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Assessment Data for the Cod Stock in NAFO Subdivision 3Ps

by

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Nominal catch and catch at age

Cod catches from Subdiv. 3Ps since 1979, along with corresponding TAC's, are as follows:

	1979	1980	1981	1982	1983	1984	1985	1986	1987
TAC ('000 t)	25	28	30	33	33	33	41	41	
Catch ('000 t)	33	38	39	34	38	37	51	57[a]	33[b]

[a]Provisional.

[b]Canada only.

Annual catches by country since 1959 (Table 1, Fig. 1) have ranged from a high of 84,000 t in 1961 to a low of 27,000 t in 1978 and have shown an increasing trend since 1984. Canadian catches for 1987 (Table 2) were obtained from the Statistics and Systems Branch of the Department of Fisheries and Oceans, Canada. Inshore catches, which make up the largest proportion of Canadian landings, have been relatively stable since 1983 with a slight increase in 1987. Line trawl catches were highest in 1980 and 1981 but have declined and been somewhat stable in recent years (Fig. 2). Catches by both the gillnet and cod trap components have shown increasing trends since 1981.

Sampling data (Table 3) used to obtain catch at age for the Canadian commercial catch in 1987 were obtained by the Canadian Port Sampling Section of the Department of Fisheries and Canada. Age frequencies for the major gear components in the Canadian fishery in 1987, along with estimated total catch at age, with associated variances, are shown in Tables 4 and 5. Average weights were obtained by applying a length-weight relationship (log wt. = 3.0879 log length -5.2106) to the length frequencies and age length keys. The 1981 and 1982 year-classes were most abundant in the 1987 catch.

Survey data

Biomass estimates from stratified-random research vessel surveys conducted by Canada (Tables 6-7) indicated little change from 1985 to 1986 but suggest an increase from 1986 to 1988. Abundance estimates increased from 1986 to 1987 but declined in 1988. Estimates of abundance for non-sampled strata were obtained after inclusion of the 1988 survey using a method previously described (Bishop et al. 1984) with the exception of the weighting factors. The previous weighting factor used was the inverse of the ln variance for each sampled stratum mean. The current analysis weights each stratum mean by its stratum area in square nautical miles.

Estimates of mean number per tow at age (Table 8) were adjusted for missing strata as well as for seasonality (Table 9). The latter adjustment had been conducted previously to account for the variation in timing (February-June) of Canadian surveys. Surveys were seasonally adjusted to correspond to February-March using monthly regression coefficients derived from the commercial catch rate standardization procedure (Table 15). The 1981 and 1982 year-classes were most abundant in the 1988 survey.

Bottom water temperatures in the survey area (Table 10) were warmer in 1988 than in the three previous years for depths to 100 fath. Temperatures at depths greater than 100 fath were similar to those observed in 1987.

Commercial catch-effort data

Catch rates for Canada, France (STPM), Spain, and Portugal were standardized by country/gear/tonnage class and month using a multiplicative model. Data for 1959-85 were obtained from NAFO/ICNAF statistical bulletins with the exception of French (STPM) data for 1980, 1983-86, which were provided by the French (STPM) laboratory. Canadian data for 1986-87 were provided by the Department of Fisheries and Oceans, Canada. There were no data available for France for inclusion in this analysis prior to the June 1988 meeting. To reduce the possible effects of rounding and truncation errors, data with less than 10 t catch or 10 hours effort were excluded. The model explained about 45% of the variation in the data (Table 11) and all categories were significant. Strong seasonal trends are evident (Table 12), with catch rates being higher during winter months. Catch rates that declined from the late 1960's to the mid 1970s, increased to 1984 with a subsequent decline (Table 13, Fig. 3).

Since 1977 only Canada and France have participated in this fishery, so catch rates were re-analyzed using only these countries' data for that time period. The model explained about 46% of the variation (Table 14) for this analysis and again all categories were significant. The trends in catch rate (Table 15, Fig. 4) were similar to trends for the same time period for the 1959-87 analysis.

Catch rate information from the Canadian inshore fishery was available for the 1980-86 period for traps, gillnets, handlines, and linetrawls, and for two vessel categories; <35' and 35-64' in length (Table 16). Up to the time of the June 1988 meeting the 1987 data was not available. The information provided is in the form of purchase slips with each slip approximating one day's fishing. In general, for the smaller vessels, no trends were apparent in the catch rates for gillnet and handline while there may have been a slight decline in linetrawl, CPUE for traps increased after 1982 (Fig. 5). For larger vessels catch rates increased for trap and gillnet since 1981 and 1982 respectively and remained stable for handline and linetrawl (Fig. 6).

Yield-per-recruit

The most recent yield-per-recruit analysis for this stock (Bishop and Gavaris, 1981) estimated $F_{0.1}$ at 0.18 and F_{max} at 0.32 and yields per recruit of 0.77 kg and 0.82 respectively. In this analysis data (average weights) were used from a period (1946-54) prior to extensive commercial fishery, when it was thought that the stock might have been stable. Partial recruitment estimates were from an early assessment (1972). Prior to this analysis others had estimated $F_{0.1}$ and F_{max} at values ranging from 0.17 to 0.20 and 0.27 to 0.30 respectively. The values that had been in general use with regard to projections have been 0.20 for $F_{0.1}$ and 0.30 for F_{max}.

In the present analysis data from research and commercial catches only since 1977 were considered because the fishery pattern has been somewhat stable in terms of the country and gear categories involved.

Average weights from the commercial fishery and research vessel catches were similar except for ages 3 to 5 (Table 17) and consequently yield per recruit analyses were conducted using commercial data only. Partial recruitment estimates were averages from fishing mortality estimates in the most recent assessment of the stock. Natural mortality was assumed to be 0.20.

Catch information from commercial and research catches indicate that fish up to age 20 are not uncommon in catches. It has also been shown that for a related cod stock (Bishop, et. al., MS 1988) a long-term yield per recruit catch at $F_{0.1}$ = 0.18 should produce catches in significant quantities (5.6% by weight) at ages older than 15 years. The most recent assessment for this stock also showed that since 1959 fully recruited fishing mortality has always been greater than $F_{0.1}$ and has not been lower than F_{max}.

A yield per recruit analysis using present data (Table 18) up to age 20 estimated $F_{0.1}$ and F_{max} at 0.15 and 0.27 (Fig. 7) with corresponding yields of 0.91 and 0.98 kg respectively (Table 18). Using data for ages 3-15, $F_{0.1}$ and F_{max} values at 0.19 and 0.33 respectively were estimated. The corresponding yield per recruit values were .89 and .98 kg.

References

Bishop, C. A., S. Gavaris, and J. W. Baird. 1984. An assessment of the cod stock in Subdivision 3Ps. NAFO SCR Doc. 84/53. Ser. No. N840. 27 p.

Bishop, C. A., and S. Gavaris. 1981. Assessment of the Cod Stock in Subdivision 3Ps. CAFSAC Res. Doc. 81/39. 27 p.

Bishop, C.A., J. W. Baird, and R. Wells. MS 1988. Yield-per-recruit analyses for cod in Division 3NO. NAFO SCR Doc. 88/20, Serial No. N1456, 12 pp.

Table 1. Cod catches (MT) from Subdivision 3Ps, 1959-87.

Year	Can(N) Offshore	Can(N) Inshore	Can(M)	France STPM	France M	Spain	Portugal	Other	Total
1959	2,726	32,718	4,784	3,078	4,952	7,794	3,647	471	60,170
1960	1,780	40,059	5,095	3,634	2,460	17,223	262	2,123	72,636
1961	2,167	32,506	3,883	4,140	11,490	21,015	4,985	3,434	83,620
1962	1,176	29,888	1,474	2,241	4,138	10,289	1,873	1,560	52,639
1963	1,099	30,447	331	1,757	324	10,826	209	6,828	51,821
1964	2,161	23,897	370	2,097	2,777	15,216	169	9,880	56,567
1965	2,459	25,902	1,203	2,570	1,781	13,404	-	4,535	51,854
1966	5,473	23,785	583	3,207	4,607	23,678	519	4,355	66,207
1967	3,861	26,331	1,259	2,244	3,204	20,851	980	4,044	62,774
1968	6,536	22,938	585	1,880	1,126	26,868	8	18,613	77,556
1969	4,269	20,009	849	2,477	15	28,141	57	7,982	63,799
1970	4,650	23,410	2,166	1,970	35	35,750	143	8,734	76,858
1971	8,657	26,651	731	1,651	2,730	19,169	81	2,778	62,448
1972	3,323	19,276	252	1,436	-	18,550	109	1,267	44,213
1973	3,107	21,349	181	1,165	-	19,952	1,180	5,707	52,641
1974	3,770	15,999	657	948	5,366	14,937	1,246	3,789	46,712
1975	741	14,332	122	775	3,549	12,234	1,350	2,270	35,373
1976	2,013	20,978	317	904	1,501	9,236	177	2,007	37,133
1977	3,333	23,755	2,171	1,252	1,734				32,245
1978	2,082	19,560	700	1,974	2,860			45	27,221
1979	2,381	23,413	863	4,289	2,060				33,006
1980	2,809	29,427	715	1,936	2,681				37,568
1981	2,696	26,068	2,321	4,101	3,706				38,892
1982	2,639	21,351	2,948	4,780	2,184				33,902
1983	2,100	23,915	2,580	5,618	4,238				38,451
1984	895	22,865	1,969	7,550	3,671				36,950
1985	4,529	24,854	3,476	10,064	8,444				51,367
1986	4,981	24,208	2,120	14,042	11,939				57,290
1987	3,693	26,589							

Table 2. Cod landings (t) by Canada in 1987 from NAFO Subdivision 3Ps by month and gear.

MO.	Can (N) OT	Trap	GN	HL	LL	Can (M) OT	LL
J	1291	1	124	28	1299	182	
F	407		73	13	1482	53	6
M	294		197	9	1714	92	1
A	373	120	362	39	1090	3	55
M	274	826	711	111	448		30
J	37	3075	2594	289	452	3	19
J	25	900	2979	443	390	13	105
A	10	10	1055	322	684		268
S	53	3	386	252	802		184
O		6	163	97	935		193
N	173	1	168	36	805	135	30
D	756	1	470	11	613	1100	45
Total	3693	4943	9282	1650	10714	1581	936

Total = 32799

Table 3. Commercial cod sampling by Can (N) in NAFO Subdivision 3Ps in 1987.

Quarter	Gear	Number Aged	Month	Number Measured	Landings (t) Country/mo	Landings (t) Total
1	OT	493	Jan	2348	1291	1473
			Feb	619	294	387
						2326
2	OT	128	Apr	239	373	431
			May	278	274	304
						794
3 + 4	OT	78[a]	Nov	276	173	3090
1 - 4	OT	699		3760		6210
1	Longline	442	Jan	3356	1299	1299
			Feb	2205	1482	1482
		442	Total	5561		2781
2	Longline	1197	Mar	5426	1714	1714
	"		Apr	816	1090	1090
	"		May	434	448	448
	Codtrap	"	May	3512	826	947
	Gillnet	"	May	2600	711	1467
		1197		12788		5666
3	Longline	870	June	717	452	452
	"		Aug	1666	684	684
	"		Total			1526
	Codtrap	"	June	6416	3075	3075
	"		July	1902	900	900
			Total			3996
	Gillnet	"	June	3180	2594	2594
	"		July	1091	2979	2979
	"		Aug	512	1055	1055
	Handline	"	June	1105	289	289
	"		July	323	443	443
	"	"	Aug	468	322	322
	"		Jan-Aug			1254
		870		17380		13404
4	Linetrawl	793	Sept	1699	802	802
	"		Oct	3674	935	935
	"		Nov	3672	805	805
			Sept-Dec			3155
	Gillnet	"	Nov	1101	168	1187
	Handline	"	Sept	216	36	396
				10362		4738
Total		4001		49851		32799

[a]. 4th quarter inshore A/L key was used to convert OT length frequency to Nos. at age.

Table 4. Cod catch at age by gear from the canadian fishery in NAFO Subdivision 3Ps during 1987.

Age	Otter Trawl	Codtrap	Gillnet	Handline	Longline	Total
2					1	1
3	6	191	1	50	243	491
4	33	1331	18	262	580	2225
5	509	2153	683	587	2204	6137
6	721	620	1081	216	1702	4339
7	596	229	900	90	987	2803
8	172	27	202	15	182	598
9	170	19	239	11	190	630
10	60	4	91	4	37	195
11	24		35	1	16	77
12	18		35	1	16	70
13	13	1	61	1	18	94
14	6	1	36	1	6	50
15	1		16		4	21
16			5		1	6
17			2		1	3
18					1	1
19			1			1
20						
>20					1	1
#	2329	4576	3406	1239	6190	17,743
WT	6210	4943	9282	1650	10,714	32,799

Table 5. Estimated catch, average weight, and average length at age, along with associated variances for the Canadian commercial cod fishery in NAFO Subdivision 3Ps during 1987.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
2	0.300	32.871	1	0.59	0.42
3	0.540	39.466	491	37.56	0.08
4	0.734	43.671	2225	92.39	0.04
5	1.265	51.914	6137	131.39	0.02
6	1.822	58.588	4339	115.30	0.03
7	2.432	64.338	2803	87.75	0.03
8	3.336	70.920	598	38.44	0.06
9	4.063	75.384	630	36.77	0.06
10	5.263	82.161	195	18.28	0.09
11	6.605	88.592	77	8.38	0.11
12	7.300	91.300	70	8.00	0.12
13	7.439	91.345	94	9.56	0.10
14	8.344	94.301	50	7.70	0.16
15	10.150	101.297	21	3.71	0.18
16	12.558	107.173	6	2.45	0.39
17	13.472	112.746	3	1.22	0.37
18	20.291	129.044	1	0.52	0.52
19	17.025	120.303	1	0.55	0.51
20	15.387	118.000		0.45	1.08
21	22.857	133.263	1	0.11	0.13
22					
23	23.854	136.000		0.15	1.43
24	20.751	130.000		0.17	1.60

Table 6. Cod biomass (MT) from stratified random cruises in Subdivision 3Ps.

Depth Range(Fm.)	Strata	Area	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
0-30	314	974	0	-	1328	-	2357	249	0	-	432	369	2028	13103	567	25	0	0	24
	320	1320	-	729	-	-	1335	-	-	-	2946	23087	1920	5618	5456	5259	284	495	1729
TOTAL			0	729	1328	-	3692	249	0	-	3378	23456	3948	18721	6023	5284	284	495	1753
31-50	308	112	-	181	279	205	193	311	38	125	240	305	490	766	681	1024	0	3	4
	312	272	210	-	243	355	456	1047	343	151	-	165	766	524	674	1016	61	33	3
	315	827	1480	0	592		1747	1550	-	1836	235	0	528	2451	1894	329	2762	885	1247
	321	1189	1917	0	-	-	1742	-	2037	-	1880	1419	2845	2419	1183	89	335	223	1738
	325	944	-	-	-	-	2	-	180	820	28	1109	85	294	449	0	35	130	31
	326	166	-	-	-	-	-	-	0	2	3	0	54	326	0	-	0	16	28
TOTAL			3607	181	1114	540	4140	2908	2598	2934	2386	2998	4768	6780	4881	2458	3193	1290	3051
51-100	307	395	2918	6133	3919	884	1127	2097	3222	4105	1763	13723	3028	892	771	5189	12339	2688	13936
	311	317	3885	590	2432	763	627	411	154	1106	3792	761	1943	3256	863	4870	399	4331	593
	317	193	101	286	589	164	551	491	-	368	536	268	1582	3685	30	14064	2180	886	109
	319	984	4604	662	478	481	3102	2493	-	10637	1652	15068	3548	3799	3995	1282	10189	7784	12609
	322	1567	-	-	-	-	5183	-	491	14	2599	26	3705	4932	2597	1073	2004	1503	369
	323	696	736	-	-	-	368	63	1652	-	775	491	1215	858	2247	1263	2881	18047	143
	324	494	-	-	-	-	8	-	-	29	0	-	430	618	136	10756	230	187	125
TOTAL			12244	7671	7418	2292	10966	5555	5519	16259	11117	30337	15451	18040	10639	38497	30222	35426	27884
101-151	306	419	-	-	376	719	214	161	416	710	457	2652	1211	1250	236	590	755	11032	3589
	309	296	662	975	479	311	178	192	103	1558	863	2983	838	926	156	1611	3216	2539	2722
	310	170	1008	191	377	2183	-	0	154	119	0	817	608	134	134	268	332	198	417
	313	165	371	29	144	242	142	41	50	1036	127	446	283	74	130	250	0	279	69
	316	189	271	937	63	58	77	17	-	65	61	25	-	207	170	85	71	71	25
	318	123	173	11	4	0	0	6	-	36	790	-	136	11	0	-	81	782	106
TOTAL			2485	2143	1443	3513	611	417	723	3524	2298	6923	3076	2602	826	2804	4455	14901	6928
151-200	705	195	-	-	66	0	0	60	1	91	674	1310	22	27	0	542	611	121	501
	706	476	-	-	23	-	-	76	-	356	827	304	30	32	0	2068	447	8319	11314
	707	93	-	-	5	0	0	228	-	326	190	-	-	7	0	-	3124	1529	6667
	715	132	-	-	-	1	1	31	142	352	499	168	154	338	54	-	1523	810	4575
	716	539	-	-	-	-	-	92	781	303	248	1608	168	147	15	344	3464	1544	2379
TOTAL					94	1	1	487	924	1428	2438	3390	374	551	69	2954	9169	12323	15256
201-300	708	117	-	-	-	0	-	11	-	177	4633	-	-	0	0	-	327	8816	27852
	711	961	-	-	-	-	-	-	-	-	1113	0	0	7	87	109	6949	477	502
	712	973	-	-	-	-	-	-	-	9077	282	259	353	0	-	993	300	128	692
	713	950	-	-	-	0	-	-	-	-	0	850	0	36	-	87	271	1339	332
	714	1195	-	-	-	-	-	-	-	-	0	161	0	163	-	-	1857	258	700
TOTAL			-	-	-	0	-	11	-	9254	6028	1270	353	206	87	1189	9704	11018	30078

Total Area per Depth Range															
0-30	2294	-	3378	23456	3948	18721	6023	5284	284	495	1753
31-50	3510	2934	2386	2998	4768	6780	4881	2458	3193	1290	3051
51-100	4646	16259	11117	30337	15451	18040	10639	38497	30222	35426	27884
101-150	1362	3524	2298	6923	3076	2602	826	2804	4455	14901	6928
151-200	1435	1428	2438	3390	374	551	69	2954	9169	12323	15256
201-300	4196	9254	6028	1270	353	206	87	1189	9704	11018	30078
TOTAL		33399	27645	68374	27970	46900	22520	53184	57028	75453	84967
Confidence interval											
Upper		126620	51812	182436	35732	75157	30681	109276	85724	122746	447584
Lower		-59817	3481	-45684	20204	18640	14359	-2908	28332	28156	-277649

Table 7. Cod abundance (000's) from stratified-random cruises in Subdivision 3Ps. Numbers in brackets are estimates for non-sampled strata.

Depth range (fath)	Strata	Area	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
0-30	314	974	0	(113)	1,170	(111)	1,060	73	0	(469)	279	307	2,237	1,859	91	21	1	0	42
	320	1,320	(1083)	545	(1094)	(536)	867	(739)	(1159)	(1950)	528	10,354	1,362	1,589	1,870	476	99	129	180
31-50	308	112	(90)	29	122	65	34	166	21	74	59	46	235	238	395	563	0	13	13
	312	272	337	(151)	225	221	257	597	378	157	(393)	92	296	347	153	1,644	31	51	20
	315	827	186	0	62	(162)	745	1,273	(367)	621	171	0	145	489	410	177	787	147	103
	321	1,189	223	0	(327)	(146)	312	(212)	179	(606)	196	402	1,227	785	342	76	27	54	162
	325	944	(137)	(55)	(139)	(54)	35	(85)	567	850	35	213	76	111	63	0	27	47	24
	326	166	(40)	(3)	(12)	(3)	(19)	(7)	0	12	6	0	69	63	0	(14)	0	19	19
51-100	307	395	1,621	2,627	2,609	423	756	1,090	1,186	2,090	949	5,505	2,372	569	193	2,006	5,802	1433	4700
	311	317	2,261	820	2,847	433	670	119	309	1,124	3,105	690	1,888	1,348	381	3,692	127	2427	898
	317	193	275	354	742	127	974	196	(659)	309	1,391	623	913	2,062	14	1,427	420	420	101
	319	984	1,717	842	1,182	638	4,136	2,958	(4,383)	15,068	2,733	13,000	3,176	2,058	1,637	111	3,241	6968	6795
	322	1,567	(1,259)	(630)	(1272)	(623)	2,235	(859)	706	118	2,641	471	2,632	1,882	509	860	1,382	1082	206
	323	696	418	(340)	(682)	(336)	78	111	1,097	(1211)	261	78	392	383	901	871	2,069	3466	199
	324	494	(284)	(146)	(299)	(144)	37	(200)	(317)	93	0	(654)	352	593	321	10,476	178	111	185
101-150	306	419	(588)	(300)	145	309	110	65	115	440	204	2,810	692	763	47	267	577	6172	1329
	309	296	678	141	86	152	89	63	67	870	289	1,811	700	496	56	933	1,700	1067	1355
	310	170	264	51	70	2,038	(248)	0	183	121	0	651	434	72	57	102	179	115	315
	313	165	121	56	89	215	54	26	17	1,018	81	266	217	37	12	111	0	173	43
	316	189	60	528	76	43	103	14	(95)	85	35	21	(205)	128	78	38	14	38	24
	318	123	32	9	5	0	0	5	(35)	503	379	(75)	92	3	0	(36)	14	374	9
151-200	705	195	(80)	(38)	55	0	0	48	7	66	432	988	15	5	0	285	366	102	271
	706	476	(204)	(98)	5	(97)	(284)	46	(219)	202	518	250	9	7	0	697	241	5041	411
	707	93	(55)	(27)	3	0	0	171	(58)	91	122	(120)	(124)	2	0	(60)	565	565	1714
	715	132	(150)	(76)	(151)	10	30	20	149	221	248	84	45	106	25	(165)	817	367	2145
	716	539	(424)	(212)	(428)	(210)	(984)	20	587	334	223	1,123	81	91	13	170	3,004	1119	1432
Total		13,247	12,576	6,790	13,906	7,103	12,867	9,167	12,867	28,712	15,283	40,639	20,000	16,107	7,371	25,285	21,672	31,507	22,702
Estimated mean no. per tow			12.64	8.24	13.98	7.14	13.80	9.21	12.93	28.87	15.36	40.86	20.11	16.19	7.41	25.42	21.79	31.68	22.82

Table 8. Mean number of cod per tow from research trips in Subdivision 3Ps (depths to 200 fath).

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0.04	0.03	1.08	0.66	0.22	0.01	0.0	1.47	0.21	0.04	0.68	0.33	0.01	0.02	0.01	0.06	0.02
2	1.04	1.40	3.31	1.33	3.14	0.30	0.47	0.61	6.09	0.73	2.60	0.62	0.25	0.36	0.34	0.48	0.55
3	1.83	1.64	3.27	3.75	2.05	3.82	0.70	0.89	1.79	4.20	1.33	1.35	0.39	2.26	0.71	1.06	1.01
4	3.77	2.50	2.34	3.41	3.77	3.35	2.63	8.24	0.89	6.90	6.53	0.74	0.71	5.77	3.04	2.39	1.47
5	2.52	2.79	3.16	2.10	2.35	3.11	1.15	19.77	2.36	7.53	3.01	4.03	0.54	7.44	5.44	10.89	2.15
6	1.69	0.78	2.92	1.94	1.07	0.93	0.83	3.12	2.11	9.70	1.41	2.06	2.30	3.34	5.52	8.15	5.90
7	2.24	1.56	0.81	1.74	0.65	0.25	0.60	1.04	0.53	9.09	1.89	0.72	0.92	3.05	2.22	3.83	5.03
8	1.32	0.61	0.65	0.65	0.60	0.20	0.42	0.55	0.61	1.80	1.95	1.41	0.47	0.96	1.84	1.62	2.96
9	0.56	0.82	0.52	0.43	0.14	0.32	0.25	0.22	0.19	1.77	0.53	2.63	0.59	0.57	1.08	1.08	1.19
10	0.33	0.19	0.26	0.26	0.11	0.12	0.23	0.19	0.17	0.41	0.14	1.22	0.92	0.56	0.38	0.46	.78
11	0.14	0.05	0.08	0.09	0.08	0.02	0.08	0.04	0.13	0.07	0.10	0.59	0.22	0.58	0.32	0.34	.69
12	0.08	0.05	0.06	0.04	0.08	0.05	0.03	0.02	0.15	0.11	0.04	0.22	0.17	0.64	0.37	0.30	.36
13	0.05		0.04	0.05		0.05	0.03	0.02	0.06	0.11	0.02	0.09	0.07	0.27	0.20	0.30	.20
14	0.09	0.02	0.04			0.01		0.03		0.06	0.02	0.08	0.03	0.15	0.13	0.30	.19
15	0.05	0.01	0.01	0.02	0.03	0.01	0.03		0.03	0.02	0.04	0.06		0.04	0.09	0.12	.14
16	0.15	0.03	0.02	0.0					0.03	0.02	0.02	0.05	0.04	0.04	0.05	0.08	.13
17	0.11	0.05	0.01	0.02	0.01		0.02		0.02	0.01		0.01	0.0	0.06	0.03	0.07	.02
18	0.07	0.04	0.01			0.01						0.02	0.03	0.03		0.06	.01
19	0.01		0.01		0.04		0.02					0.02				0.03	.01
20	0.01			0.01		0.02				0.01		0.02			0.01	0.02	
20+	0.01	0.01	0.01				0.05					0.03	0.01	0.03		0.06	
NK		0.01									0.03						
Total	16.09	12.60	18.62	16.50	14.34	12.57	7.53	36.21	15.40	42.58	20.35	16.30	7.67	26.16	21.79	31.68	22.82
Confidence limits																	
Upper	25.10	21.58	24.37	23.38	21.20	17.40	11.01	319.07	20.45	115.88	26.63	22.08	10.88	172.68	35.87	49.99	31.86
Lower	7.09	3.62	12.87	9.61	7.48	7.74	4.06	-246.66	10.34	-30.71	14.07	10.52	4.46	-120.36	7.71	13.37	13.77
Sets	44	55	81	56	69	98	44	76	71	53	79	132	84	87	112	113	118
Survey dates	Mar. 20-30	Mar. 16-23	Apr. 19-30	June 2-13	May 11-21	Apr. 14-26	Feb. 21-28	Feb. 16- Mar. 5	Mar. 19- Apr. 2	Mar. 7-26	May 28- June 9	Apr. 22- May 8	Apr. 9-18	March 7-26	March 6-23	Feb. 13- March 22	Jan. 27 Feb. 14
Trip #	ATC 197	ATC 207	ATC 221	ATC 234	ATC 247	ATC 261	ATC 273	ATC 287	ATC 302	ATC 316	ATC 330	AN 9	AN 26	WT 26	WT 45	WT 55,56	WT 68

Table 9. Mean numbers of cod at age per tow from research vessel surveys in NAFO Subdivision 3Ps including factors used to adjust for missing strata and for seasonality.

2/ 6/88

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0.03	0.02	1.05	0.47	0.31	0.01	0.00	1.17	0.21	0.04	1.16	0.45	0.01	0.02	0.01	0.06	0.02
2	0.82	0.92	3.23	0.94	4.38	0.29	0.81	0.49	6.07	0.70	4.42	0.84	0.31	0.35	0.34	0.48	0.55
3	1.44	1.07	3.19	2.66	2.86	3.63	1.20	0.71	1.79	4.03	2.26	1.84	0.49	2.20	0.71	1.06	1.01
4	2.96	1.63	2.28	2.42	5.26	3.19	4.52	6.57	0.89	6.62	11.11	1.01	0.89	5.61	3.04	2.39	1.47
5	1.98	1.82	3.08	1.49	3.28	2.96	1.97	15.76	2.35	7.23	5.12	5.48	0.68	7.23	5.44	10.89	2.15
6	1.33	0.51	2.85	1.38	1.49	0.88	1.43	2.49	2.10	9.31	2.40	2.80	2.88	3.25	5.52	8.15	5.90
7	1.76	1.02	0.79	1.23	0.91	0.24	1.03	0.83	0.53	8.72	3.21	0.98	1.15	2.96	2.22	3.83	5.03
8	1.04	0.40	0.63	0.46	0.84	0.19	0.72	0.44	0.61	1.73	3.32	1.92	0.59	0.93	1.84	1.62	2.96
9	0.44	0.54	0.51	0.30	0.20	0.30	0.43	0.18	0.19	1.70	0.90	3.58	0.74	0.55	1.08	1.08	1.19
10	0.26	0.12	0.25	0.18	0.15	0.11	0.39	0.15	0.17	0.39	0.24	1.66	1.15	0.54	0.38	0.46	0.78
11	0.11	0.03	0.08	0.06	0.11	0.02	0.14	0.03	0.13	0.07	0.17	0.80	0.28	0.56	0.32	0.34	0.69
12	0.06	0.03	0.06	0.03	0.11	0.05	0.05	0.02	0.15	0.11	0.07	0.30	0.21	0.62	0.37	0.30	0.36
13	0.04	0.00	0.04	0.04	0.00	0.05	0.05	0.02	0.06	0.11	0.03	0.12	0.09	0.26	0.20	0.30	0.20
14	0.07	0.01	0.04	0.00	0.00	0.01	0.00	0.02	0.00	0.06	0.03	0.11	0.04	0.15	0.13	0.30	0.19
15	0.04	0.01	0.01	0.01	0.04	0.01	0.05	0.00	0.03	0.02	0.07	0.08	0.00	0.04	0.09	0.12	0.14
16	0.12	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.03	0.07	0.05	0.04	0.05	0.08	0.13
17	0.09	0.03	0.01	0.01	0.01	0.00	0.03	0.00	0.02	0.01	0.00	0.01	0.00	0.06	0.03	0.07	0.02
18	0.05	0.03	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.03	0.00	0.06	0.01
19	0.01	0.00	0.01	0.00	0.06	0.00	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.03	0.01
20	0.01	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.01	0.02	0.00
21	0.01	0.01	0.01	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.04	0.01	0.03	0.00	0.06	0.00
1+	12.66	8.23	18.15	11.70	20.00	11.97	12.95	28.87	15.33	40.86	34.54	22.18	9.62	25.43	21.78	31.70	22.81
2+	12.62	8.21	17.10	11.23	19.69	11.96	12.95	27.70	15.12	40.82	33.39	21.73	9.61	25.41	21.77	31.64	22.79
3+	11.81	7.29	13.87	10.29	15.31	11.67	12.14	27.21	9.05	40.12	28.96	20.89	9.29	25.06	21.43	31.16	22.24
4+	10.37	6.22	10.68	7.63	12.45	8.04	10.94	26.50	7.26	36.09	26.70	19.05	8.80	22.86	20.72	30.10	21.23
5+	7.41	4.58	8.40	5.21	7.20	4.85	6.42	19.93	6.37	29.47	15.60	18.04	7.91	17.26	17.68	27.71	19.76
6+	5.43	2.76	5.32	3.72	3.92	1.89	4.45	4.17	4.02	22.24	10.48	12.56	7.24	10.03	12.24	16.82	17.61

Adjustment factors

Year	Missing Strata	Seasonality
1972	.786	1.00
73	.654	1.00
74	.975	.77
75	.709	.61
76	1.395	.69
77	.952	.77
78	1.717	1.00
79	.797	1.00
80	.997	1.00
81	.960	1.00
82	1.701	.61
83	1.361	.73
84	1.254	.77
85	.972	1.00
86	1.000	1.00
87	1.000	1.00
88	1.000	1.00

Table 10. Mean bottom temperature (°C) by stratum from research vessel surveys in NAFO Subdivision 3Ps over the period 1978–88.

Depth range	Strata	1978		1979		1980		1981		1982		1983		1984		1985		1986		1987		1988	
		Mean	Max.	Mean	Max.	Mean	Max.	Mean	Max.	Mean	Max.	Mean	Max.	Mean	Max.	Mean	Max.	Mean	Max.	Mean	Max.	Mean	Max.
0–30	314	0.20	0.50			-0.20	0.0	1.52	2.0	1.64	2.5	1.96	2.4	1.40	1.5	-1.23	-0.8	-0.79	-0.6	-0.52	-0.2	0.14	0.40
	320			-0.70	-0.50	-0.22	0.0	1.60	1.6	1.72	2.5	2.53	3.3	1.88	2.5	-1.09	-1.0	-0.74	0.7	-1.12	-1.0	0.20	0.70
	Total	0.20		-0.70		-0.21		1.55		1.68		2.34		1.72		-1.17		-0.76		-0.85		0.17	
31–50	308	1.75	2.0	1.65	1.9	0.00	0.1	1.00	1.0	0.40	0.4	0.73	1.0	2.40	2.5	-0.25	-0.2	-0.50	-0.3	0.85	1.4	1.45	1.7
	312	0.75	1.0	0.13	0.5	0.00	0.0	1.30	1.3	1.45	2.2	1.60	1.7	2.80	3.0	-0.85	-0.2	-0.80	-0.8	-0.45	0.1	1.23	1.7
	315			-0.80	-0.7	-0.60	-0.1	1.90	1.9	-0.67	-0.5	1.14	2.2	1.44	2.2	-1.37	-1.1	-0.80	-0.5	-1.07	-0.9	0.43	0.7
	321	0.53	0.8			-0.42	-0.2	1.50	1.7	0.35	1.6	0.83	2.0	0.52	0.8	-1.21	-0.6	-0.82	-0.7	-0.73	0.0	0.19	0.7
	325	0.55	1.4	-0.85	-0.8	-0.95	-0.8	2.05	2.8	-0.48	1.0	-0.12	0.7	0.14	0.9	-1.50	-1.4	-1.18	-0.9	-0.79	-0.4	-0.08	0.5
	326	-0.50	-0.5	-0.85	-0.8	-1.05	-0.9	-0.20	-0.1	0.90	-0.8	-0.97	-0.9	-1.00	-0.9			-1.45	-1.3	-0.90	-0.9	-0.35	-0.3
	Total	.61		0.08		-0.58		1.19		-0.06		0.59		0.88		1.15		-0.93		-0.73		0.37	
51–100	307	1.20	2.1	3.92	4.3	3.30	5.1	2.73	3.8	2.05	3.7	2.15	3.5	4.70	5.0	2.33	3.4	2.23	4.7	3.83	5.3	2.47	3.5
	311	1.32	1.7	1.48	2.3	1.60	1.6	4.35	5.7	0.07	0.2	1.50	2.5	1.20	1.7	-0.35	0.6	1.50	3.0	1.47	4.0	1.16	1.9
	317			-0.43	-0.4	-0.35	0.2	2.40	4.0	-0.30	0.1	1.97	2.5	5.80	8.3	-0.15	0.7	-0.55	-0.2	-0.40	0.3	0.40	0.5
	319			5.20	7.8	0.45	2.1	2.70	5.3	0.74	5.3	0.60	5.0	3.27	6.9	2.90	4.9	2.40	5.3	0.17	4.1	1.59	4.3
	322	0.60	1.7			-0.32	-0.1	-0.05	0.0	-0.46	0.8	-0.22	1.0	0.04	0.6	-1.32	-0.8	-0.42	1.3	-0.47	0.0	0.18	1.7
	323	0.27	0.4			-0.67	-0.5	0.00	0.1	-0.70	-0.7	-0.40	0.0	0.20	1.0	1.97	4.5	0.54	2.2	-0.65	0.0	-0.26	0.0
	324			-0.50	-0.5	-0.70	-0.7			-0.95	-0.9	-0.65	-0.3	-1.03	-0.6	-1.05	-0.7	-1.40	-1.2	-0.75	-0.6	-0.05	0.8
	Total	0.91		1.98		0.21		2.08		0.22		0.4		1.52		0.02		0.55		0.11		0.71	
101–150	306	2.90	6.6	6.06	6.8	6.05	6.3	6.15	6.8	5.30	5.7	4.60	5.1	5.95	6.1	7.15	7.3	7.10	7.7	6.25	6.4	6.02	6.40
	309	2.07	2.5	5.67	6.4	5.75	6.2	4.70	4.7	4.05	4.4	5.00	5.3	5.80	5.9	5.53	5.9	6.45	6.5	5.65	5.8	5.37	5.60
	310	3.83	4.9	5.27	6.8	6.20	6.4	6.50	6.7	4.70	5.0	5.47	5.6	6.10	6.8	7.27	7.5	7.50	7.6	6.40	7.0	5.67	6.00
	313	2.60	3.0	5.22	7.3	5.30	6.2	7.25	7.5	3.00	5.1	5.00	5.7	6.90	7.0	6.05	6.5	8.10	8.2	7.00	7.2	6.60	6.70
	316			6.60	7.0	6.70	6.8	7.95	8.2	5.40	5.4	5.15	5.3	5.60	7.5	4.80	7.4	8.15	8.3	5.03	6.4	6.93	7.10
	318			7.45	8.1	6.20	6.4			5.60	5.8	5.53	5.6	7.95	8.4			6.90	6.9	4.70	4.9	5.00	5.40
	Total	2.85		5.81		6.03		6.71		4.67		5.10		6.38		6.09		7.35		5.84		5.95	
151–200	705	5.90	6.3	6.52	7.5	5.35	5.5	6.40	7.3	4.60	4.7	5.33	5.5	5.15	5.2	7.30	7.5	6.75	6.8	6.30	6.5	5.65	5.8
	706			6.10	7.3	5.50	5.6	6.30	6.8	4.72	5.0	5.28	5.5	6.60	7.2	7.40	7.8	7.10	7.4	4.96	5.8	5.90	6.9
	707			7.40	7.8	6.05	6.1					5.17	5.3	6.20	6.2			5.20	5.4	4.60	4.6	3.70	3.7
	715	5.30	5.3	6.00	6.3	5.80	6.4	6.30	6.3	4.45	4.8	5.03	5.1	6.25	7.3	6.30	6.3	7.00	7.5	6.25	6.5	5.60	6.0
	716	4.20	5.9	6.35	6.4	6.00	6.3	6.05	6.3	5.10	5.5	5.32	5.4	6.20	6.3	7.26	7.9	6.65	7.0	6.13	6.4	5.88	6.0
	Total	5.13		6.41		5.74		6.21		4.72		5.24		6.08		7.23		6.64		5.54		5.66	
201–300	708			5.60	6.1	4.95	5.3					4.95	5.1	5.95	6.1			4.75	5.1	4.20	4.2	3.85	4.0
	711					4.95	5.0	5.40	5.5	4.70	4.7	4.81	5.0	5.12	5.3	6.12	6.7	5.77	6.3	4.99	5.3	4.53	5.1
	712			5.40	5.8	4.85	4.9	5.50	5.5	4.20	4.2	4.99	6.7			5.65	5.7	5.62	5.8	4.90	5.2	4.76	4.9
	713					5.00	5.0	5.80	6.2	4.30	4.4	4.76	5.0			5.38	5.4	5.66	5.8	5.12	5.3	4.82	5.1
	714			5.20	5.2	4.95	5.0	5.15	5.4	4.50	4.7	4.71	4.8			6.30	6.3	5.62	5.8	5.28	5.3	4.84	4.9
	Total			5.44		4.94		5.44		4.43		4.82		5.36		5.75		5.61		4.98		4.70	
0–30		0.20		-0.70		-0.21		1.55		1.68		2.34		1.72		-1.17		-0.76		-0.85		0.17	
31–50		0.61		0.08		-0.58		1.19		-0.06		0.59		0.88		-1.15		-0.93		-0.73		0.37	
51–100		0.91		1.98		0.21		2.08		0.22		0.40		1.52		0.02		0.55		0.11		0.71	
101–150		2.85		5.81		6.03		6.71		4.67		5.10		6.38		6.09		7.35		5.84		5.95	
151–200		5.13		6.41		5.74		6.21		4.72		5.24		6.08		7.23		6.64		5.54		5.66	
201–300				5.44		4.94		5.44		4.43		4.82		5.36		5.75		5.61		4.98		4.70	

Table 11. Analysis of variance from the regression of ln catch rate for cod in Subdivision 3Ps for the period 1959-87.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.672
MULTIPLE R SQUARED..... 0.451

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	1.793E1	1.793E1	
REGRESSION	48	1.854E2	3.861E0	13.567
TYPE 1	9	1.001E2	1.112E1	39.081
TYPE 2	11	3.711E1	3.374E0	11.854
TYPE 3	28	6.883E1	2.458E0	8.637
RESIDUALS	792	2.254E2	2.846E-1	
TOTAL	841	4.287E2		

Table 12. Regression coefficients from the regression of ln catch rate for cod in Subdivision 3Ps for the period 1959-87.

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	27124	INTERCEPT	-0.010	0.175	841
3	1				
4	59				
1	3124	1	-0.401	0.124	192
	3125	2	-0.267	0.122	127
	9125	3	0.206	0.123	74
	17126	4	0.538	0.164	32
	19126	5	0.148	0.138	103
	19164	6	0.492	0.131	170
	19165	7	0.841	0.154	42
	19166	8	0.485	0.220	13
	27125	9	0.227	0.134	52
3	2	10	-0.104	0.079	110
	3	11	-0.201	0.077	121
	4	12	-0.337	0.082	97
	5	13	-0.517	0.095	62
	6	14	-0.684	0.114	37
	7	15	-0.845	0.121	29
	8	16	-0.639	0.115	34
	9	17	-0.593	0.102	42
	10	18	-0.616	0.091	61
	11	19	-0.398	0.084	83
	12	20	-0.238	0.086	77
4	60	21	-0.157	0.147	24
	61	22	0.283	0.139	31
	62	23	0.053	0.145	28
	63	24	0.253	0.147	29
	64	25	0.149	0.146	28
	65	26	0.173	0.150	27
	66	27	0.288	0.141	32
	67	28	0.120	0.151	27
	68	29	0.321	0.144	32
	69	30	0.311	0.146	30
	70	31	0.150	0.143	30
	71	32	0.109	0.141	32
	72	33	-0.104	0.138	43
	73	34	-0.223	0.136	53
	74	35	-0.475	0.140	36
	75	36	-0.478	0.158	20
	76	37	-0.480	0.150	32
	77	38	-0.420	0.162	30
	78	39	-0.126	0.177	21
	79	40	-0.060	0.161	29
	80	41	-0.233	0.162	30
	81	42	0.042	0.168	23
	82	43	0.226	0.157	30
	83	44	0.448	0.159	29
	84	45	0.754	0.180	17
	85	46	0.815	0.158	27
	86	47	0.339	0.154	30
	87	48	0.399	0.177	20

Table 13. Standardized catch rate index for cod in Subdivision 3Ps for the period 1959-87.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1959	0.1960	0.0236	1.386	0.212	60170	43402
1960	0.0389	0.0229	1.185	0.178	72636	61283
1961	0.4792	0.0202	1.843	0.261	83620	45362
1962	0.2494	0.0219	1.464	0.215	52639	35965
1963	0.4490	0.0225	1.787	0.266	51821	29006
1964	0.3453	0.0221	1.611	0.238	56567	35118
1965	0.3693	0.0222	1.650	0.244	51854	31429
1966	0.4842	0.0194	1.853	0.257	66207	35724
1967	0.3159	0.0221	1.564	0.231	62774	40132
1968	0.5166	0.0190	1.915	0.263	77556	40504
1969	0.5068	0.0203	1.895	0.269	63799	33671
1970	0.3457	0.0201	1.613	0.227	76858	47647
1971	0.3048	0.0187	1.549	0.211	62448	40302
1972	0.0922	0.0184	1.253	0.169	44213	35288
1973	-0.0272	0.0176	1.112	0.147	52641	47326
1974	-0.2787	0.0188	0.864	0.118	46712	54038
1975	-0.2822	0.0248	0.859	0.135	35373	41185
1976	-0.2839	0.0216	0.859	0.126	37133	43241
1977	-0.2236	0.0221	0.912	0.135	32245	35360
1978	0.3221	0.0215	1.574	0.230	27221	17290
1979	0.1364	0.0168	1.311	0.169	33006	25183
1980	-0.0375	0.0190	1.100	0.151	37568	34147
1981	0.2378	0.0179	1.450	0.193	38892	26827
1982	0.4217	0.0168	1.743	0.225	33902	19447
1983	0.6440	0.0164	2.178	0.278	38451	17658
1984	0.9497	0.0203	2.951	0.418	36950	12523
1985	1.0114	0.0144	3.148	0.376	51367	16319
1986	0.5348	0.0133	1.956	0.225	57290	29296
1987	0.5953	0.0263	2.064	0.333	57290	27757

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.141

Table 14. Analysis of variance and regression coefficients from the regression of ln catch rate for cod in Subdivision 3Ps for the period 1977-87.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.676
MULTIPLE R SQUARED..... 0.457

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	4.228E0	4.228E0	
REGRESSION	25	8.411E1	3.365E0	8.765
TYPE 1	4	1.868E1	4.670E0	12.166
TYPE 2	11	2.177E1	1.979E0	5.155
TYPE 3	10	3.657E1	3.657E0	9.528
RESIDUALS	260	9.980E1	3.839E-1	
TOTAL	286	1.881E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	27124	INTERCEPT	-0.148	0.199	286
3	1				
4	77				
1	3124	1	-0.477	0.147	64
	3125	2	-0.236	0.145	60
	91125	3	0.220	0.143	74
	27125	4	0.177	0.150	52
3	2	5	-0.342	0.152	34
	3	6	-0.373	0.149	36
	4	7	-0.623	0.155	32
	5	8	-0.743	0.169	22
	6	9	-0.855	0.211	13
	7	10	-1.461	0.266	6
	8	11	-0.471	0.341	5
	9	12	-0.999	0.237	10
	10	13	-0.914	0.188	17
	11	14	-0.560	0.150	36
	12	15	-0.404	0.145	40
4	78	16	0.401	0.196	21
	79	17	0.285	0.174	29
	80	18	0.155	0.175	30
	81	19	0.349	0.193	23
	82	20	0.662	0.168	30
	83	21	0.768	0.169	29
	84	22	1.121	0.194	17
	85	23	1.228	0.171	27
	86	24	0.704	0.168	30
	87	25	0.719	0.186	20

Table 15. Standardized catch rate index for cod in Subdivision 3Ps for the period 1977-87.

	PREDICTED CATCH RATE					
	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1977	0.0721	0.0381	1.279	0.248	32245	25221
1978	0.4732	0.0320	1.915	0.340	27221	14214
1979	0.3574	0.0268	1.710	0.279	33006	19300
1980	0.2274	0.0308	1.499	0.262	37568	25066
1981	0.4207	0.0278	1.821	0.302	38892	21357
1982	0.7344	0.0286	2.491	0.419	33902	13610
1983	0.8398	0.0268	2.771	0.451	38451	13878
1984	1.1931	0.0364	3.925	0.744	36950	9413
1985	1.2997	0.0264	4.389	0.710	51367	11703
1986	0.7766	0.0255	2.602	0.414	57290	22014
1987	0.7915	0.0373	2.626	0.504	57290	21818

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.173

Table 16. Purchase slips and inshore catches by gear for the period 1979-86 in Subdivision 3Ps.

	INSHORE <35'				NEARSHORE (35-64')			
YEAR	TRAP	GN	JIGGER & HL	LT	TRAP	GN	JIGGER & HL	LT
PURCHASE SLIPS								
1979					728	1160	369	4743
1980	670	9574	4821	23393	621	1487	238	4544
1981	614	8971	2706	24861	533	1978	210	5545
1982	1155	9345	3968	16804	572	1880	245	4065
1983	1767	7684	5814	11255	974	1677	598	4201
1984	1494	11055	6596	14271	694	1511	663	3202
1985	1848	11197	4261	15851	1002	1302	231	3174
1986	1244	17527	4254	15426	837	1604	250	3286
CATCHES								
1979					1287	1145	206	4712
1980	635	4086	2391	12147	1301	1297	152	5545
1981	404	3326	1071	9829	541	1668	68	6704
1982	801	4816	1494	6965	1127	1464	102	4579
1983	1473	3007	2245	6301	2212	1457	293	5576
1984	1683	5697	2669	5697	1588	1540	273	3679
1985	2174	5707	2011	5843	3503	1373	84	3504
1986	1368	6674	1548	5558	2628	1934	146	4242
CATCH PER SLIP								
1979					1.77	0.99	0.56	0.99
1980	0.95	0.43	0.50	0.52	2.10	0.87	0.64	1.22
1981	0.66	0.37	0.40	0.40	1.02	0.84	0.32	1.21
1982	0.69	0.52	0.38	0.41	1.97	0.78	0.42	1.13
1983	0.83	0.39	0.39	0.56	2.27	0.87	0.49	1.33
1984	1.13	0.52	0.40	0.40	2.29	1.02	0.41	1.15
1985	1.18	0.51	0.47	0.37	3.50	1.05	0.36	1.10
1986	1.10	0.38	0.36	0.36	3.14	1.21	0.58	1.29

Table 17. Average weights at age of Subdivision 3Ps cod from the commercial fishery (1977-86) and research vessel catches (1977-88) along with partial recruitment estimates (1977-86) from a cohort analysis.

Age	Average Weights 1977-86 Comm	1977-88 Res.	Partial Recruitment 1977-86
3	0.53	0.23	0.015
4	0.78	0.64	0.214
5	1.21	1.12	0.533
6	1.80	1.71	0.780
7	2.50	2.58	1.000
8	3.30	3.43	1.000
9	4.37	4.62	1.000
10	5.61	5.77	1.000
11	6.36	6.87	1.000
12	8.13	8.18	1.000
13	9.11	10.25	1.000
14	10.52	11.09	1.000
15	12.08	12.62	1.000
16	13.74	15.80	1.000
17	14.16	16.76	1.000
18	16.51	21.37	1.000
19	17.05	20.92	1.000
20	19.04	19.61	1.000

Table 18. Yield per recruit analysis - Subdivision 3Ps cod.

YIELD PER RECRUIT ANALYSIS

	FISHING MORTALITY	CATCH (NUMBER)	YIELD (KG)	AVG. WEIGHT (KG)	YIELD PER UNIT EFFORT
	0.1000	0.209	0.789	3.776	1.314
F0.1---	0.1515	0.273	0.910	3.334	1.000
	0.2000	0.319	0.958	3.007	0.798
FMAX---	0.2722	0.370	0.976	2.636	0.597
	0.3000	0.387	0.975	2.521	0.541
	0.4000	0.433	0.954	2.202	0.397
	0.5000	0.468	0.927	1.980	0.309
	0.6000	0.495	0.900	1.819	0.250
	0.7000	0.517	0.876	1.696	0.208
	0.8000	0.535	0.856	1.600	0.178
	0.9000	0.550	0.837	1.522	0.155
	1.0000	0.564	0.821	1.457	0.137
	1.1000	0.575	0.807	1.403	0.122
	1.2000	0.586	0.795	1.356	0.110
	1.3000	0.595	0.783	1.316	0.100
	1.4000	0.604	0.773	1.281	0.092
	1.5000	0.611	0.764	1.249	0.085

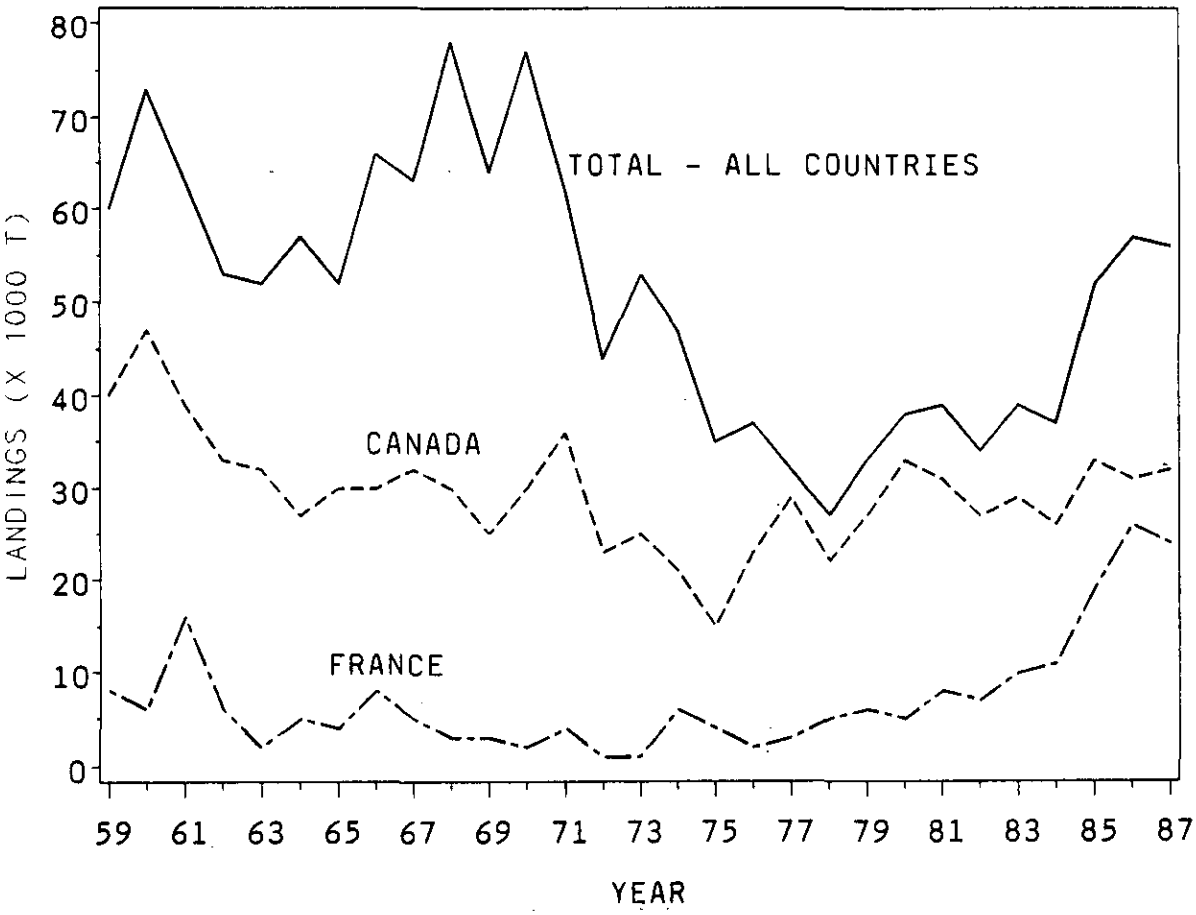

Fig. 1. Landings of cod in Subdivision 3Ps for Canada, France and the total for all countries for the period 1959-87.

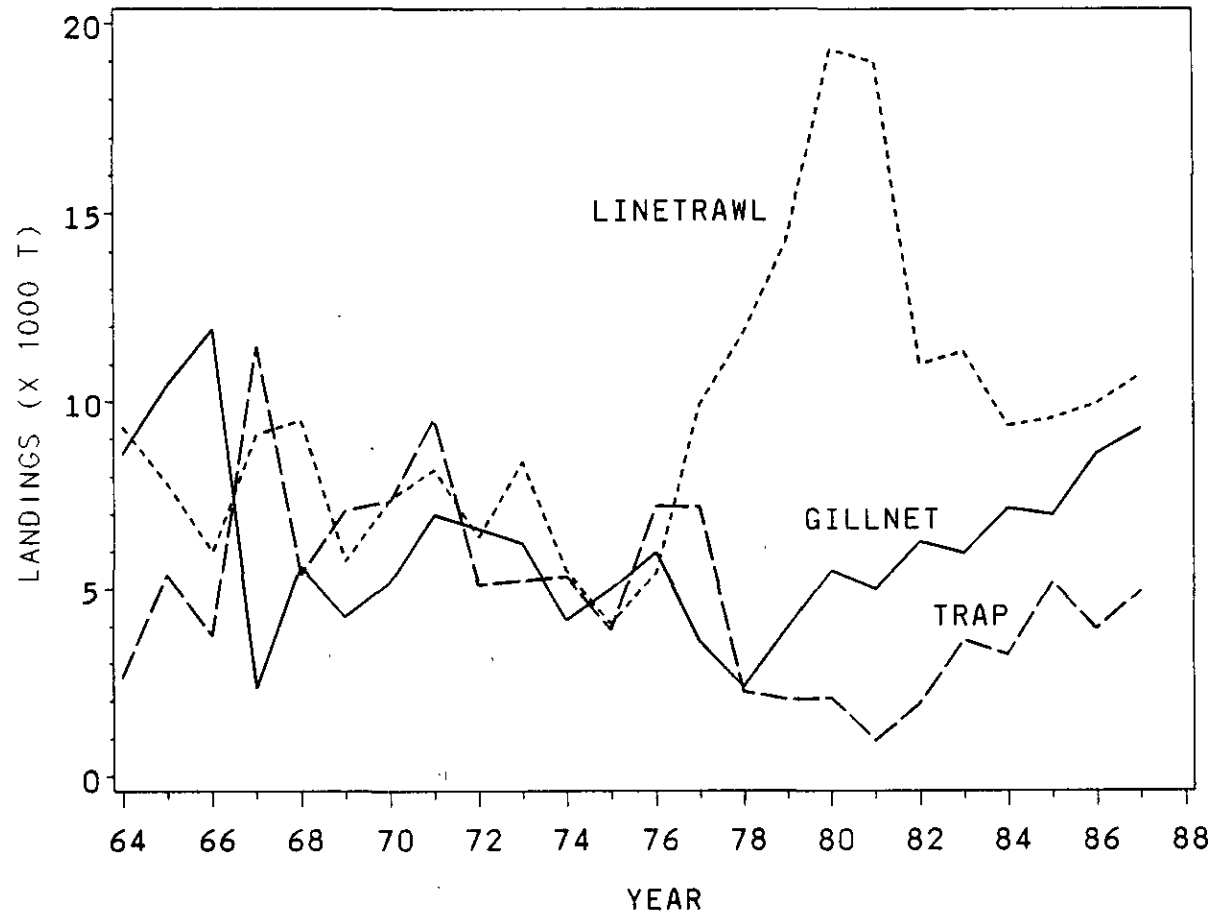

Fig. 2. Inshore cod landings by gear in Subdivision 3Ps for the period 1964-87.

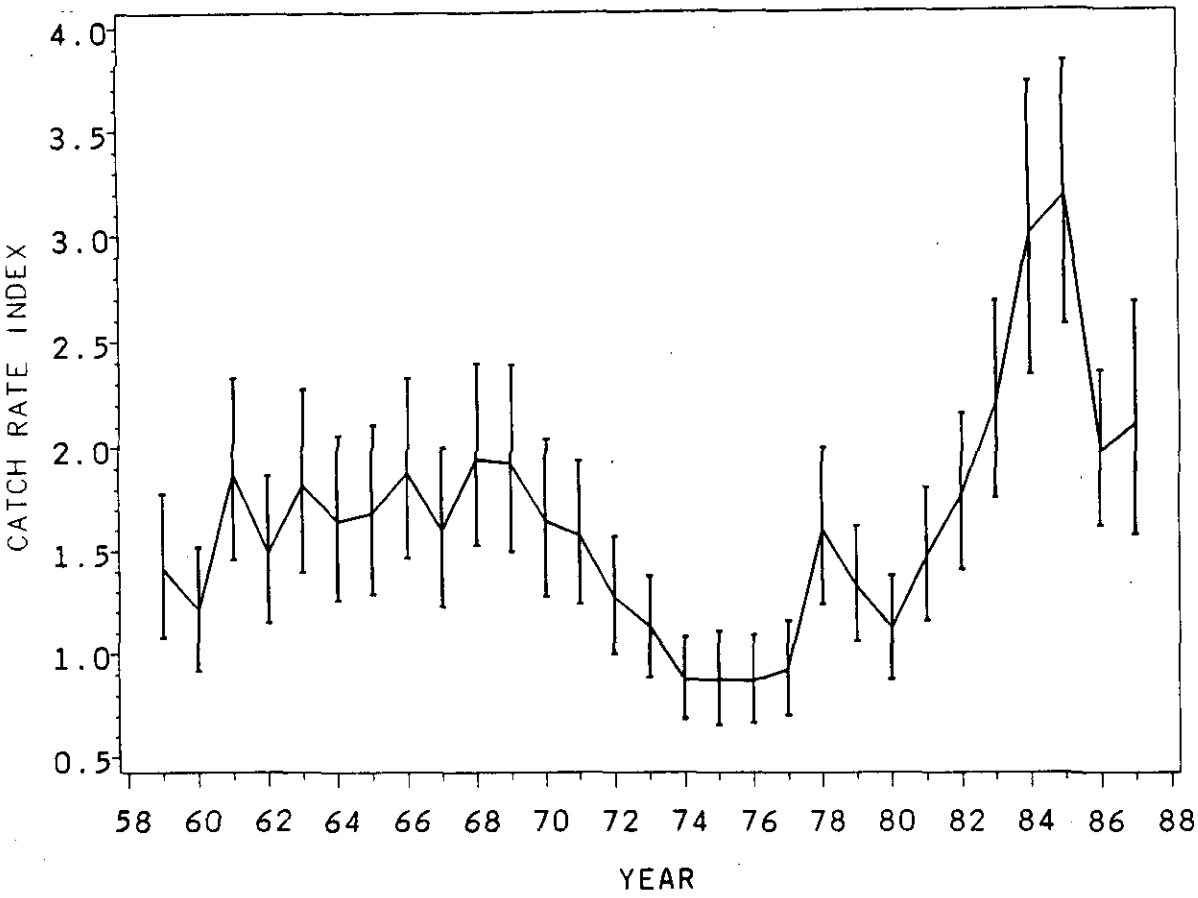

Fig. 3. Catch rate index with approximate 90% confidence interval for Subdiv. 3Ps Cod using data for the period 1959-87.

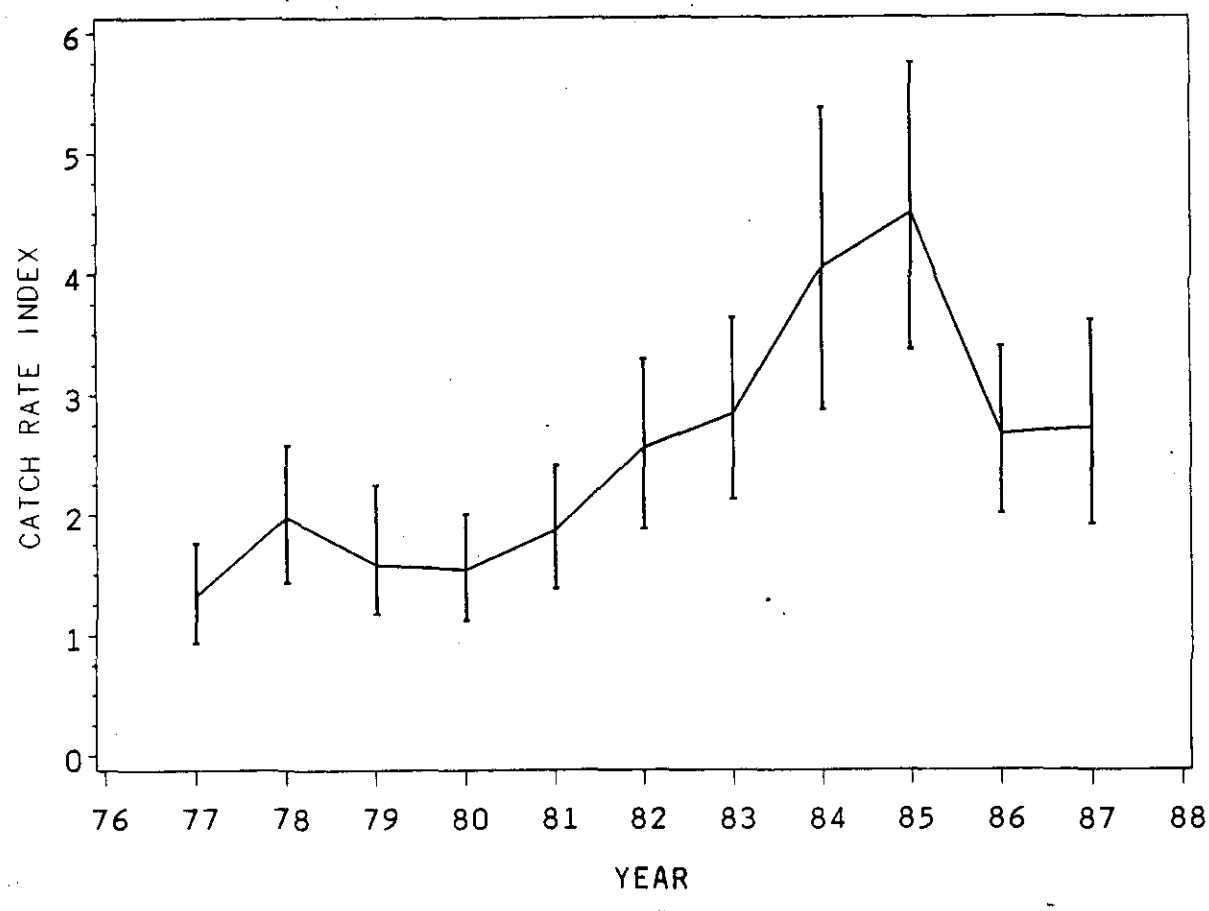

Fig. 4. Catch rate index with approximate 90% confidence interval for Subdiv. 3Ps Cod using data for the period 1977-87.

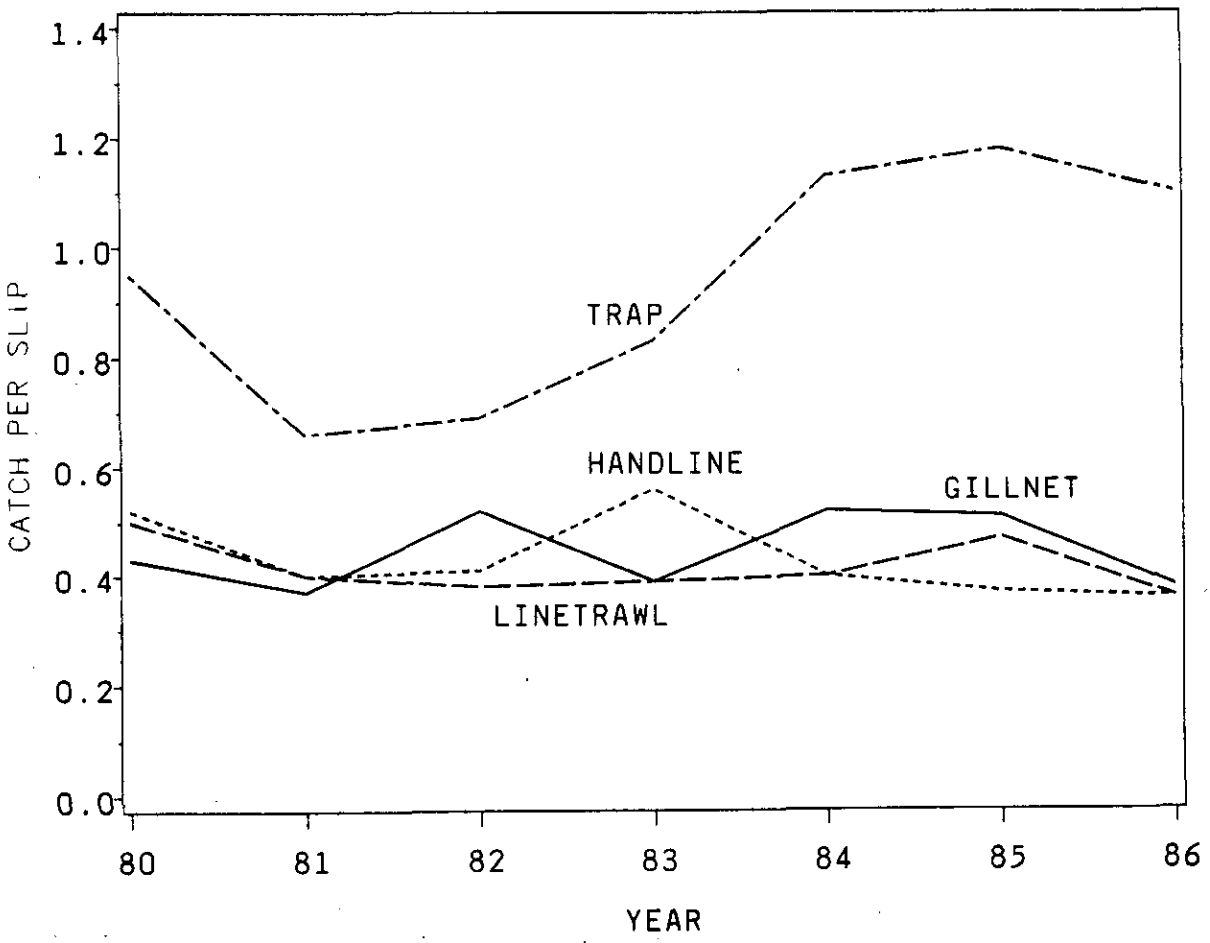

Fig. 5. Catch per purchase slip for cod in Subdiv. 3Ps for the period 1979-86 (Vessels <35 ft.).

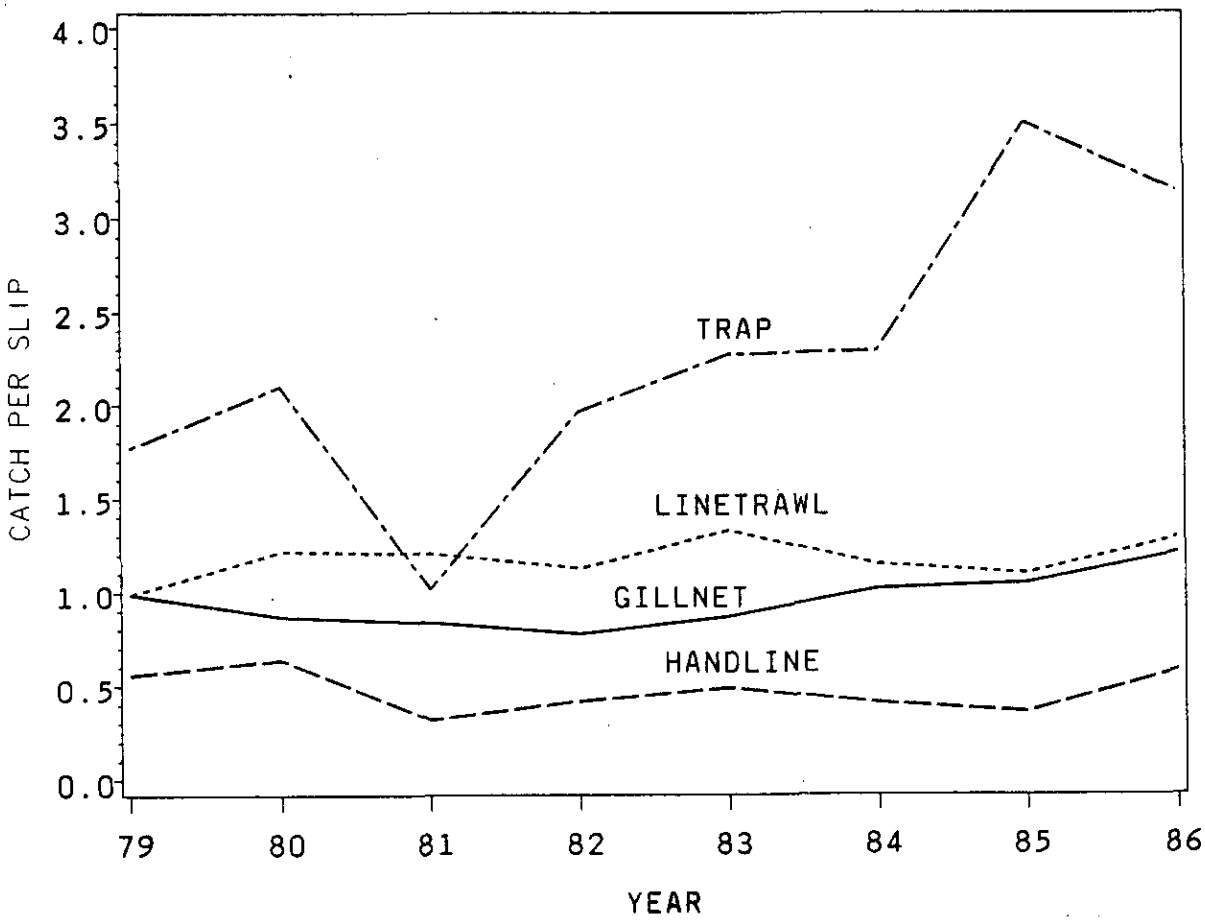

Fig. 6. Catch per purchase slip for cod in Subdiv. 3Ps for the period 1979-86. (Vessels 35-64 ft.).

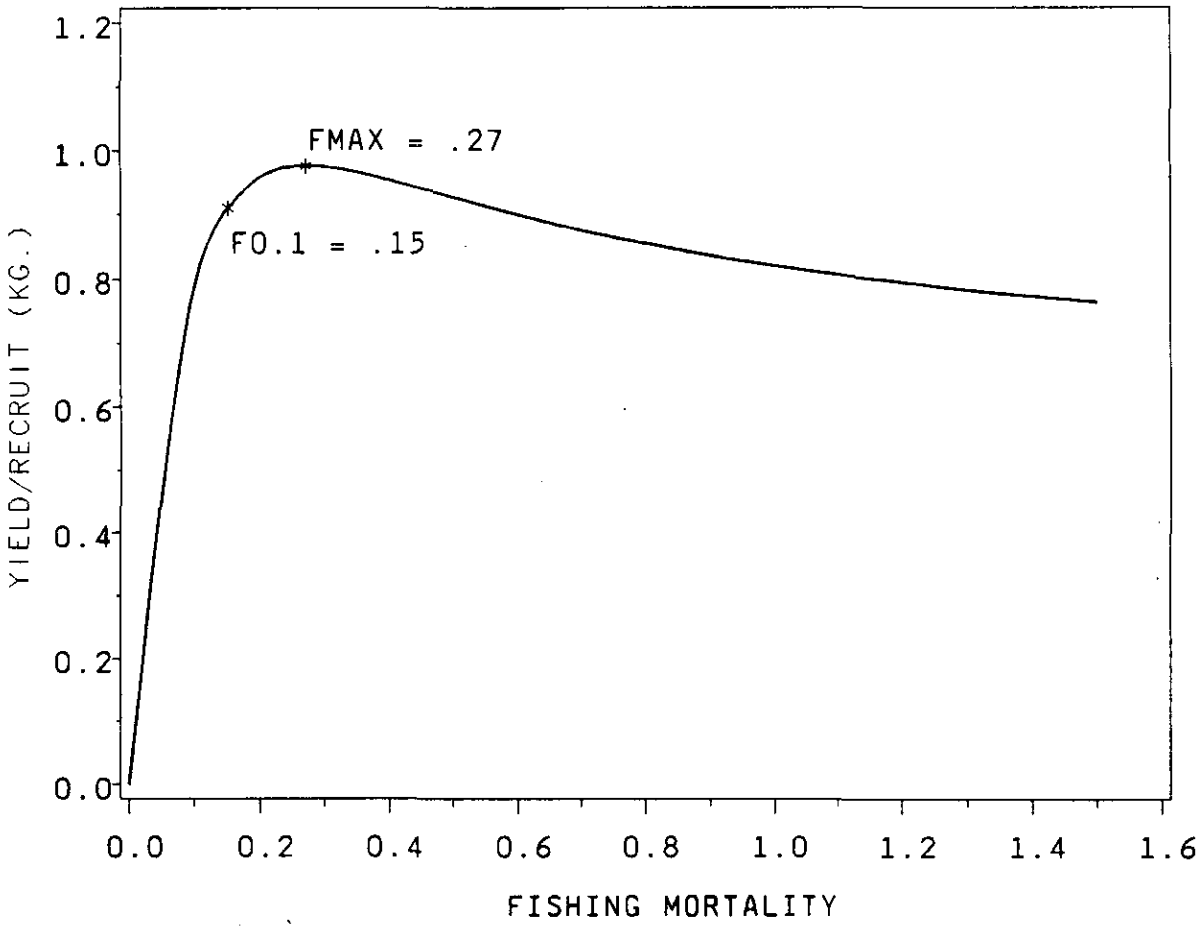

Fig. 7. Yield per recruit for a range of fishing mortalities for cod in Subdiv. 3Ps.