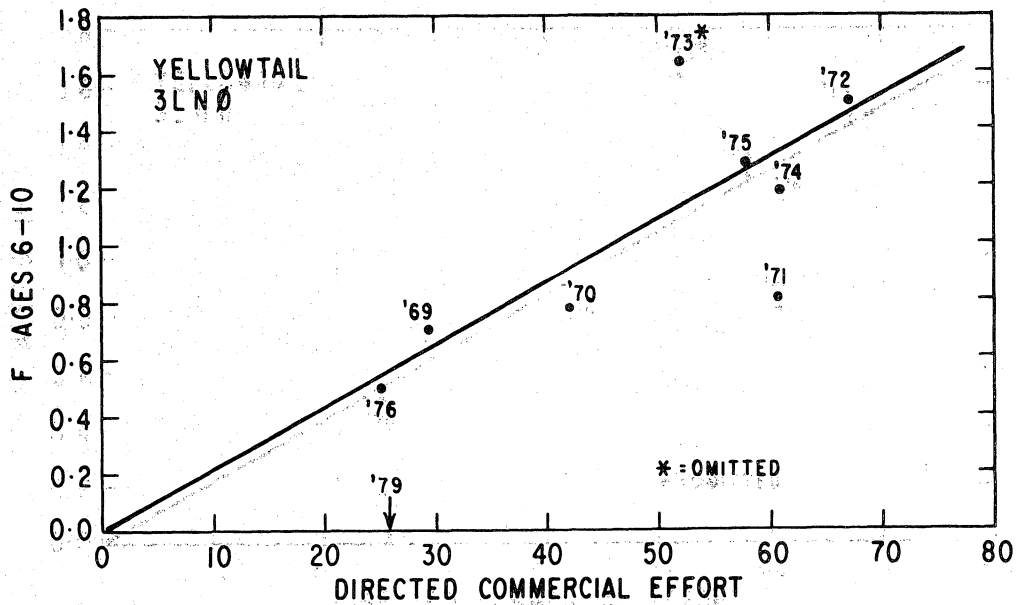


Fig. 1. Regression of fishing mortality calculated from population numbers on directed commercial effort.

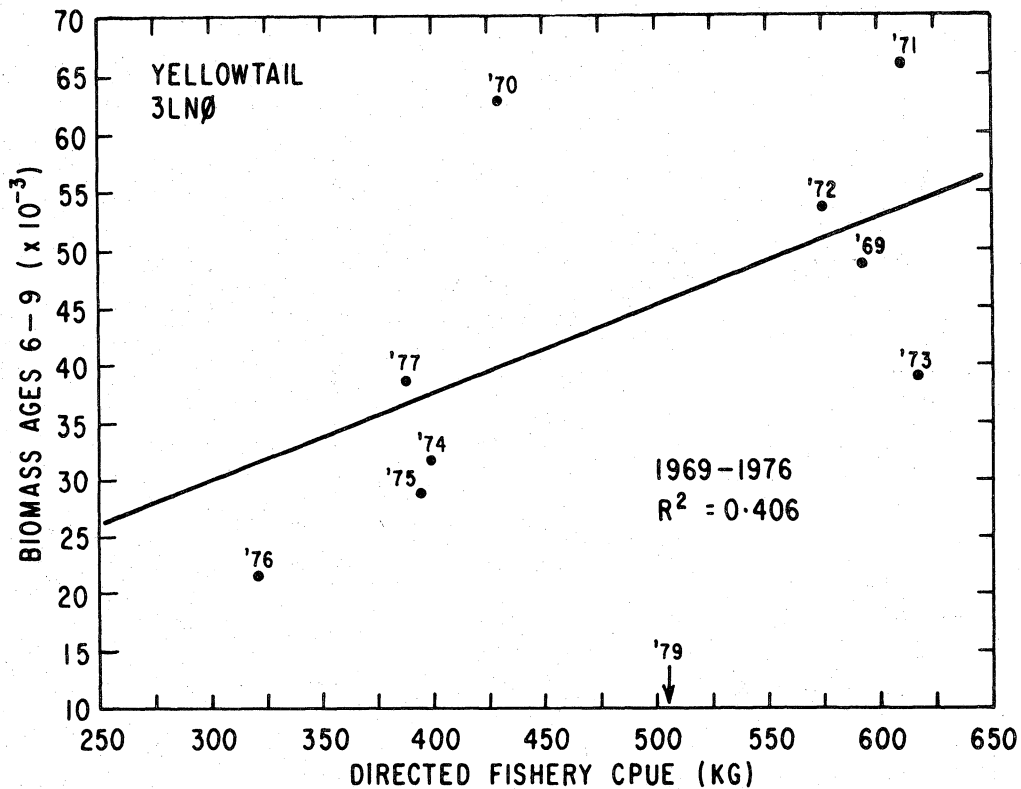


Fig. 2. Regression of biomass on CPUE.

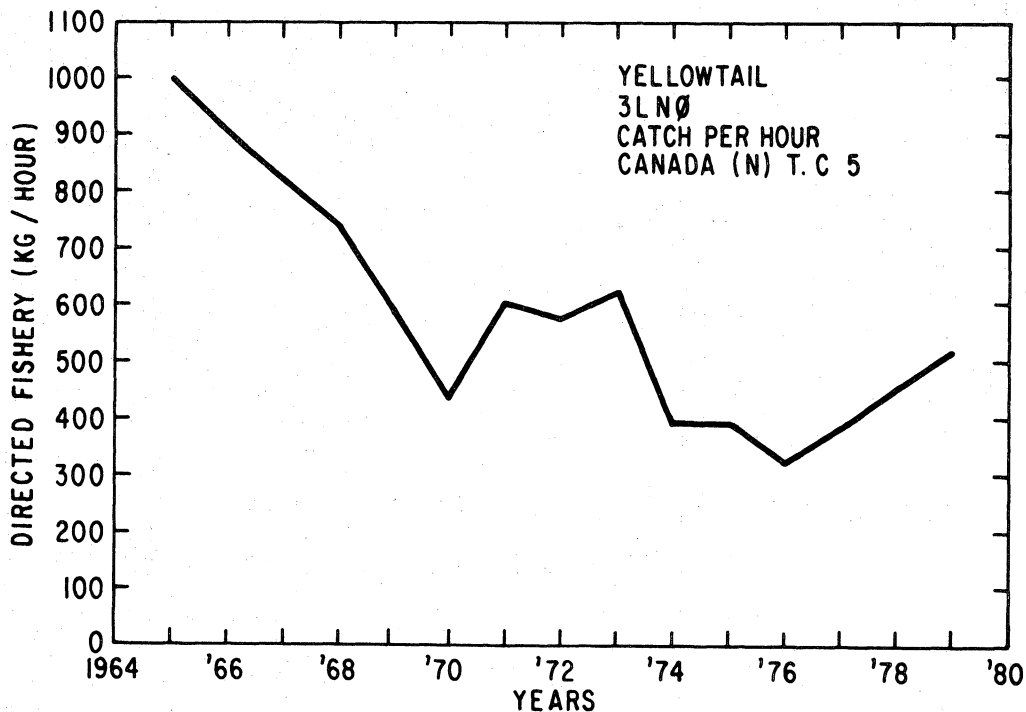


Fig. 3. Catch per unit effort for 3LNØ yellowtail 1965-79 the directed fishery (Can (N) OT5).

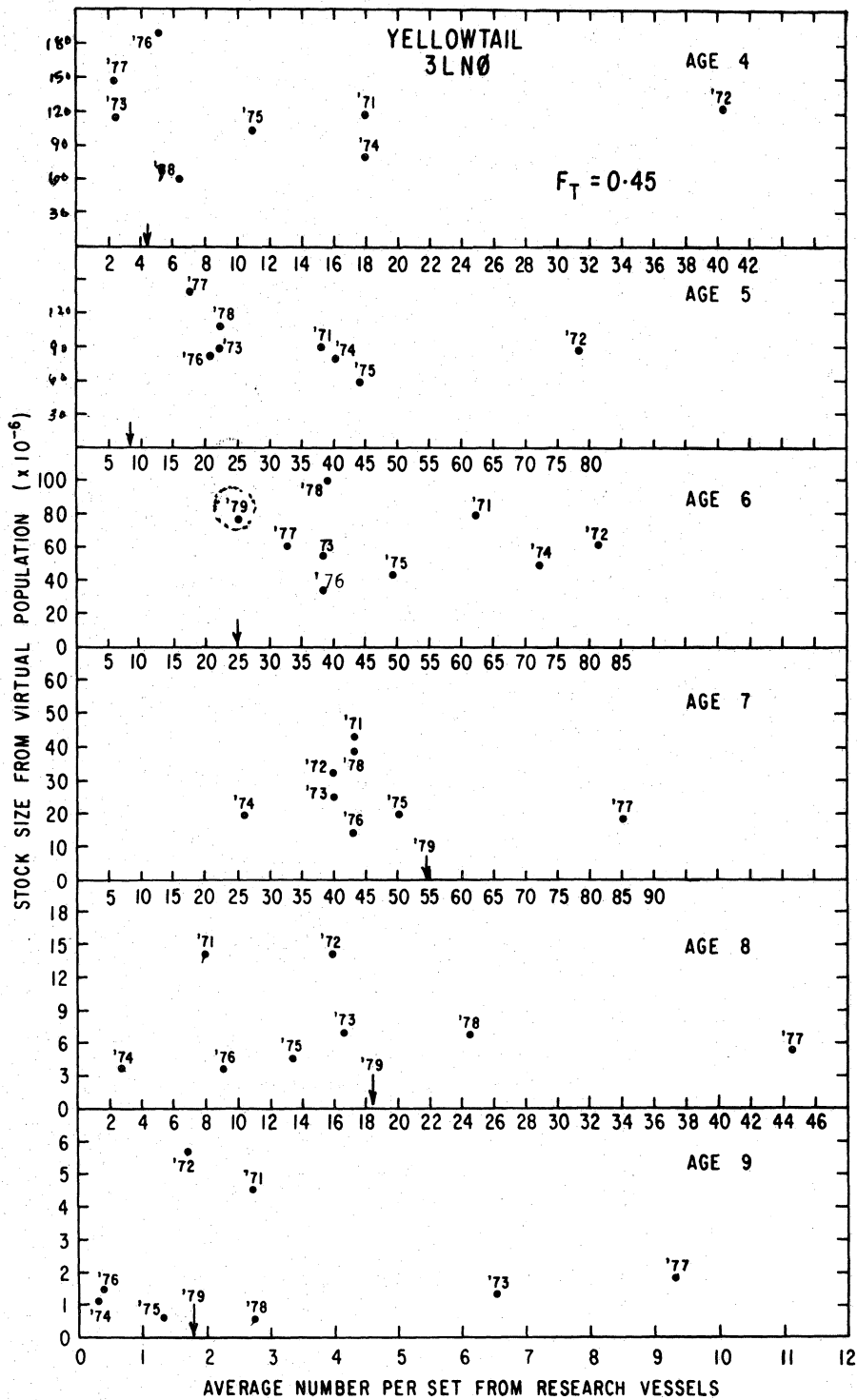


Fig. 4. Stock size (numbers) from virtual population plotted against average number per set from research vessel surveys for ages 4-9.