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## **Update of the Status of 4Vn Cod: 1994.**

by

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## **ABSTRACT**

The 4Vn cod fishery has been closed since September 1993. Nevertheless the stock appears to continue to decline, largely due to lack of recruitment. About 50 tonnes of cod were taken commercially as bycatch in redfish and flatfish fisheries. The stock is monitored by an annual DFO trawl survey in July, and for the first time in September 1994 was surveyed by an extension into 4Vn of the regular DFO 4T cod survey. In addition, a "sentinel survey" employing commercial longliners was inaugurated in September 1994. All of these surveys gave a similar picture of the stock status. Until there is substantial addition of biomass through recruitment, there are no prospects for a reopening in the near future.

## **RÉSUMÉ**

La pêche de la morue dans 4Vn est fermée depuis septembre 1993. Le stock continue néanmoins de diminuer, en grande partie à cause de l'absence de recrutement. Environ 50 tonnes de morue ont été capturées comme prises accidentelles par des pêcheurs commerciaux de sébaste et de poissons plats. Le stock fait l'objet d'un relevé de recherche au chalut par le MPO chaque année en juillet; pour la première fois en septembre 1994, il a également été intégré au relevé régulier du MPO sur la morue de 4T. De plus, un «relevé sentinelle», faisant appel à des palangriers commerciaux, a été lancé en septembre 1994. Tous ces relevés reflètent la même image du stock. À moins d'un accroissement important de la biomasse résultant de l'apport de bonnes classes d'âge, on ne peut envisager de rouvrir la pêche dans un proche avenir.

## INTRODUCTION

Cod landings in NAFO Subdivision 4Vn have declined sharply during recent years. Throughout most of the 80's, catch quotas restrained the fishery, but after 1990 the catch was substantially less than the TAC. In September 1993 the cod fishery was closed and this moratorium is still in effect. In the few years prior to the closure, vessels using mobile gear generally managed to maintain a catch close to their allocation, whereas the longline fleet fared less well. Mixing of Gulf of St. Lawrence (4T) cod with the resident stock and inability to apportion landings according to stock has complicated the assessment and management of the 4Vn stock.

4T cod overwinter along the shelf edge from Sydney Bight to Banquereau Bank region, leaving the Gulf in the late autumn and returning in the spring (Lambert 1993). During this period the catch of cod in 4Vn comprised both Gulf and resident cod, although the 4T cod made up the bulk, being a much larger stock. Thus, unknown quantities of 4Vn cod were being caught during the overwintering period. Furthermore, the dragger fleet which had traditionally caught most of its catch between May and October began to transfer its activities toward the latter part of the year to exploit migrant cod. The effect was to maintain the overall catch for 4Vn even as the abundance of resident fish fell (Lambert & Wilson 1994). Information on the overwintering migration of Gulf of St. Lawrence (4T) cod into the Sydney Bight area was reviewed in the spring of 1994. From patterns of commercial fleet movements and results of tagging studies it was clear that many 4T cod had departed the Gulf by mid November and probably all by December. Therefore it was decided to modify the 4Vn management unit definition by shortening the assessment period from May to December to May to October, inclusive.

With the closure of the fishery, information on the status of the stock is now largely limited to two sources; the DFO July groundfish survey and a "Sentinel" survey operated by commercial longliners in June and September (Lambert 1995). Additional data are to be found from commercial bycatch port samples and a limited DFO inshore survey of the western half of Sydney Bight.

This report will provide information on landings of cod taken as bycatch during 1994 and summarise the findings of research surveys carried out by DFO and the fishing industry in that year.

## COMMERCIAL CATCH

Fifty-four tonnes of cod were taken as bycatch in 4Vn between May 1 and October 31, 1994 (Fig 1 and see also Appendix A for an historical time series of landings by gear type back to 1970). The bulk of this bycatch was caught along with redfish and flatfish (see Appendix B). Large tonnage otter trawlers and small tonnage class seiners took 49% and 29% of the cod bycatch respectively (Table 1)

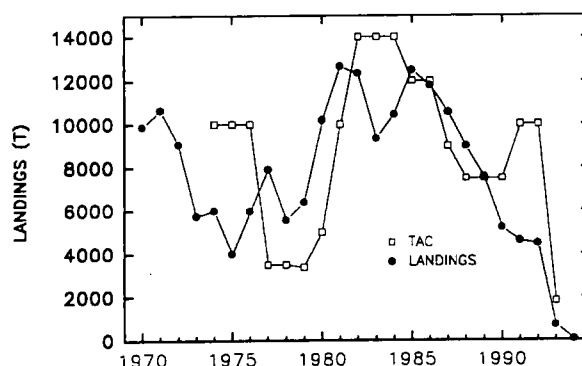


Fig. 1. Annual landings and corresponding TAC's for 4Vn cod.

Table 1. Nominal catch of cod in 4Vn (May to October, 1994) by tonnage class and gear type.

TONNAGE	OTTER TRAWL	SEINE	LONGLINE	HANDLINE	OTHER	TOTAL
0-24.9	0.2	10.8	0.3	2.4		13.7
25-49.9	0.1	4.7	2.4			7.2
50-149.9	7.7	<0.1				7.8
150-499.9	0.3					0.3
500-999.9	18.1					18.1
1000+						
Unknown		0.2	1.4	5.5	<0.1	7.1
TOTAL	26.4	15.6	4.1	7.9	<0.1	54.1

The distribution of the catch by month in 1994 is found in Table 2. The highest amount of cod was landed in August and lowest in September. However, it should be noted that 13.6 tonnes of cod were taken by the Sentinel survey (see later section) between September 20 and October 8.

Table 2. Nominal catch (1994) of 4Vn cod landed by month and gear.

GEAR	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	TOTAL
Longline	1.0	1.7	<0.1	0.3	0.3	0.8	4.1
Handline	0.5	1.9	0.5	0.5	1.6	2.9	7.9
Otter trawl	0.8	1.7	4.9	12.1	1.7	5.2	26.4
Seine	7.2	5.8	2.3	0.2	<0.1	0.1	15.6
Other				<0.1			
TOTAL	9.5	11.1	7.8	13.1	3.6	9.0	54.1

Normally the commercial catch is analysed and characterised according to a number of biological indices such as mean length, weight and age; however, this was not done due to the small size of catch and also due to the difficulty of comparing indices derived from cod bycatch to the longer time series derived from directed cod catch.

## JULY GROUND FISH SURVEY

The July survey is notoriously variable due to low numbers of sets and also no doubt due to high natural variability. Although the greatest mixing of stocks in 4Vn occurs in the winter, there appears to be mixing of cod stocks in this area during all months of the year. Whereas judging the stock status by this index in any given year would be rash given this variability, trend lines plotted through a number of years appear to accurately reflect real changes in abundance.

The RV survey abundance index continues to fall (Fig 2). As has often been the case for this time of year, no cod were caught in the deep water stratum and most cod were taken in the

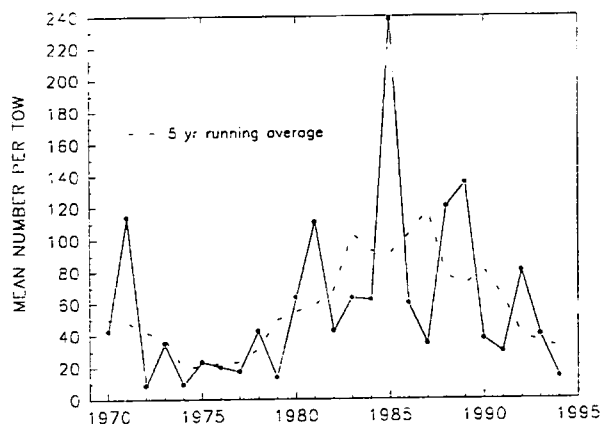


Fig 2. Abundance of 4Vn cod - July groundfish research survey.

mid-depth stratum and, as is often the case in this subdivision, mostly from one set. The bulk of the catch in 1994 was made up the 1987 and 1989 year-classes (Fig 3). The historical time series

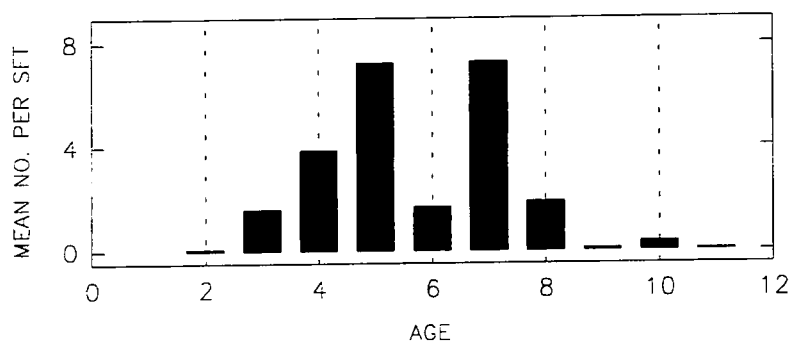


Fig 3. Age frequency of 4Vn cod - July 1994 groundfish research cruise.

of catch per set by age can be found in Appendix C. The average length of cod caught was about 50 cm. and the length frequency distribution was more or less unimodal. Very few fish over 60 cm were taken (Fig 4), which has been the case since the late eighties.

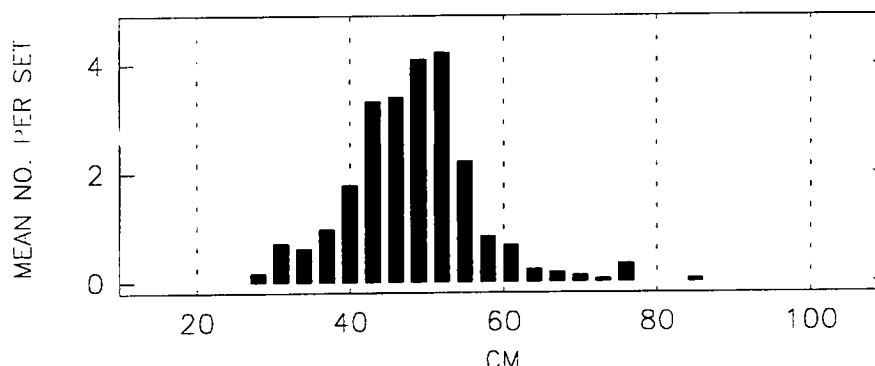


Fig 4. Length frequency of 4Vn cod - July 1994 groundfish research cruise.

### INSHORE SURVEY

A two-part inshore survey was begun in Sydney Bight in 1991; an ichthyoplankton component was abandoned early in 1992 due to reduction of funding but a bottom trawl program has continued at a reduced level until present. The trawl survey has consistently found 0-group and 1 year-old cod in the Bird Island area. These fish are present in the area from at least May to October after which time they disappear and presumably move to deeper water to overwinter. The 4Vn inshore survey is an important adjunct to the July groundfish survey since it can provide additional information. The latter does not provide good evidence of the presence of young cod because it does not sample the shallow water area favoured by these juveniles. Although too early to tell, it is probable the inshore survey will be able to provide a good recruitment index.

In September 1994, the numbers of one year-old cod (1993 year-class) were the highest in the short time series (Fig 5). Their length frequency mode was at 12 cm. (Cod 16 cm and less are counted as one year-olds for this index.) In addition, these small fish were found over a larger area.

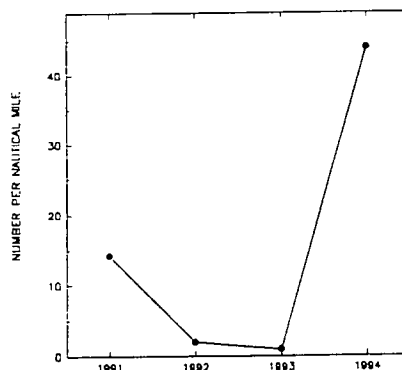


Fig 5. Recruitment index (1 yr-old cod)

## SENTINEL SURVEY

This survey forms an adjunct to DFO groundfish surveys that have been carried out in this area during the past two decades. Conducted by the fishing industry (inshore fixed gear) under DFO Science direction, its primary goal is to provide an index of abundance of the 4Vn cod stock. In addition, good information on distribution of cod and other groundfish species is collected. It also fulfills the desire of the inshore fishing industry to take an active role in the determination of the status of the 4Vn cod stock while providing information to the DFO that it would be unable to obtain with its own resources. Having to monitor the entire Scotian Shelf, the DFO groundfish survey cannot afford to expend much effort in 4Vn which is the smallest of the NAFO statistical subdivisions. In recent years about 15 of the 100 plus sets made on the eastern half of the Shelf are done in 4Vn. This low number is a contributing factor to the high variability seen in the survey abundance index for 4Vn. In contrast, the high resolution afforded by the sentinel survey (up to 60 sets) should alleviate this problem and provide a more stable and reliable index.

An inaugural sentinel survey carried out during September in 4Vn by commercial longliners followed a random design stratified by depth, similar to that used by the July groundfish survey. The area surveyed by the sentinel survey was the same with the exception of there being no sets over 100 fathoms and the stratification schemes being slightly different. The July survey uses three strata: <50 fath., 50 - 100 fath., and >100 fath. The sentinel survey also employs three strata; however, the deep stratum was dropped, the mid-depth was retained and the shallow stratum was divided in two. Hence the sentinel strata are; <30 fath., 30 to 50 fath. and 51 to 100 fath. Over the 19 day survey period (September 20 to October 8), 13,634 kg of cod were taken in 4Vn. The average catch rate of cod over this period was 110.5 kg/1000 hooks. Only ten of 54 sets made could be considered good; that is, in excess of 500 kg/1000 hooks. As was the case for the July survey, most of the fish caught by the sentinel survey were taken in the 51 to 100 fathom stratum (Fig 6). The highest concentrations of cod were found on Smokey Bank with the next highest being north-east of Scaterie Bank in the extreme east of the survey area (Fig 7).

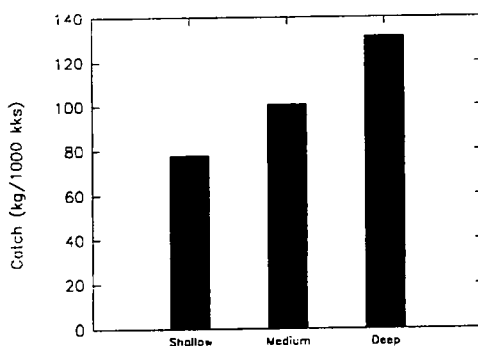


Fig 6. Mean catch of cod by stratum.

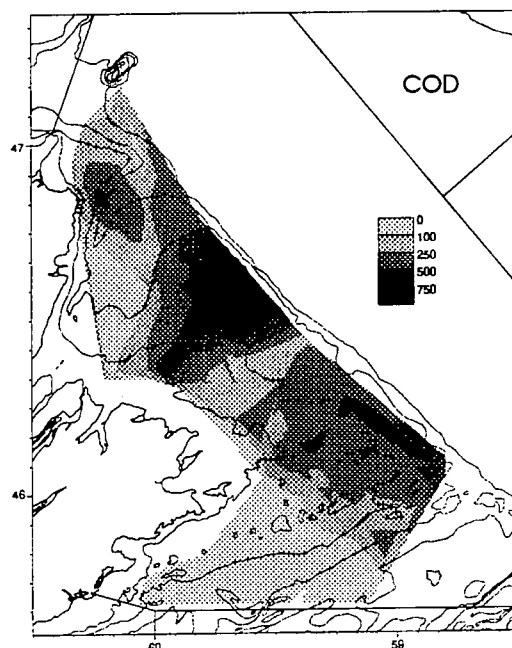


Fig 7. Cod Abundance (kg per set)

Verification of cod distribution as indicated by the sentinel survey came from the annual September 4T (Gulf of St. Lawrence) groundfish trawl survey, which in 1994 was extended into 4Vn. The distributional pattern of cod in Sydney Bight as seen by the trawl survey mirrored that of the longline survey.

The length frequency of cod caught in the sentinel survey was similar to that of caught in the July RV survey (Fig 8). Both curves were unimodal but the mode in the sentinel survey catch was at a length about 3 cm smaller. It is probable this is because the longline survey had many more sets in shallower water where the cod are younger. A disaggregation of total length frequency by stratum, did indeed show this.

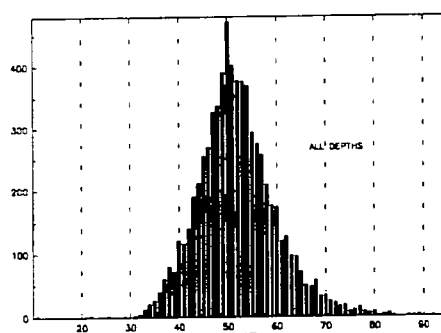


Fig 8. Length frequency of cod (all strata)



The potential of the sentinel survey for providing an index of abundance appears good. With the addition over time of more data collected in an equally rigorous manner, an invaluable time series could be developed. However, only if maintained on an annual basis will this survey achieve its potential of becoming a useful tool in the evaluation of the status of this stock.

## **CONCLUSIONS**

The July RV survey index continued its downward trend and showed no sign of incoming year-classes of any note. During September later that year, the abundance of cod was similar when monitored by an extension of the annual 4T cod survey. In the same month a longliner sentinel survey showed a similar distribution of cod to the RV trawl survey. The future of this stock looks bleak at present; until there is substantial recruitment there can be no thought of reopening the fishery. Certainly, the first signs of a good year-class are likely to be seen in the inshore survey first. The July RV and the longline survey so not sample juvenile cod well; the former due to set location and the latter due to hook size. It is to be hoped that within a few years the inshore survey will produce information upon which to establish a reliable recruitment index which can provide advance notice of the arrival of a good year-class.

## **ACKNOWLEDGEMENTS**

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## **REFERENCES**

- Lambert, Timothy C. 1993. The timing of the winter migration of 4T cod into 4Vn. DFO Atl. Fish. Res. Doc. 93/25; 24pp.
- Lambert, T.C. and S. Wilson. 1994. Update of stock status of 4Vn cod: 1992-1993. DFO Atl. Fish. Res. Doc. 94/46 23p.
- Lambert, Timothy C. 1995. The first report of the 4Vn Sentinel Survey autumn 1994: A government/industry cooperative venture. DFO Atl. Fish. Res. Doc. 95/107 52pp.

**Appendix A.** Nominal catch (tonnes) of 4Vn cod (May to December) by gear type.

YEAR	OTTER TRAWL	SEINE	LOGLINE	HANDLINE	MISC.	TOTAL
1970	4,859	83	3,229	495	1,222	9,888
1971	5,308	109	3,728	696	790	10,631
1972	4,418	121	3,185	286	1,094	9,104
1973	2,099	143	1,982	404	1,120	5,748
1974	2,842	138	1,469	568	967	5,984
1975	1,851	100	875	360	812	3,998
1976	4,375	83	620	310	569	5,957
1977	4,613	554	1,805	595	354	7,921
1978	1,600	326	3,035	466	122	5,549
1,979	624	278	4,483	640	349	6,374
1980	1,150	561	6,440	1,820	219	10,190
1981	1,488	557	9,801	741	61	12,648
1982	2,785	724	7,287	1,360	177	12,333
1983	2,448	863	5,101	924	26	9,362
1984	3,344	1,112	4,831	1,112	45	10,444
1985	5,081	1,162	4,823	1,408	20	12,494
1986	3,552	1,258	5,764	1,182	15	11,771
1987	2,034	1,285	6,369	848	16	10,552
1988	1,377	1,109	5,858	626	31	9,001
1989	2,129	851	3,610	718	157	7,465
1990	2,029	593	1,889	591	8	5,110
1991	p 2213	694	1,249	389	49	4,602
1992	p 2629	468	1,043	232	88	4,461
1993	p 138	60	406	77	21	702
1994*	p 26	16	4	8	<1	54

\* Redefinition of assessment period: Summed over six months (May to October)

p Preliminary statistics.

**Appendix B.** Detailed summary of cod bycatch (tonnes) by dominant species occurring in catch.

MAIN SPECIES	OTTER TRAWL	SEINE	LONGLINE	HANDLINE	OTHER	TOTAL
<b>Cod</b>	1.6		0.8	6.4	<0.1	8.8
<b>Haddock</b>				0.8		0.8
<b>Redfish</b>	8.7	0.2				8.9
<b>Halibut</b>			0.7			0.7
<b>Plaice</b>		1.4				1.4
<b>Witch Fl.</b>	0.1	4.4				4.5
<b>Unknow Fl</b>	0.2	9.6				9.7
<b>Pollock</b>	15.5					15.5
<b>White Hake</b>		0.1	1.7	0.1		1.9
<b>Mackerel</b>				0.6		0.6
<b>Mack. Shark</b>			0.1			0.1
<b>Unknown</b>	0.3		0.9			1.2
<b>TOTAL</b>	26.4	15.6	4.1	7.9	<0.1	54.1

**Appendix C. Research vessel abundance indices (mean number per tow and mean weight per tow) by age group fo 4Vn cod.**

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	NK	NO TOW	KG TOW
1970	0	6.35	1.77	4.78	10.9	10.46	4.5	2.59	0.84	0	0.29	0.14	0.13	0.21	42.96	57.47
1971	0	1.17	42.4	10.09	26.51	16.16	10.65	3.59	1.97	0.54	0	0	0.56	0.4	114.05	128.2
1972	0	0.52	0.28	2.35	0.3	1.61	1.47	0.39	0.27	0.25	0.19	0	0.37	0.37	8.39	22.12
1973	0	0	2.62	4.48	18.59	0.73	3.06	2.91	0.46	0.22	0	0	0	0.22	35.28	52.58
1974	0	0	0.61	1.36	2.79	3.21	0.4	0.5	0.26	0.22	0.11	0	0	0	9.47	14.44
1975	0	0.61	6.42	8.58	4.65	0.81	1	0.58	0.21	0.33	0	0.11	0	0.16	23.47	22.12
1976	0	6.49	2.25	1.48	1.93	1.55	0.73	1.79	1.65	1.41	0.24	0.23	0.47	0	20.21	43.41
1977	0	0.25	6.26	4.01	2.74	1.9	0.72	0.21	0.24	0.14	0.21	0.24	0.15	0.09	17.16	24.58
1978	0	0.66	9.13	19.31	5.54	4.38	1.53	1.17	0.44	0.43	0	0	0.11	0.12	42.84	67.55
1979	0	1.3	0.79	5.15	2.51	0.59	1.72	0.56	0.29	0.15	0	0.17	0.45	0	13.66	27.58
1980	0	1.88	10.52	3.97	23.58	16.4	5.15	1.16	0.45	0.37	0.37	0	0	0	63.84	85.55
1981	0.33	4.36	16.91	36.48	12.02	25.45	11.5	1.26	0.93	0.86	0.24	0.16	0.31	0.17	110.98	161.81
1982	0	2.53	1.74	5.77	10.22	7.61	9.25	3.41	1.32	0.45	0.1	0.23	0	0.1	42.73	74.82
1983	0	4.37	22.11	7.9	10.64	10.04	1.7	3.41	1.52	0.66	0.25	0	0.43	0.27	63.3	78.6
1984	2.83	7.25	10.02	10.48	13.51	8.75	3.58	1.81	1.58	0.85	0.32	0.41	0.46	0.28	62.14	102.3
1985	0	0.48	3.75	19.1	125.9	52.13	22.38	7.26	1.44	0.77	0.67	0	0.37	3.63	237.94	295.97
1986	0	1.33	6.36	11.13	8.11	17.55	6.38	4.92	2.17	1.02	0.55	0.1	0.22	0.09	59.93	83.83
1987	0	0.21	3.7	4.14	5.13	8.89	6.63	2.8	1.18	0.62	0.97	0.31	0	0.08	34.66	49.21
1988	0.61	0.55	2.49	17.05	13.18	31.89	26.45	18.93	6.24	1.7	0.5	0.24	0.32	0.23	120.39	171.24
1989	0	4.6	4.39	11.6	29.76	17.64	32.08	25.53	8.25	1.3	0.33	0	0	0	135.47	177.77
1990	0	0.24	15.07	9.03	3.29	3.87	2.05	2.29	0.73	0.81	0.13	0.09	0.05	0.05	37.68	35.11
1991	0.27	1	0.5	11.1	5.34	3.21	0.74	0.7	0.14	0.3	0.3	0	0.06	0	23.66	25.23
1992	0	0.66	3.44	5.13	44.36	15.15	4.88	3.66	1.31	0.82	0.23	0.4	0.3	0	80.34	105.59
1993	0	0.4	3.18	6.18	5.7	14.67	7.36	1.74	0.5	0.05	0.06	0.07	0	0	39.96	47.67
1994	0	0.08	1.57	3.87	7.22	1.66	7.28	1.88	0.08	0.34	0	0	0	0.05	24.04	25.09