

Status of the 3Ps Cod Stock

by

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Evaluation of the stock was attempted using biomass estimates, catch and effort data and a cohort analysis. Biomass estimates were obtained from data obtained during stratified-random research cruises (1972-77) and these were compared to Spanish pair trawler catch and effort data (T.C. 151-500) for the period 1972-75. Data for the period indicated some inconsistencies (Table 1) in that all the strata were not fished during each year. Several methods were used (methods 1-3, Tables 1-4, Fig. 1) to provide estimates for the strata with missing data. Another method (4) adjusted all strata to a standard (Table 1, Fig. 1). Details of the methods used are described in ICNAF Res. Doc. 77/VI/17.

Catch and catch-per-unit-effort data were also evaluated for the years 1960-75 (Table 5, Fig. 2). Total catch all countries was compared with Spanish pair trawler CPUE (T.C. 151-500).

Discussion

Biomass estimates indicate somewhat of a decline from 1972 to 1975. However, when compared to Spanish pair trawl, which also showed a decline, 'r' values from a regression had values of: method 1 - .35, method 2 - .40, method 3 - .36, and method 4 - .63. Biomass estimates increased in 1976 and dropped drastically in 1977. The reasons for this decline are unknown but could possibly be related to availability rather than stock reduction.

Catch and CPUE show a decline from high levels in the late 1960s but now show some levelling off (Fig. 2).

Cohort Analysis

Numbers at age data for 1976 were obtained from frequencies and age-length keys supplied by Canada (N). They were as follows.

<u>Gear</u>	<u>Length Frequencies</u>	<u>Age-Length Key</u>
Trap	June, July	
GN	June, July	
LT	Sept.	
OT	June, Aug., Nov.	

Age compositions for inshore gears were assigned on the basis of Canada (N) samples. All catches from other countries (Table 6) were adjusted using the total for Canada (N) - OT. The total numbers at age for the year was combined with similar data for years back to 1962. This data was used in a cohort analysis. Other input data are: $M = 0.2$, partial recruitment as per Table 8, average weights as per Table 7. Table 8 shows a run at a terminal F value of .55.

Table 1. Biomass estimates (numbers in thousands) from stratified random cruises--Subdivision 3Ps. Also data obtained using method 4.

ICNAF	Strata	1972	1973	1974	1975	1976	1977	Conversion Factors Method 4.	
3Ps	306			156	309	110	12	.383	
	307	1668	2703	2609	423	756	146	2.374	
	308		30	122	65	34	79	.846	
	309	1511	314	187	152	89	17	.404	
	310	744	144	192	2038		1	1.063	
	311	2325	843	2847	433	670	20	1.000	
	312	347		225	221	257	117	1.394	
	313	275	127	89	215	54	21	.321	
	314			1170		1060	4	.548	
	315	192		62		745	82	1.063	
	316	213	1868	76	43	103	6	.481	
	317	257	364	742	127	974	54	.875	
	318	58	17	5		0	3	.039	
	319	1766	866	1182	638	4136	240	3.641	
	323	430					78	4	.167
	705				55		0	13	.223
707				3		0	98	1.634	
Ave. Values Method 4		1176	1089	971	606	1268	105		

Table 2. Biomass estimates obtained from method 1.

ICNAF	Strata	1972	1973	1974	1975	1976	1977	Conversion Factor
	Total of strata with consecutive data	8015	7085	7732	2031	6782	504	
3Ps	306	273	241	156	309	110	12	.034
	307	1668	2703	2609	423	756	146	
	308	112	30	122	65	34	79	.014
	309	1511	314	187	152	89	17	
	310	744	144	192	2038	834	1	.123
	311	2325	843	2847	433	670	20	
	312	347	333	225	221	257	117	.047
	313	275	127	89	215	54	21	
	314		687	1170	197	1060	4	.097
	315	192		62	73	745	82	.036
	316	213	1868	76	43	103	6	
	317	257	364	742	127	974	54	
	318	58	17	5	6		3	.003
	319	1766	866	1182	638	4136	240	
	323	430	241	263	69	78	4	.034
	705	32	28	55	8		13	.004
	707	56	50	3	14		98	.007
	Average	603	521	587	296	582	54	
	SP (PT)							
	CPUE							
	151-500 T	.913	.691	.434	.541			

Table 3. Biomass estimates obtained using method 2.

ICNAF	Strata	Stratum Area	1972	1973	1974	1975	1976	1977
3Ps	306	419	732	809	156	309	110	12
	307	395	1668	2703	2609	423	756	146
	308	112	196	30	122	65	34	79
	309	296	1511	314	187	152	89	17
	310	170	744	144	192	2038	247	1
	311	317	2325	843	2847	433	670	20
	312	272	347	525	225	221	257	117
	313	165	275	127	89	215	54	21
	314	974	0	1880	1170	1293	1060	4
	315	827	192	0	62	1098	745	82
	316	189	213	1868	76	43	103	6
	317	193	257	364	742	127	974	54
	318	123	58	17	5	163		3
	319	984	1766	866	1182	638	4136	240
	323	696	430	1343	1182	924	78	4
	705	195	341	376	55	259		13
	707	93	162	179	3	124		98
Average			660	729	641	501	548	54

Table 4. Biomass estimates obtained using method 3.

ICNAF	Strata	1972	1973	1974	1975	1976	1977
3Ps	307	1668	2703	2609	423	556	146
	309	1511	314	187	152	89	17
	311	2325	843	2847	433	670	20
	313	275	127	89	215	54	21
	316	213	1868	76	43	103	6
	317	257	364	742	127	974	54
	319	1766	866	1182	638	4136	240
Average		1145	1012	1106	290	940	72

Table 5. Total catch (all countries) and catch-per-unit-effort Spain PT (151-500 T) data for Subdivision 3Ps, 1960-75.

<u>Year</u>	<u>SP PT CPUE 151-500 T</u>	<u>Total Catch</u>
1960	.978	77,775
1961	1.044	86,211
1962	.920	55,266
1963	.930	50,051
1964	1.042	53,956
1965	1.001	51,400
1966	1.307	65,749
1967	1.203	62,393
1968	1.451	77,217
1969	1.408	63,103
1970	1.186	76,161
1971	1.192	63,967
1972	.913	44,323
1973	.691	52,641
1974	.434	46,706
1975	.541	35,373

Table 6. Cod nominal catches - 3Ps, 1976.

Country	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
Can MQ	0	16	172	18	41	78	3	9	20	10	33	0	40
Can N	223	321	763	816	1514	8917	4503	2477	1806	868	938	588	2301
Den F	0	0	84	0	0	0	0	0	0	0	0	0	8
Fra	0	352	1449	43	162	185	0	193	124	28	1	0	253
Nor	0	0	0	0	0	0	0	111	237	401	215	78	104
Port	16	0	0	0	0	0	0	0	0	0	0	0	1
Spain	70	204	390	36	500	0	0	0	0	1462	6453	121	923
USSR	0	0	14	23	101	17	427	0	0	0	0	335	91
Total	309	893	2872	936	2318	8477	4903	2790	2187	2769	7640	1122	3724

Table 7.. Projection of 1978 cod catches - 3Ps.

Age	1975 Pop.	1975 Catch	1975 F	1976 Pop.	1976 Catch	1976 F	1977 Pop.	1977 F	1977 Catch	Ave. Wt.	F _{opt} = 0.2			F _{max} = 0.3				
											1978 Pop.	1978 F = .2	1978 Catch	1978 F = .3	1978 Catch			
3	9396	66	.008	(4453)*	411	.11	(4453)	.025	100	.280	(4453)	.010	40	.02	80			
4	4060	480	.14	7623	1214	.19	(3266)	.175	477	.690	3556	.07	217	.11	333			
5	1762	402	.29	2890	792	.36	5161	.325	1306	1.080	2245	.13	249	.20	370			
6	1025	556	.89	1079	288	.35	1651	.315	406	1.680	3053	.13	339	.19	479			
7	782	565	1.50	345	130	.53	623	.500	224	2.400	986	.20	163	.30	233			
8	157	102	1.21	143	50	.48	1166	.500	60	3.210	294	.20	49	.30	69			
9	108	83	1.74	16	14	2.00	72	.500	26	4.100	78	.20	13	.30	18			
10	28	20	1.47	5	5	1.50	2	.500	1	5.080	34	.20	6	.30	8			
11	23	15	1.22	6	2	.45	2	.500	1	6.030	1	.20		.30				
12	25	6	.31	15	2	.16	3	.500	1	8.580	1	.20		.30				
											#	26,020			#	10,760	#	15,950
											Wt.	33,070			Wt.	16,290	Wt.	23,600

*From average of 3-year-olds over period 1969-74 at F₇₆ = 0.55

Table 8

COO 3P5 1962-76

NATURAL MORTALITY		0.20														
PARTIAL RECRUITMENT MULTIPLIER		0.0500 0.3500 0.6500 0.6300 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000														
ASSUMED FISHING MORTALITY FOR LAST AGES		0.4000 0.3000 0.5000 0.4800 0.8000 0.5100 0.4600 0.4800 0.4200 0.4700 0.3100 0.2900 0.3000 0.3000 0.5500														
ESTIMATED POPULATION																
AGE	YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3		4710.	4197.	7005.	8560.	8489.	10003.	7320.	5345.	3532.	5589.	3621.	3482.	5147.	9386.	16710.
4		4090.	3744.	3349.	5562.	6799.	6864.	7930.	5690.	4306.	2823.	4315.	2899.	2760.	4060.	7625.
5		3374.	2738.	2658.	2219.	3682.	4331.	4633.	5352.	4780.	2792.	1729.	3086.	1548.	1762.	2853.
6		1876.	1946.	1803.	1866.	1292.	1833.	2379.	2604.	3334.	2253.	1510.	1000.	1486.	1025.	1079.
7		1763.	1126.	1117.	842.	1037.	640.	922.	1418.	1482.	1847.	1187.	915.	457.	782.	336.
8		618.	925.	693.	648.	395.	386.	311.	432.	749.	637.	768.	556.	397.	157.	129.
9		219.	342.	484.	397.	344.	179.	193.	136.	194.	391.	239.	390.	256.	108.	36.
10		219.	168.	231.	225.	215.	116.	93.	108.	40.	93.	204.	120.	138.	28.	13.
11		73.	128.	62.	131.	91.	82.	66.	38.	23.	14.	27.	126.	53.	23.	5.
12		47.	42.	92.	20.	77.	27.	33.	34.	26.	3.	4.	4.	85.	25.	5.
KNOX CATCHES																
AGE	YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3		124.	96.	191.	231.	95.	287.	114.	77.	76.	288.	73.	100.	170.	66.	411.
4		675.	450.	578.	964.	1366.	1091.	1260.	710.	811.	644.	494.	470.	550.	480.	1214.
5		900.	709.	564.	580.	1306.	1290.	1314.	1158.	1292.	857.	459.	1150.	630.	402.	792.
6		453.	528.	518.	361.	462.	639.	585.	714.	976.	727.	355.	400.	460.	556.	256.
7		572.	253.	294.	325.	512.	235.	357.	455.	637.	822.	460.	390.	240.	565.	130.
8		137.	303.	180.	206.	159.	130.	131.	176.	246.	313.	264.	220.	240.	102.	50.
9		79.	90.	189.	122.	163.	60.	55.	79.	73.	128.	83.	200.	200.	83.	14.
10		57.	29.	65.	103.	104.	32.	42.	72.	21.	54.	56.	50.	100.	20.	5.
11		19.	14.	34.	33.	52.	38.	22.	6.	18.	8.	20.	20.	20.	15.	2.
12		14.	10.	33.	7.	39.	10.	11.	12.	8.	1.	1.	1.	20.	6.	2.
ESTIMATE FISHING MORTALITY																
AGE	YEAR	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3		0.0266	0.0256	0.0366	0.0303	0.0124	0.0322	0.0174	0.0160	0.0241	0.0586	0.0225	0.0323	0.0372	0.0078	0.0
4		0.2013	0.1425	0.2116	0.2126	0.2511	0.1932	0.1931	0.1430	0.2334	0.2905	0.1353	0.1975	0.2444	0.1400	0.0
5		0.3493	0.3371	0.2672	0.3408	0.4976	0.3493	0.3761	0.2733	0.4180	0.4144	0.3473	0.5308	0.4423	0.2905	0.0
6		0.3104	0.3561	0.4427	0.2738	0.5027	0.4867	0.3172	0.3635	0.3908	0.4410	0.3008	0.5834	0.4416	0.9152	0.0
7		0.4442	0.2864	0.3438	0.3565	0.7826	0.5206	0.5583	0.4379	0.6442	0.6770	0.5592	0.6365	0.8637	1.6006	0.0
8		0.2810	0.4462	0.3563	0.4325	0.5887	0.4933	0.6256	0.5922	0.4507	0.7827	0.4776	0.3757	1.1052	1.2672	0.0
9		0.5082	0.3015	0.5656	0.4144	0.8845	0.4612	0.3783	1.0226	0.5358	0.4493	0.4855	0.8359	1.9972	1.9187	0.0
10		0.3335	0.3523	0.3716	0.7056	0.7650	0.3619	0.6952	1.3290	0.8628	1.0229	0.2863	0.6159	1.6000	1.5043	0.0
11		0.3407	0.1293	0.9285	0.3273	0.9969	0.7191	0.4560	0.1926	1.6839	1.0144	1.6368	0.1936	0.5377	1.2881	0.0
12		0.4000	0.3000	0.5000	0.4800	0.8000	0.5100	0.4600	0.4800	0.4200	0.4700	0.3100	0.2900	0.3000	0.3000	0.5500
POPULATION WTS AND NOS																
WT	NO	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
WT		19999.	18909.	19058.	19264.	20687.	20124.	21676.	22139.	21401.	18976.	15927.	14973.	13115.	12377.	16384.
NO		16988.	15339.	17292.	20271.	22422.	24462.	23880.	21358.	17868.	16442.	13605.	12577.	12727.	17357.	28628.
POPULATION WTS AND NOS AGE 6 TO 12																
WT	NO	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
WT		12214.	12194.	11914.	10632.	9643.	7810.	9151.	10798.	12927.	12448.	10068.	8665.	7665.	5044.	3323.
NO		4814.	4659.	4279.	3929.	3452.	3264.	3997.	4771.	5850.	5238.	3940.	3111.	2871.	2148.	1604.

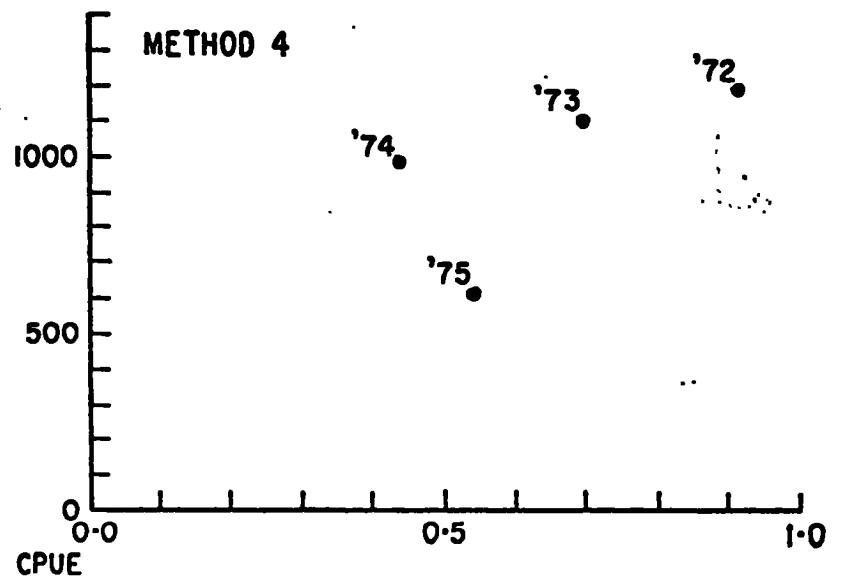
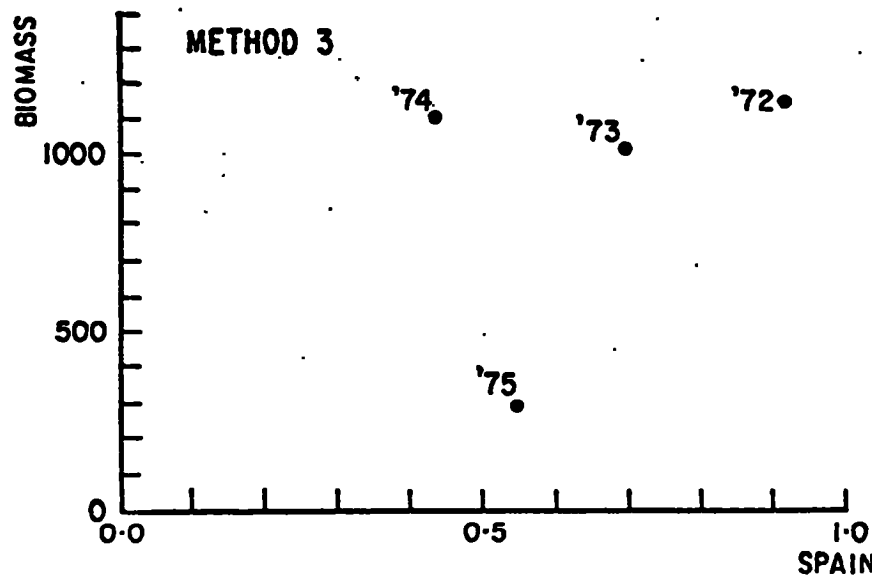
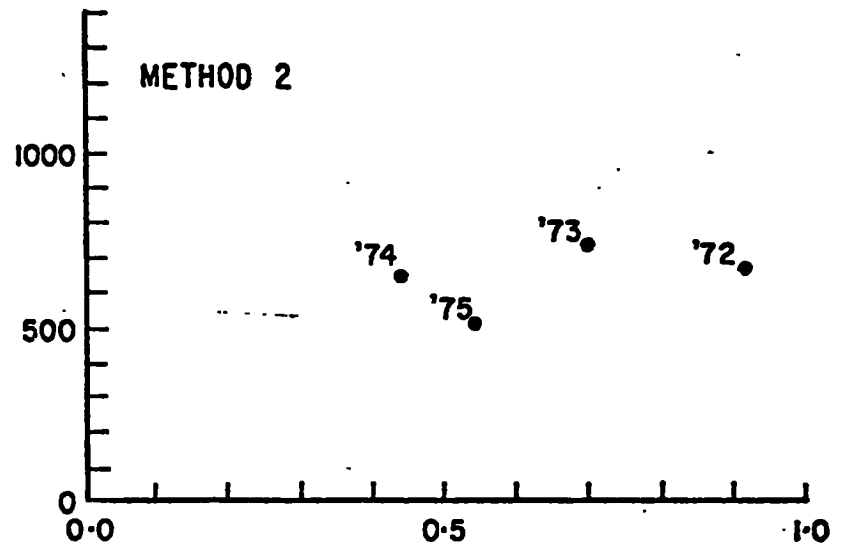
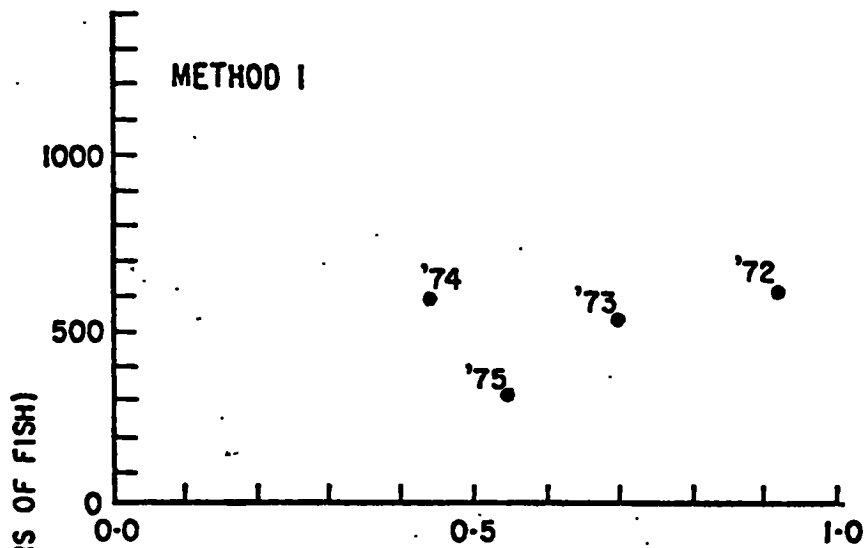


Fig. 1. Biomass estimates against Spain PT catch-per-unit-effort (CPUE) in metric tons/hr--1972 to 1975.

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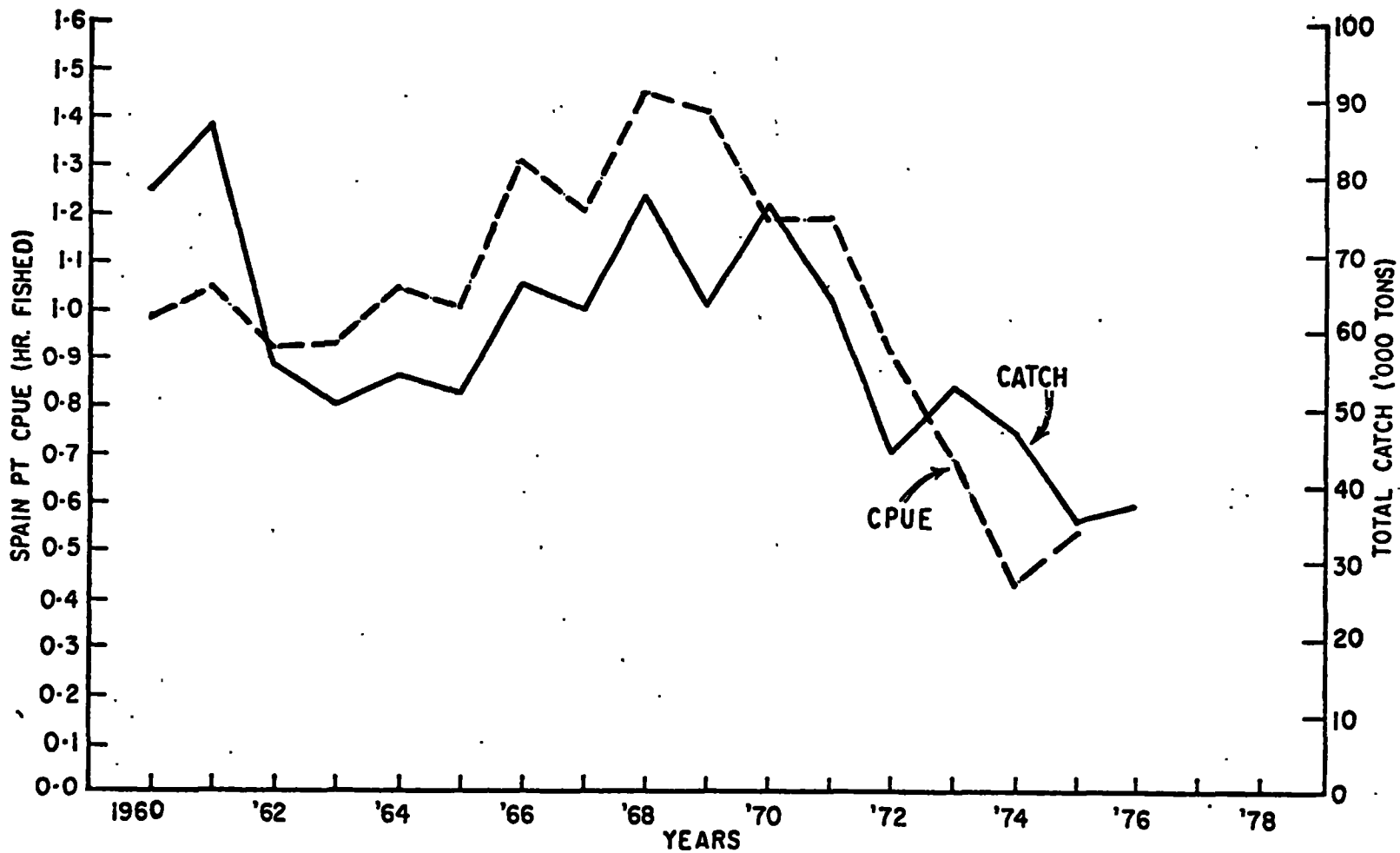


Fig. 2. Total catch (all countries) and total catch-per-unit-effort (CPUE) data for Subdivision 3Ps (1960-76).

3Ps COD

Further to the Resolution of the Stock Problem

R. Wells

and

T.K. Pitt

3Ps COD

Table 1

CATCH PROJECTION INITIAL YEAR 1976

AGE	WEIGHT	BEFORE CATCH		CATCH CALCULATED		CATCH INPUT		AFTER CATCH		
		NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	FISHING MORTALITY
3	.36	4500	1625	426	154	411	148	3301	1192	.110
4	.89	5327	5187	1214	1081	1214	1081	3678	3274	.260
5	1.39	2148	2993	796	1109	792	1103	1346	1457	.523
6	2.17	534	1266	233	624	233	624	221	433	.773
7	3.13	210	650	130	402	130	402	57	173	1.110
8	4.14	93	385	50	207	50	207	32	131	.333
9	5.29	21	111	14	74	14	74	5	26	1.270
10	6.35	12	79	5	33	5	33	5	33	.610
11	7.73	6	47	2	15	2	15	3	24	.450
12	11.07	6	66	2	22	2	22	3	35	.450

TOTAL BIOMASS BEFORE CATCH: 12408.3036

MATURE BIOMASS BEFORE CATCH: 2603.6973

WEIGHTED FISHING MORTALITY: 0.2734429287

AVERAGE FISHING MORTALITY: 0.643

RECRUITMENT TO INITIAL AGE: 4500

3Ps COD

Table 2

CATCH PROJECTION FOR 1977 QUOTA IS 3237.051741

AGE	WEIGHT	BEFORE CATCH		CATCH		AFTER CATCH		
		NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	FISHING MORTALITY
3	.36	4500	1625	140	50	3558	1285	.035
4	.89	3301	2938	523	465	2232	1986	.191
5	1.39	3678	5125	1107	1542	2018	2312	.400
6	2.17	1046	2266	322	698	567	1229	.412
7	3.13	221	685	89	276	101	314	.500
8	4.14	57	235	33	94	26	108	.500
9	5.29	32	157	13	67	14	77	.500
10	6.33	5	32	2	13	2	15	.500
11	7.73	5	42	2	17	2	19	.500
12	11.07	3	35	1	14	1	16	.500

TOTAL BIOMASS BEFORE CATCH: 13148.87325

NATURE BIOMASS BEFORE CATCH: 3460.816151

WEIGHTED FISHING MORTALITY: 0.2103447317

AVERAGE FISHING MORTALITY: 0.45182

3 Ps COD

Table 3

$F_{opt} = 0.2$

CATCH PROJECTION FOR 1978 QUOTA IS 1495.502628

AGE	WEIGHT	BEFORE CATCH		CATCH		AFTER CATCH		FISHING MORTALITY
		NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	
3	.36	4500	1625	49	18	3640	1315	.012
4	.89	3558	3167	206	184	2727	2427	.066
5	1.37	2232	3109	261	364	1592	2217	.138
6	2.17	2018	4374	243	526	1434	3107	.142
7	3.10	567	1756	93	289	330	1177	.200
8	4.14	101	420	17	69	68	282	.200
9	5.29	26	137	4	23	17	92	.200
10	6.55	14	95	2	15	10	64	.200
11	7.73	2	17	0	3	1	12	.200
12	11.07	2	27	0	4	2	18	.200

TOTAL BIOMASS BEFORE CATCH: 14723.28131

NATURE BIOMASS BEFORE CATCH: 6826.719577

WEIGHTED FISHING MORTALITY: 0.07700776104

AVERAGE FISHING MORTALITY: 0.1558

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3Ps COD

Table 3

$F_{max} = 0.3$

CATCH PROJECTION FOR 1978 QUOTA IS 2168.25538

AGE	WEIGHT	BEFORE CATCH		CATCH		AFTER CATCH		FISHING MORTALITY
		NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	
3	.36	4500	1625	73	26	3619	1307	.018
4	.39	3558	3167	304	271	2539	2349	.099
5	1.33	2232	3109	379	529	1485	2069	.207
6	2.17	2018	4374	352	763	1335	2394	.213
7	3.10	567	1756	134	414	344	1065	.300
8	4.14	101	420	24	99	62	255	.300
9	5.29	26	137	6	32	16	83	.300
10	6.55	14	95	3	22	9	53	.300
11	7.78	2	17	1	4	1	10	.300
12	11.07	2	27	1	6	1	16	.300

TOTAL BIOMASS BEFORE CATCH: 14728.28131

MATURE BIOMASS BEFORE CATCH: 6826.719577

WEIGHTED FISHING MORTALITY: 0.1141810505

AVERAGE FISHING MORTALITY: 0.2337

Table 1

CATCH PROJECTION INITIAL YEAR 1976

AGE	WEIGHT	BEFORE CATCH		CATCH CALCULATED		CATCH INPUT		AFTER CATCH		
		NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	FISHING MORTALITY
3	.36	4500	1620	407	147	411	148	3317	1194	.105
4	.89	9594	8539	1214	1081	1214	1080	6761	6017	.150
5	1.39	3265	4538	793	1102	792	1101	1961	2725	.310
6	2.17	860	1866	287	623	288	625	447	969	.455
7	3.10	288	893	130	402	130	403	120	371	.677
8	4.14	124	513	50	207	50	207	57	235	.580
9	5.29	27	143	14	74	14	74	10	51	.832
10	6.55	14	92	5	33	5	33	7	46	.495
11	7.78	7	54	2	16	2	16	4	31	.377
12	11.07	8	89	2	22	2	22	5	53	.320

TOTAL BIOMASS BEFORE CATCH: 18346.92

MATURE BIOMASS BEFORE CATCH: 3649.91

WEIGHTED FISHING MORTALITY: 0.1872404827

AVERAGE FISHING MORTALITY: 0.4301

RECRUITMENT TO INITIAL AGE: 4500

TOTAL CATCH (WEIGHT): 3708.77

Table 2

CATCH PROJECTION FOR 1977 QUOTA IS 3172.293515

AGE	WEIGHT	BEFORE CATCH		CATCH		AFTER CATCH		
		NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	FISHING MORTALITY
3	.36	4500	1620	73	26	3619	1303	.018
4	.89	3317	2952	284	253	2460	2189	.099
5	1.39	6761	9397	1150	1598	4500	6255	.207
6	2.17	1961	4255	342	742	1297	2815	.213
7	3.10	447	1385	105	327	271	840	.300
8	4.14	120	496	28	117	73	301	.300
9	5.29	57	301	13	71	34	182	.300
10	6.55	10	63	2	15	6	38	.300
11	7.78	7	54	2	13	4	33	.300
12	11.07	4	44	1	10	2	26	.300

TOTAL BIOMASS BEFORE CATCH: 20566.65608

MATURE BIOMASS BEFORE CATCH: 6596.9962

WEIGHTED FISHING MORTALITY: 0.1370156164

AVERAGE FISHING MORTALITY: 0.2337

RECRUITMENT TO INITIAL AGE: 4500

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Table 3

CATCH PROJECTION FOR 1978 QUOTA IS 2742.603491

AGE	WEIGHT	BEFORE CATCH		CATCH		AFTER CATCH		FISHING MORTALITY
		NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	
3	.36	4500	1620	49	18	3640	1311	.012
4	.89	3619	3221	210	187	2773	2468	.066
5	1.39	2460	3419	288	400	1754	2438	.138
6	2.17	4500	9766	541	1174	3197	6937	.142
7	3.10	1297	4022	214	663	870	2696	.200
8	4.14	271	1122	45	185	182	752	.200
9	5.29	73	384	12	63	49	258	.200
10	6.55	34	226	6	37	23	151	.200
11	7.78	6	45	1	7	4	30	.200
12	11.07	4	47	1	8	3	31	.200

TOTAL BIOMASS BEFORE CATCH: 23871.05092

MATURE BIOMASS BEFORE CATCH: 15611.41559

WEIGHTED FISHING MORTALITY: 0.0939407001

AVERAGE FISHING MORTALITY: 0.1558

RECRUITMENT TO INITIAL AGE: 4500

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Table 4

CATCH PROJECTION FOR 1978 QUOTA IS 3967.340303

AGE	WEIGHT	BEFORE CATCH		CATCH		AFTER CATCH		
		NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	FISHING MORTALITY
3	.36	4500	1620	73	26	3619	1303	.018
4	.89	3619	3221	310	276	2683	2389	.099
5	1.39	2460	3419	418	581	1637	2276	.207
6	2.17	4500	9766	785	1704	2978	6462	.213
7	3.10	1297	4022	306	949	787	2439	.300
8	4.14	271	1122	64	265	164	680	.300
9	5.29	73	384	17	91	44	233	.300
10	6.55	34	226	8	53	21	137	.300
11	7.78	6	45	1	11	4	28	.300
12	11.07	4	47	1	11	3	28	.300

TOTAL BIOMASS BEFORE CATCH: 23871.05092

MATURE BIOMASS BEFORE CATCH: 15611.41559

WEIGHTED FISHING MORTALITY: 0.1394088114

AVERAGE FISHING MORTALITY: 0.2337

RECRUITMENT TO INITIAL AGE: 4500

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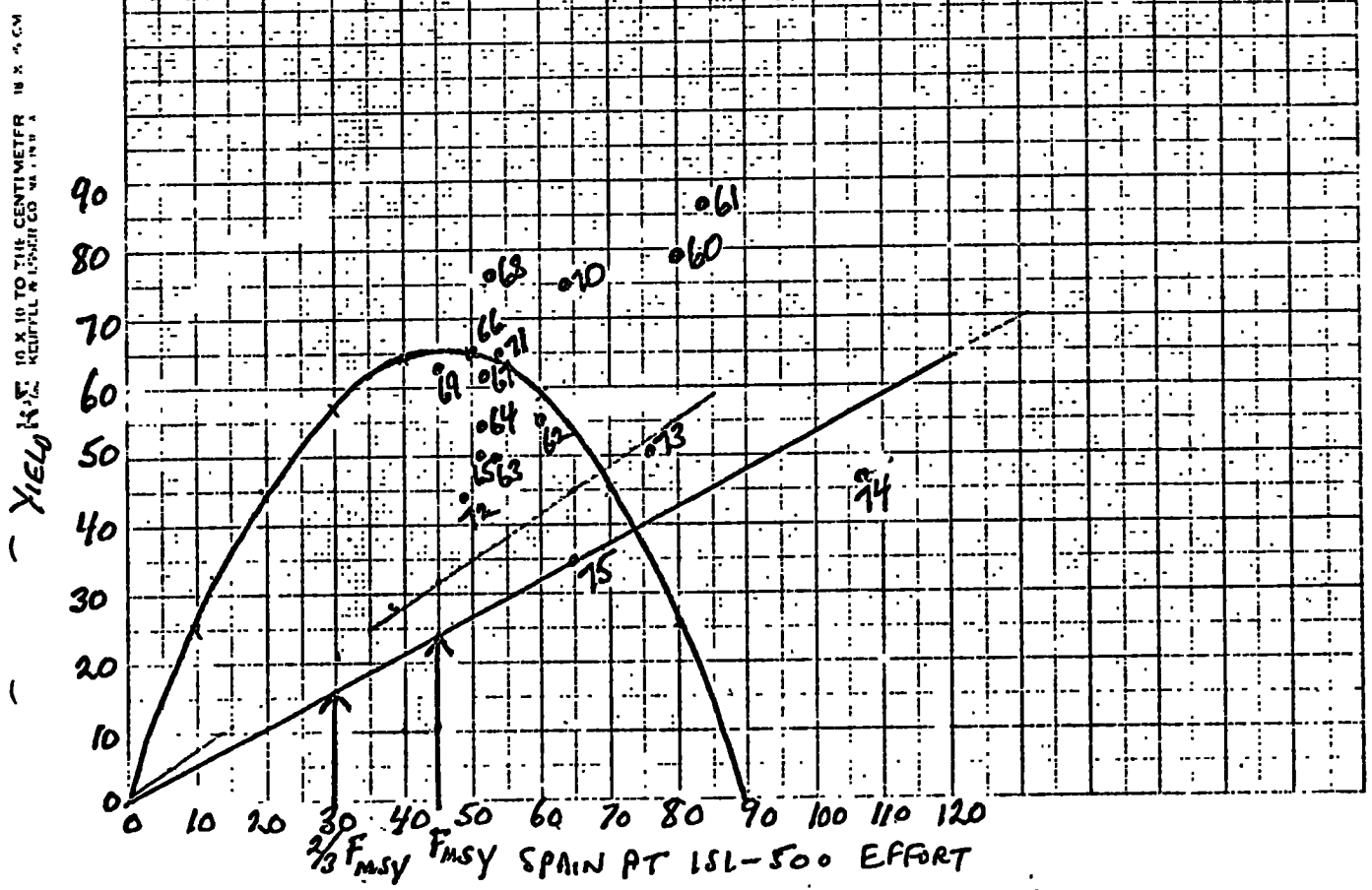
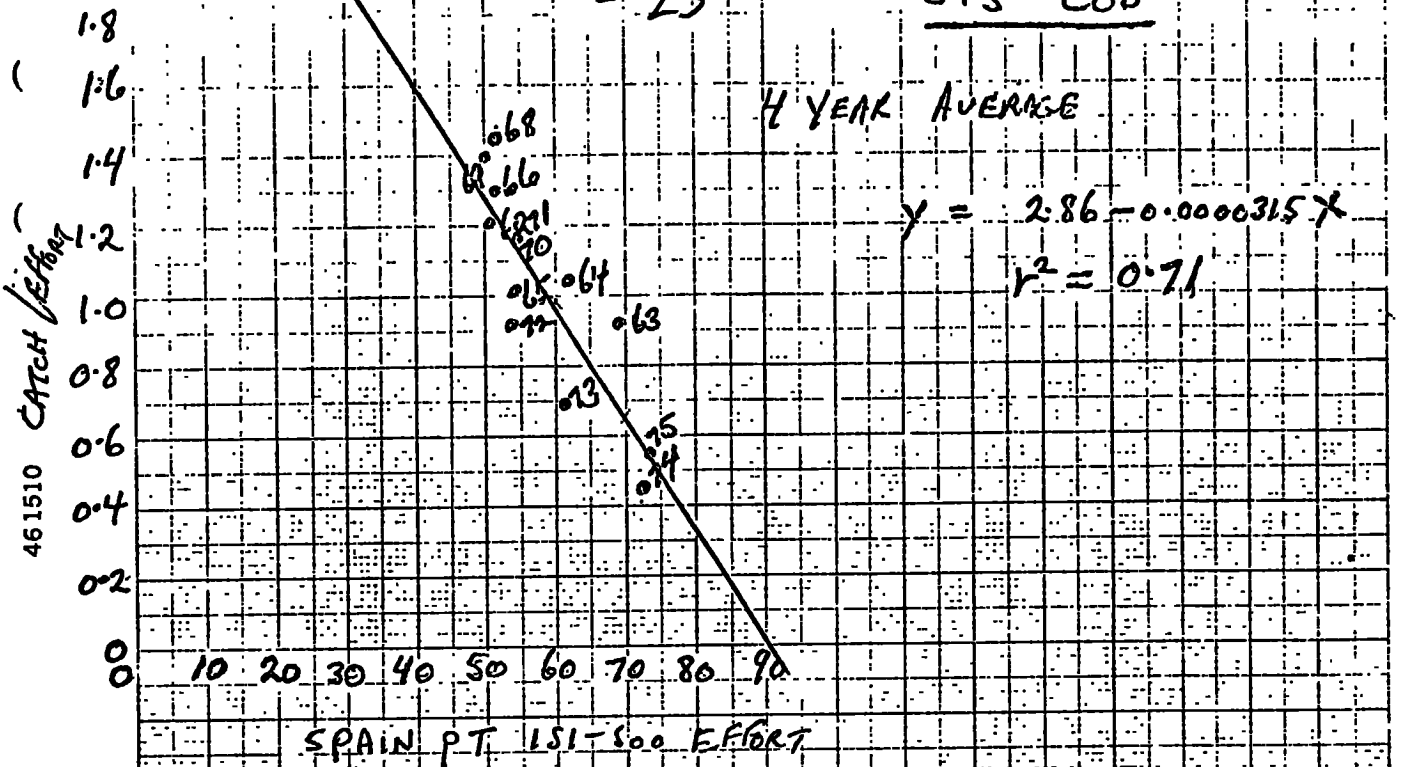
(A r n u u i l)

3Ps Cod

Paloheimo Z¹⁵

No. in Catch

Age	1972	1973	1974	1975
3	73	100	170	66
4	494	470	550	480
5	459	1150	630	402
6	355	400	480	556
7	460	390	240	565
8	264	220	240	102
9	83	200	200	83
10	46	50	100	20
11	20	20	20	15
Effort (sp pt units)	48500	76200	107600	65350
	C/E 73/72 (8-11/7-10)	74/73 (8-11/7-10)	75/74 (8-11/7-10)	
	= 64/176	52/113	34/72	
	S = 0.37	0.46	0.47	
	Z = 1.01	0.78	0.75	
	F = 0.81	0.58	0.55	
	Ave. Z = 0.85			
	F = 0.65			



10 X 10 TO THE CENTIMETER 18 X 4 CM KEIPILL & LINDNER CO. W. VA. U.S.A.