4Vn COD (MAY-DECEMBER): STATUS REVIEW FOR THE 1984 FISHING YEAR

by

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ABSTRACT

Nominal catch of cod in 4Vn (May-December) was 10,527 t in 1984, an increase of 1185 t from 1983. Landings for all gear categories with the exception of longliners increased from last year. The decrease in longline catch was slight compared to decreases in previous years.

This report summarizes available information for this fishery in 1984. Samples were obtained from all major components in the fishery allowing for comparisons of age composition of landings between gear types.

RESUME

En 1984, la prise nominale de morue dans la zone 4Vn (mai-décembre) s'est établie à 10 527 t, soit 1 185 t de plus qu'en 1983. Les débarquements ont augmenté pour toutes les catégories d'engins de pêche, à l'exception des palangriers. Toutefois, la diminution de la prise dans le case de la pêche à la palangre est faible si on la compare aux baisses des années précédentes.

On trouve dans le rapport un résumé des informations disponibles sur la pêche à la morue (année 1984). Des échantillons obtenus des principaux participants à cette pêche ont permis d'établir des comparaisons entre les types d'engins de pêche et l'âge des poissons débarqués.

INTRODUCTION

A complete review of the management history of 4Vn (May-Dec) cod stock for the period 1974 to 1983 was given in Sinclair and Smith (MS 1984). The following is a review of developments since 1983. In 1983 CAFSAC (Adv. Doc. 83/19) suggested that a catch of 14,000 t in 1984 would roughly correspond to the 2/3 E_{MSY} catch. This advice was based on the results of a general production analysis and the apparent strength of the 1977 year class from the survey and commercial (longliner) catch-at-age information. Nominal catch in 1983 was 9342 t, substantially below the TAC and approximately 3000 t lower than in 1982 (Table 1). Catch by longlines in 1983 was over 2100 t lower than in 1982 and 4700 t lower than the record high level in 1981 (Table 2).

In a review of the status of the stock for 1983 Sinclair and Smith (MS 1984) presented a reanalysis of the general production model which resulted in a calculated 2/3 E_{MSY} yield of 10,200 t. The fit of the model to the data used was admittedly poor with an r-square of 0.46. Estimated fishing mortality for 5+/6+ from surveys and CPUE-at-age for longliners indicated that fishing mortalities in recent years were slightly above $F_{0.1}$ = 0.20. Concern was also expressed over the possible effect of increasing otter trawl catches on the abundance of younger year classes which were not fully recruited to the longline gear.

Based on the apparent strength of the 1977, 1979 and 1980 year classes CAFSAC (1984, Adv. Doc. 84/14) suggested that the 4Vn (May-Dec.) cod stock was still above equilibrium but were unable to quantify how much the stock was above this level. Therefore it was suggested that a catch of 10,000 t in 1985 would approximately correspond to 2/3 E_{MSY}. AGAC set the 1985 TAC at 12,000 t.

Nominal Catch

The nominal catches by country for the period 1970-1984 are presented in Table 1. Total catch for the same period is plotted in Figure 1. There were no landings reported by countries other than Canada for 1984. Total landings for 1984 were up by 1185 t from 1983. This increase was shared by the otter trawls, seines and handlines (Table 2). The longliner catch decreased for the third year in a row, but the decrease in 1984 was slight compared to the two previous years. The percent composition of catch by gear over the period 1970-1984 is shown in Figure 2.

The original 1984 quota for the mobile gear <65' was 1900 t. According to the quota reports this was exceeded on 1 August report and the fishery was declared closed August 12th. In the September 12th report 1200 t was reallocated to the mobile gear <65' from the fixed gear <65'. This new quota of 3100 t was exceeded and the fishery was closed as of the first of November.

Landings by gear and tonnage class are presented for 1983 and 1984 in Table 3. As was noted in 1983 the TC 1-3 otter trawlers which roughly correspond to vessels <65' are becoming a major part of the otter trawl fishery. Substantial increase in landings by TC2 vessels occurred in 1984 compared to the previous year. For longliners, only the TC2 vessels showed an increase in catch.

The monthly breakdown of landings by gears given in Tables 4a and 4b do not show any appreciable change in pattern from past years. Landings for longlines, otter trawls and seines are relatively high in the spring, decrease over the summer and then increase again in the fall.

RESEARCH SURVEY RESULTS

Results from the analysis of the comparative fishing experiments given in Fanning (MS 1985) and discussed by CAFSAC indicate that no conversion factors are necessary for catches of cod by the A.T. Cameron and the Lady Hammond. Also, since there are still questions extant regarding the comparison of the Lady Hammond and A. Needler it was deemed inappropriate to apply a conversion factor to catches of cod by these two vessels at this time. We have avoided the problem of differences in sampling unit sizes between the gear used by the two vessels by considering stratified mean catch/tow as our index of abundance rather than total biomass estimates.

The mean numbers/tow, total number/tow and total weight/tow for the 1970-1984 summer research cruises by age are presented in Table 5. Results for 1970-81 inclusive are from the A.T. Cameron cruises. The Lady Hammond conducted the 1982 cruise and the last two cruises (1983-84) were made by the A. Needler.

The 1977 year class (age 7) no longer appears to be exceptionally large in the 1984 survey compared to the 1974 and 1975 year classes at the same age. The 1979 and the 1980 year classes continue to look good in comparison to previous year classes at the same ages. The 1981 year class also shows promise. The 1978 year class does not appear to be exceptional, but is having a large impact on the commercial catch (see below).

The total mean number/tow shows little change from the previous year but the total weight/tow has increased substantially, reflecting the greater proportion of older fish caught in the 1984 survey (9+).

The estimates of mean number and mean weight per tow are plotted in Figure 3. The estimates for 1981 continue to appear to be anomalous in comparison to adjacent years. A comparison of mean numbers per tow by strata (Table 6) shows that 1981 was also unusual for having substantial numbers of cod caught in stratum 40. This occurrence was recorded by both vessels in the comparative survey that year.

The percent contribution of specific year classes (1974, 1975, 1977, and 1978) to the total survey within the three strata in 4Vn are plotted in

Figure 4. Details concerning depth range and percent of area contained within each stratum are given in Table 6. For the 1974, 1975, and 1977 year classes the percent contributions peaked first in the shallow strata (42), then in stratum 41 and finally in stratum 40. This indicates that cod move to deeper waters as they grow older.

Anecdotal information from Department staff in Cape Breton indicated that longliners in 1981 and, in 1982 to a lesser extent, were fishing in the deep waters close to the edge of the Laurentian channel. This was at a time when the deepest stratum was dominated by the larger 1974 and 1975 year classes. Recently, it appears that these vessels have been concentrating in the shallower water in Sydney Bight. The 1984 survey indicates an absence of large amounts of older fish in the deeper stratum.

Commercial Catch at age

Sampling coverage of the commercial catch in 1984 was the best for this stock to date. All major gears were covered and for the first time a comparison can be made between the age composition of the fish landed by each of these gears. The data used to generate the age-length keys are summarized in Table 7.

The length frequencies from the handline and longline (tonnage class 1) samples were judged to be similar and information from both gears were combined to estimate the age composition of the landings for each of these gears.

The longliner catch at age is at present our only time series for this stock and is presented in Table 8 for the years 1970 to 1984. Although 1975 and 1974 year classes are still contributing to the catch the 1977-1979 year classes predominate.

The mean weights at age for the longliner catch are given in Table 9. Weights at age in 1984 for the younger year classes appear to be in line with previous years while the weights of the 1974 and 1975 year classes appear to be low in comparison to previous years.

A comparison between the catch at age for the major gears is presented in Table 10 and in Figure 5. The longlines have a higher proportion of older fish (age 8-11) than the other gears while the otter trawl catch was dominated by ages 5-6. In last year's report concern was expressed over the effect that increased otter trawl catch could have on the age groups not yet fully recruited to the longliner gear. Figure 5 shows that the otter trawls concentrate heavily on the younger age classes (ages 4-7) which may result in a decrease in the future availability of older fish to the longliner fishery.

Catch per Unit Effort

The CPUE estimates for longliners TC2 for 1968 to 1984 are given in Table 11. The estimate for 1984 shows a slight increase over that for 1983. However, the number of log book returns from longliners continues to be small.

General Production Model

A general production model was fitted to nominal catch and an effort series derived from the research survey mean weight/tow for 1970 to 1981 in last year's document (Sinclair and Smith MS 1984). Now that the comparative fishing analysis by Fanning (MS 1985) has concluded there was no difference between the two vessels for cod we have extended the above general production analysis to include data up to 1984 (Table 12 and Figure 6). The r-squared has changed very little from that obtained with 1970-1981 data (0.46) and catches have been fairly stable for recent years (1980-1984) with respect to the equilibrium yield reference curve (Figure 6b).

Mortality Estimates

Estimates of total mortality were calculated from survey catch per tow at age (Table 5) and longline CPUE at age (Table 13) for the period 1980-1984. These estimates were averaged and are presented in Table 14 for age groups 4+/5+ to 10+/11+. The mortality estimates indicate full recruitment at age 5 for the surveys and age 7 for the commercial data. Estimates of total mortality for fully recruited age groups were obtained by averaging 5+/6+ and 6+/7+ estimates for surveys and 7+/8+ and 8+/9+ estimates for the commercial data. Estimates of mortality beyond these age groups were not used due to the small numbers of fish caught a these ages which would make the estimates unreliable. Assuming that natural mortality equals 0.2 estimates of total mortality for fully recruited age groups imply that fishing mortalities are equal to 0.36 from the longline data and 0.46 from the survey data.

SUMMARY

Abundance indices from the research vessel survey indicate fairly stable conditions for this stock with signs of potentially good recruitment from the 1979, 1980 and 1981 year classes. Surveys for the adjacent stocks (4VsW, 4T and 4RS-3Pn) give similar indications for these same year classes, with the exception of 1981 for 4VsW.

Commercial catch per unit effort (CPUE) from the longliners increased slightly in 1984 over 1983. The number of logbooks returned remains small. Tonnage class (TC) 1 vessels which land the largest portion of the longline catch are not required to carry logbooks. Therefore, trends in this index remain difficult to interpret.

Estimates of fishing mortality from summer research surveys and longline CPUE at age suggest that fishing mortalities in recent years have been above $F_{0.1} = 0.20$. Average estimates for the period 1980-1984 for fully recruited age groups indicate fishing mortalities of 0.36 from the commercial catch rates and 0.46 from the research surveys.

This is the first year for which age composition has been available for all of the major gears in the fishery. The commercial age composition indicates that the otter trawlers are concentrating on younger age-classes than longliners. The recent trend of increasing allocations to otter trawlers may reduce future yields to the longliners, especially at current levels of fishing mortality. Further sampling of all gears will aid in assessing the impact of the otter trawl fishery over the next few years.

The general production model used in the last three assessments was updated to include catch and effort derived from the survey indices of the last three years. Results suggest a long-term sustainable yield at the reference fishing effort level of 2/3 E_{MSY} (effort at MSY) of 10,500 t. This estimate differs little from the previous one, although the fit to the model remains poor.

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Table 1. Nominal cod catch (t) by countries in Subdivision 4VN (May - December).

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Canada	8701	8469	6729	5245	4836	3363	5746	7786	5496	6301	9976	12476	12101	9237	10527
Spain	1141	2161	1171	241	852	89	-	-	-	-	-	-	-	-	-
Portugal	-	-	459	189	84	360	-	-	-	-	-	-	-	-	-
France	34	1	745	-	-	-	211	135	53	73	214	172	232	105	-
Norway	-	-	-	-	137	186	-	-	-	-	-	-	-	-	-
U.K.	-	-	-	-	61	-	-	-	-	-	-	-	-	-	-
F.R.G.	-	-	-	73	14	-	-	-	-	-	-	-	-	-	-
U.S.A.	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poland	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS	9888	10631	9104	5748	5984	3998	5957	7921	5549	6374	10190	12648	12333	9342[1]	10527[1]
% Canadian	88	80	74	91	81	84	95	98	99	99	99	99	99	99	100
TAC	-	-	-	-	10000	10000	10000	3500	3500	3400	5000	*	**	14000	14000

* Initially set at 7500 t, increased in September to 10,000 t.
** Initially set at 10500 t, increased November 1 to 14,000 t.

[1] Preliminary statistics

Table 2. Nominal catch (t) of cod in Subdivision 4Vn (May-December) by gear type for all countries, 1970-1984.

Year	Otter Trawls	Seines	Longlines	Handlines	Misc.	TOTAL
1970	4859	33	3229	495	1222	9888
1971	5308	109	3728	696	790	10631
1972	4418	121	3185	286	1094	9104
1973	2099	143	1982	404	1120	5748
1974	2842	138	1469	568	967	5984
1975	1851	100	875	360	812	3998
1976	4375	83	620	310	569	5957
1977	4613	554	1805	595	354	7921
1978	1600	326	3035	466	122	5549
1979	624	278	4483	640	349	6374
1980	1150	561	6440	1820	219	10190
1981	1488	557	9801	741	61	12648
1982	2785	724	7287	1360	177	12333
1983	2312	864	5101	924	141	9342[1]
1984	3400	1084	4831	1112	100	10527[1]

[1] Preliminary statistics

Table 3. Nominal catch by Canada of cod in 4Vn (May-Dec) by vessel size and gear. Percentage of year total catch by tonnage class is in parenthesis.

Tonnage Class (GT)	Otter Trawls	Seines	Gillnets	Longlines	Handlines	Other	TOTAL
1983							
0-24.9	126 (6)	370 (43)	31 (63)	3379 (67)	920 (100)	21 (23)	4847
25-49.9	284 (13)	475 (55)	18 (37)	1460 (29)	4 (0)	-	2241
50-149.9	1068 (47)	19 (2)	-	260 (4)	-	71 (77)	1418
150-499.9	126 (6)	-	-	2 (0)	-	-	128
500-999.9	603 (28)	-	-	-	-	-	603
Total	2207	864	49	5101	924	92	9237
1984							
0-24.9	163 (5)	474 (44)	-	3146 (65)	1110 (100)	45 (45)	4938
25-49.9	1132 (33)	594 (55)	-	1605 (33)	2 (10)	-	3333
50-149.9	1652 (49)	16 (1)	-	80 (2)	-	55 (55)	1803
150-499.9	115 (3)	-	-	-	-	-	115
500-999.9	338 (10)	-	-	-	-	-	338
Total	3400	1084	-	4831	1112	100	10527

Table 4a. 1983 Nominal catch (t) for cod fishery in Subdivision 4Vn (May-December) by months and year.

Gear	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTALS
Gillnets	2	24	3	3	17	-	-	-	49
Handlines	3	45	187	317	194	162	13	3	924
Longlines	703	675	353	338	655	693	646	1038	5101
Traps (fixed)	-	9	2	-	-	-	-	-	11
Misc.	-	1	-	-	-	-	-	-	1
OTB1	36	4	13	1	5	2	1	-	62
OTB2	226	260	65	79	278	337	197	703	2145
Danish Seine	349	274	48	10	42	38	8	86	854
Scottish Seine	8	1	-	-	-	-	-	-	9
Shrimp Trawl	17	12	18	14	9	2	-	-	72
Scallop Dragger	-	4	5	-	-	-	-	-	9
TOTAL	1344	1309	694	762	1200	1234	865	1830	9237
France (OTB)	105								
TOTAL	1448	1309	694	762	1200	1234	865	1830	9342

Table 4b. 1984 nominal catch for cod fishery in 4Vn (May-Dec) by month and gear.

GEAR	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
Longlines	697	557	399	452	535	871	756	564	4831
Handlines	1	65	271	374	119	241	24	17	1112
Otter Trawls	512	453	390	103	518	703	342	379	3400
Seines	611	174	52	49	32	49	29	88	1084
Shrimp trawl	17	17	13	7	-	1	-	-	55
Other	18	22	2	1	-	2	-	-	45
TOTAL	1856	1288	1127	986	1204	1867	1151	1048	10527

Table 5. 4Vn cod (May-Dec) Research vessel abundance indices (mean catch per tow) by age group.

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	-	-	-	-	-	-	-	-	-	-	-	0.33	-	-	2.83
2	6.35	1.17	0.52	-	-	0.61	6.49	0.13	0.66	1.30	1.88	4.36	2.53	4.37	7.25
3	1.77	42.40	0.28	2.91	0.61	6.42	2.25	7.12	9.13	0.79	10.52	16.91	1.74	22.11	10.02
4	4.78	10.09	2.35	4.58	1.36	8.58	1.48	4.19	19.31	5.15	3.97	36.48	5.77	7.90	10.48
5	10.90	26.51	0.30	21.20	2.79	4.65	1.93	2.90	5.54	2.51	23.58	12.02	10.22	10.64	13.51
6	10.46	16.16	1.61	2.61	3.21	0.81	1.55	2.05	4.38	0.59	16.40	25.45	7.61	10.04	8.75
7	4.50	10.65	1.47	2.98	0.40	1.00	0.73	0.84	1.53	1.72	5.15	11.50	9.25	1.70	3.58
8	2.59	3.59	0.39	3.08	0.50	0.58	1.79	0.19	1.17	0.56	1.16	1.26	3.41	3.41	1.81
9	0.84	1.97	0.27	0.46	0.26	0.21	1.65	0.28	0.44	0.29	0.45	0.93	1.32	1.52	1.58
10	-	0.54	0.25	0.15	0.22	0.33	1.41	0.14	0.43	0.15	0.37	0.86	0.45	0.66	0.85
11	0.29	-	0.19	-	0.11	-	0.24	0.19	-	-	0.37	0.24	0.10	0.25	0.32
12	0.14	-	-	-	-	0.11	0.23	0.25	-	0.17	-	0.16	0.23	-	0.41
13+	0.13	0.56	0.37	-	-	-	0.47	0.22	0.11	0.45	-	0.31	-	0.43	0.46
UK	0.21	0.40	0.37	0.22	-	0.16	-	0.07	0.12	-	-	0.17	0.10	0.27	0.28
No./tow	42.96	114.05	8.39	38.18	9.47	23.47	20.21	18.58	42.84	13.66	63.84	110.98	42.73	63.30	52.14
kg./tow	57.47	128.20	22.12	53.25	14.44	32.75	43.41	26.58	67.55	27.58	85.55	161.81	74.82	78.60	102.30

Table 6. A comparison of the mean numbers of cod caught per tow for each stratum from the 4Vn summer survey (Numbers corrected for distance towed).

Stratum no.		40	41	42
Percent of area:		27.5%	29.8%	42.7%
Depth range:		>100 fm.	51-100 fm.	≤50 fm.
Year	Vessel			
1970	ATC	0.49	107.81	25.02
1971	ATC	1.25	320.84	41.99
1972	ATC	5.07	8.81	10.16
1973	ATC	1.01	79.92	33.32
1974	ATC	8.12	14.50	6.83
1975	ATC	0.00	71.88	4.86
1976	ATC	0.00	16.58	35.73
1977	ATC	0.36	19.05	29.83
1978	ATC	2.53	62.40	55.16
1979	ATC	2.72	15.62	19.34
1980	ATC	0.34	135.79	54.44
	LH	0.29	127.99	69.37
1981	ATC	79.19	37.39	182.64
	LH	123.88	80.37	60.86
1982	LH	6.74	75.70	42.93
1983	AN	7.63	113.18	48.23
	LH	7.62	149.24	44.03
1984	AN	2.31	99.29	74.76

Table 7. Data used to generate 1984 catch-at-age estimates for 4Vn (M-D) cod.

Length-weight parameters: a=0.00929, b=2.989.

Gear	Time Period	# of samples Length (age)	No. Measured	No. Aged	Catch(t)
Longline TC 1	May-Sept	8 (8)	2862	493	1737
Handline	May-Sept	0	0	0	830
Longline TC 1	Oct-Dec	11 (5)	3334	253	1409
Handline	Oct-Dec	2 (1)	464	39	282
Longline TC 2	May-Sept	8 (8)	2758	466	875
	Oct-Dec	6 (4)	1561	204	730
Otter Trawls	May-Dec	9 (9)	3400	401	1976
	Oct-Dec	8 (6)	2966	286	1424
Seines	May-Dec	16 (6)	4825	277	1084

Table 8. 4Vn Cod(May-Dec): catch-at-age by longlines(thousands)

AGES	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–
3	3	10	–	7	15	44	–	–	35	–	–	85	32	8	5
4	62	43	676	133	179	177	–	–	277	17	8	221	227	69	116
5	322	236	39	437	181	127	5	–	265	208	105	310	662	412	306
6	314	492	604	87	184	73	10	–	197	480	532	409	477	436	438
7	181	600	444	193	54	36	25	–	120	305	747	672	805	294	400
8	208	63	209	230	66	17	27	–	76	185	386	529	507	492	228
9	56	152	2	51	82	13	17	–	49	91	219	267	209	163	250
10	40	48	21	17	26	11	15	–	54	17	127	151	78	137	152
11	82	14	50	9	–	4	10	–	20	39	32	57	50	35	69
12	21	7	2	5	4	–	10	–	18	8	8	52	22	33	23
13	17	28	1	6	1	–	–	–	13	4	8	53	8	11	8
14	11	1	–	1	1	1	–	–	3	4	–	5	3	5	4
15	1	7	1	–	1	–	–	–	8	–	–	8	2	5	4
16	–	5	1	2	1	–	10	–	4	–	–	18	15	11	6

Table 9. 4Vn Cod(May-Dec): mean weight at age for longline catch(kg.)

AGES	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	0.28	-	-	-	-	-	0.21	-	-	-
3	0.60	0.48	-	0.40	0.49	0.53	-	-	0.56	-	-	0.50	0.58	0.65	0.51
4	0.79	0.77	0.82	0.72	0.81	0.84	-	-	0.99	0.93	0.73	0.90	0.91	0.84	0.83
5	1.09	1.04	0.91	1.17	1.28	1.29	1.82	-	1.40	1.63	1.22	1.35	1.33	1.22	1.28
6	1.67	1.45	1.72	1.75	1.72	1.79	2.46	-	2.14	2.54	2.03	2.15	1.79	1.63	1.64
7	2.14	2.01	1.66	1.78	2.65	2.29	3.08	-	3.27	3.78	2.49	2.94	2.09	2.12	2.12
8	3.11	4.33	2.10	2.14	2.40	2.00	4.18	-	4.14	3.92	3.14	4.28	3.01	2.31	2.60
9	4.38	3.60	9.29	2.79	2.50	3.18	4.23	-	4.97	4.99	4.55	5.21	4.09	3.50	2.97
10	4.39	5.24	6.91	5.33	3.14	3.50	6.19	-	5.27	6.95	6.21	6.23	5.87	3.95	3.98
11	5.15	6.29	3.46	5.98	7.72	4.41	6.07	-	6.27	7.78	6.99	7.75	6.22	6.41	5.71
12	8.07	8.55	9.29	5.68	4.15	7.72	7.50	-	6.45	9.78	7.65	9.29	7.39	8.53	8.64
13	8.79	4.84	15.23	7.24	11.06	11.06	-	-	7.98	10.72	8.36	8.80	8.91	9.75	9.82
14	9.49	13.45	-	10.15	10.26	8.79	-	-	8.93	6.88	-	8.53	8.60	10.22	11.39
15	12.02	12.03	11.06	13.03	11.37	-	-	-	9.16	-	-	9.45	11.94	11.34	10.50
16	-	10.71	15.23	7.01	6.08	8.48	9.39	-	14.09	-	-	11.59	10.80	12.24	11.73

Table 10. 4Vn cod(May-Dec): catch at age by longlines, handlines, otter trawls and seiners for 1984(thousands).

	Gear			
Age	Longlines	Handlines	Otter Trawls	Seiners
1	-	-	-	-
2	-	-	-	-
3	5	3	6	-
4	116	39	247	10
5	306	95	658	104
6	438	128	804	223
7	400	120	301	113
8	228	32	148	36
9	250	42	31	37
10	152	22	28	15
11	69	20	6	4
12	23	4	1	2
13	8	2	-	1
14	4	1	-	-
15	4	1	1	-
16	6	1	1	1

Table 11. Longliner catch of cod and associated catch-per-unit-effort for 1968-1984, 4Vn(May-Dec).

Year	Longliner Catch (t)	Proportion of catch with effort reported	CPUE (t/1000 hks)
1968	2455	0.066	0.452
1969	3300	0.097	0.646
1970	3229	0.130	0.625
1971	3728	0.071	0.507
1972	3185	0.138	0.440
1973	1982	0.192	0.338
1974	1469	0.197	0.325
1975	875	0.022	0.232
1976	620	0.011*	0.084
1977	1805	0.027	0.499
1978	3035	0.141	0.422
1979	4483	0.169	0.545
1980	6440	0.111	0.504
1981	9801	0.028	0.666**
1982	7287	0.077	0.408
1983	5101	0.105	0.319
1984	4831	0.111	0.435

* based on one log record
** calculated for records from May to September only.

Table 12. Results of a general production analysis of 4Vn cod using catch biomass and survey mean weight per tow for 1970-1984.

Year	Catch(t)	Mean Weight per tow	Effort
1970	9888	57.47	172
1971	10631	128.20	83
1972	9104	22.12	412
1973	5748	53.25	108
1974	5984	14.44	414
1975	3998	32.75	122
1976	5957	43.41	137
1977	7921	26.58	298
1978	5549	67.55	82
1979	6374	27.58	231
1980	10190	85.55	118
1981	12648	161.81	78
1982	12333	74.82	165
1983	9342	78.60	119
1984	10527	102.30	103

Results of Regression

Slope= -0.2573
Origin= 110.453
R-squared= 0.48

Yield at 2/3 Emsy= 10,536 t.

Table 13. 4Vn cod(May-Dec): longliner CPUE-at-age(numbers) 1980-1984.

AGE	1980	1981	1982	1983	1984
1	-	-	-	-	-
2	-	1	-	-	-
3	-	58	18	5	5
4	6	150	127	43	108
5	82	210	371	258	285
6	418	277	267	273	408
7	586	455	451	184	373
8	303	358	284	308	212
9	172	181	117	102	233
10	100	102	44	86	142
11	25	39	28	22	64
12	6	35	12	21	21
13	6	36	4	7	7
14	-	3	2	3	4
15	-	5	1	3	4
16	-	12	8	7	6

Table 14. 4Vn cod(May-Dec): total mortality estimates from surveys and CPUE-at-age(numbers) averaged for 1980-1984.

AGE GROUPS	SURVEYS	CPUE
4+/5+	.358	.041
5+/6+	.521	.191
6+/7+	.797	.295
7+/8+	.737	.485
8+/9+	-	.626
9+/10+	-	.524
10+/11+	-	.568

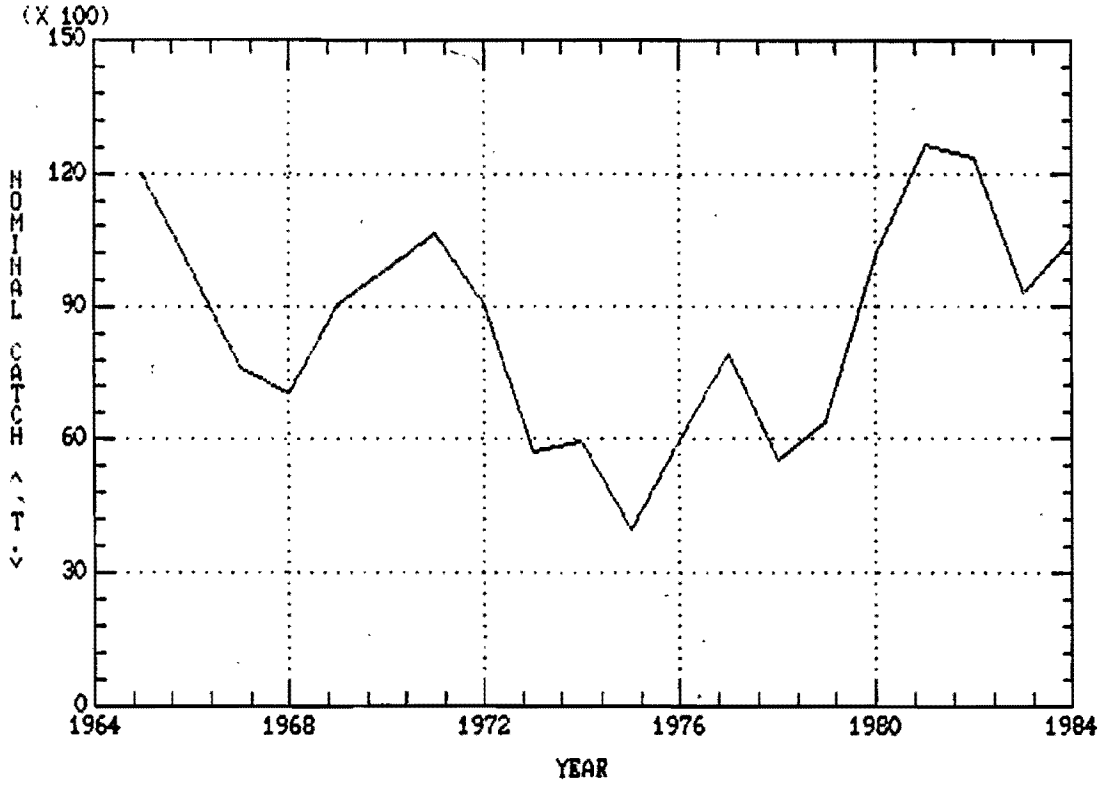

Figure 1. 4Vn cod(May-Dec):Nominal catch

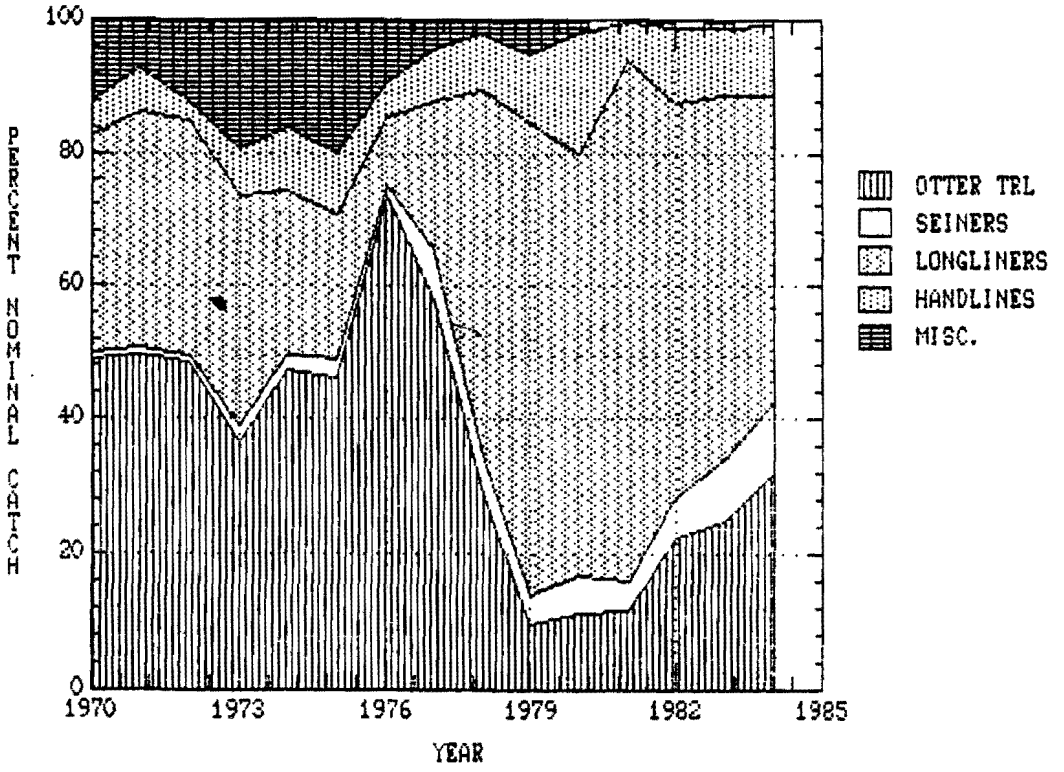

Figure 2. 4Vn cod (May-Dec): Cumulative percent catch by gear.

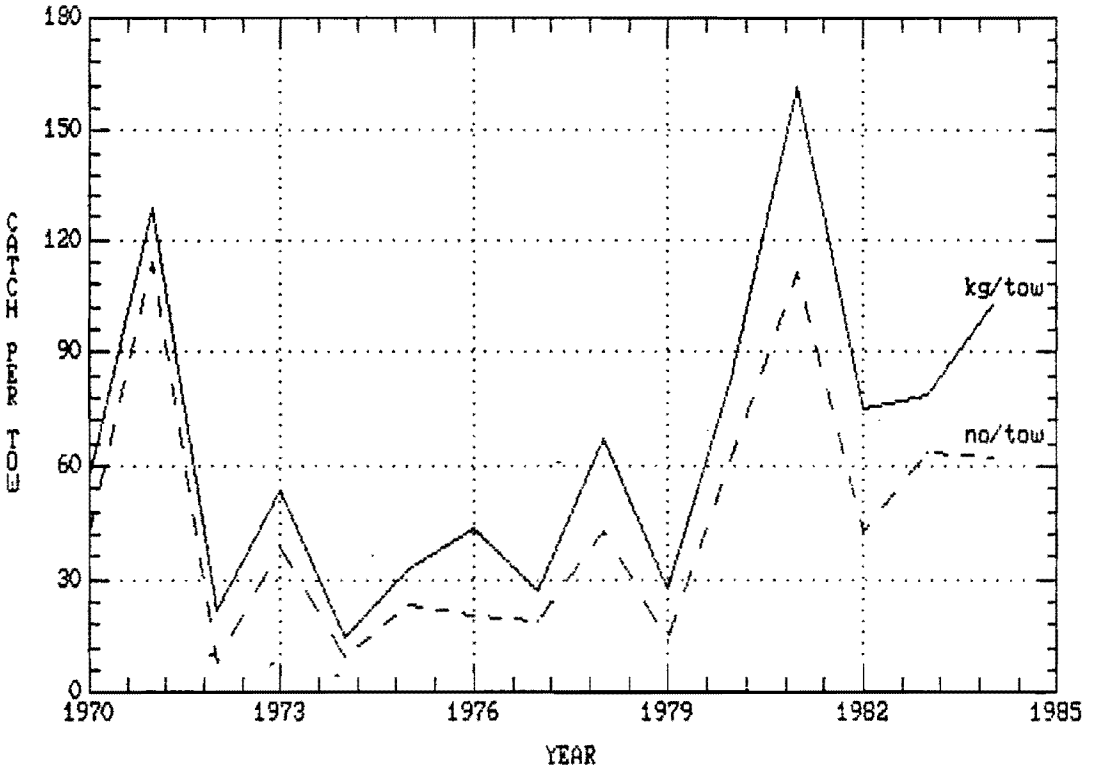

Figure 3. 4Vn cod (May-Dec): Abundance indices from summer research surveys.

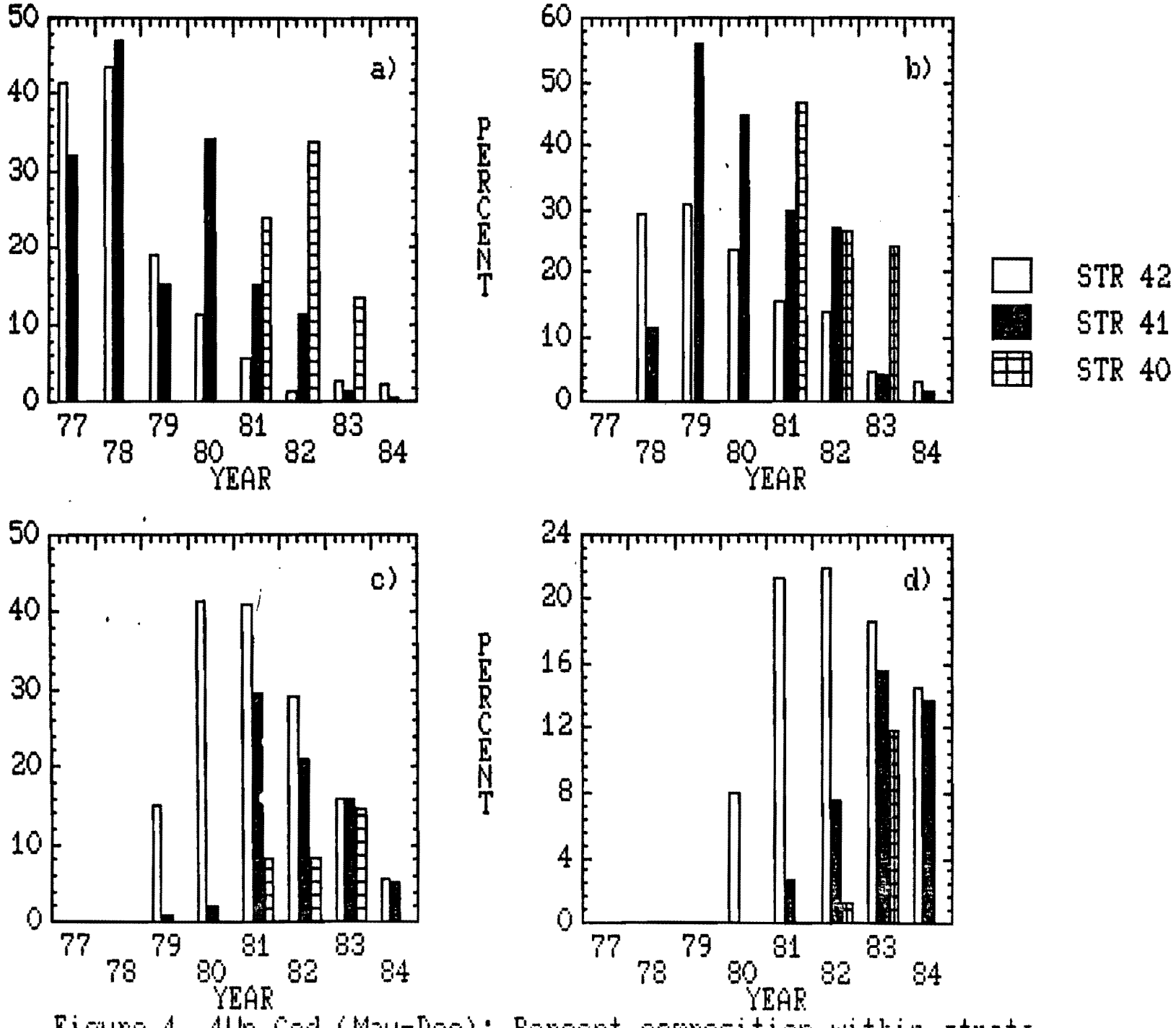

Figure 4. 4Vn Cod (May-Dec): Percent composition within strata
a) 1974 cohort, b) 1975 cohort, c) 1977 cohort, d) 1978 cohort

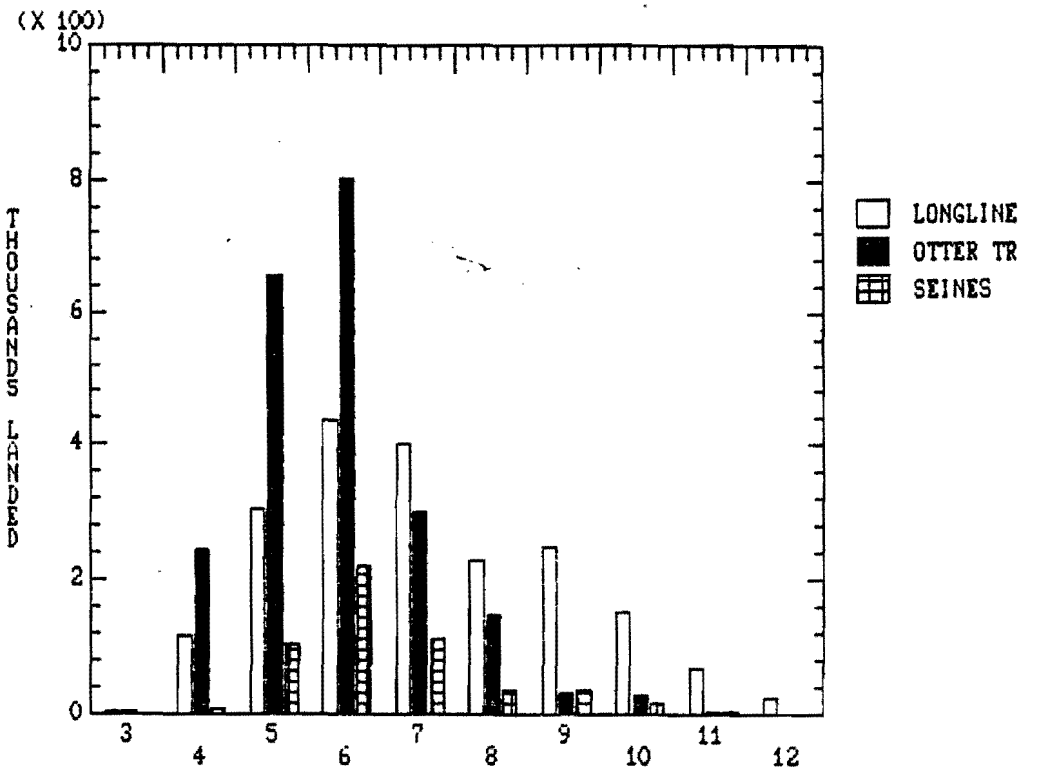

Figure 5. 4Vn cod (May-Dec): Numbers landed at age by longlines, otter trawls and seiners for 1984.

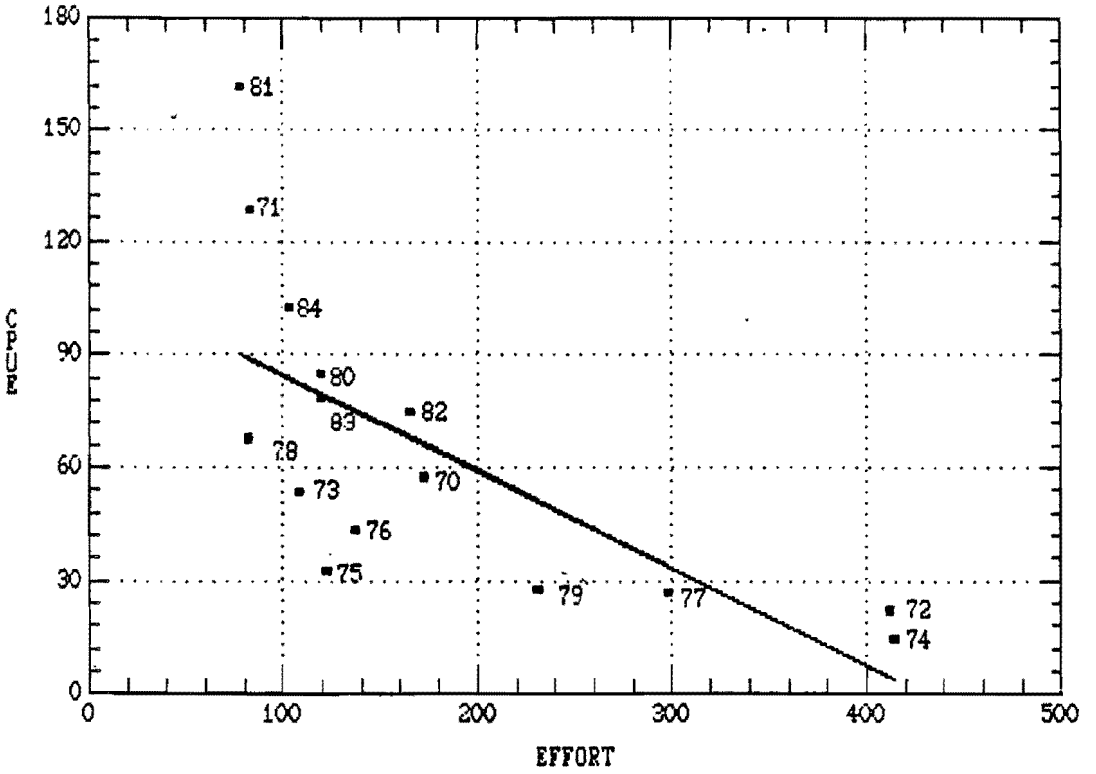

fIGURE 6A. 4Vn Cod (May-Dec):General Production Analysis, CPUE vs Effort.

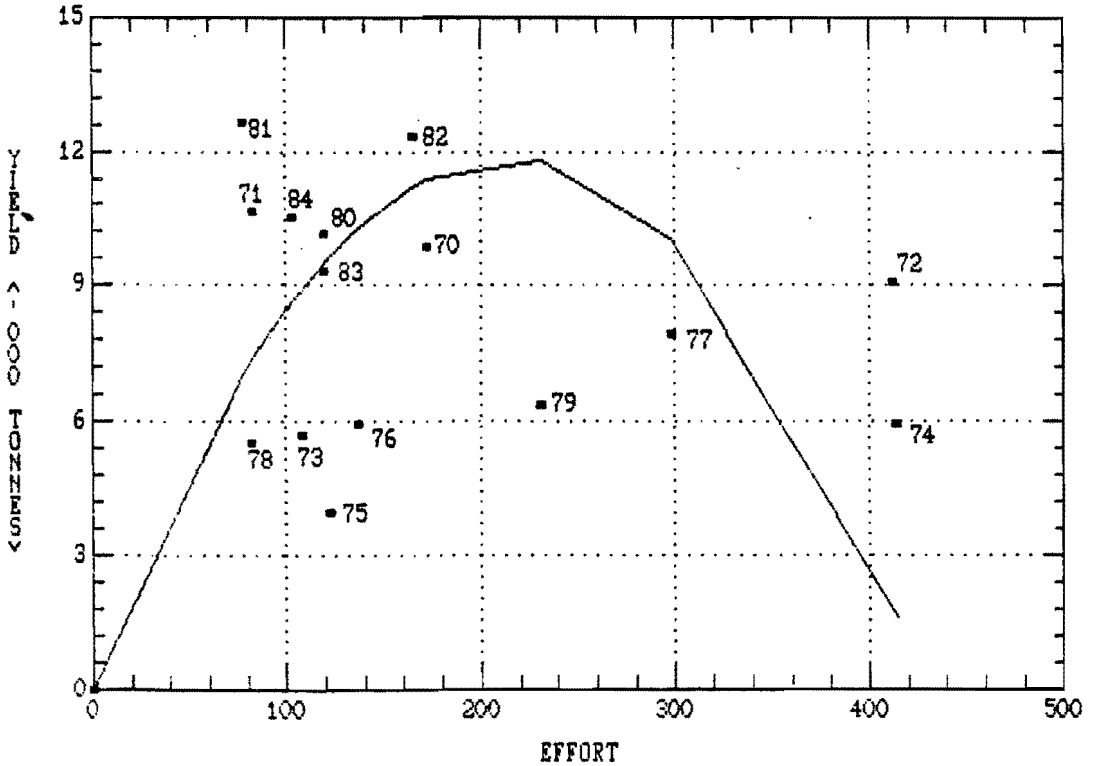

Figure 6b. 4Vn Cod(May-Dec): General Production Analysis, Equilibrium Yield