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**4Vn Cod (May to December): Status review  
for the 1989 fishing year**

by

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#### ABSTRACT

The status of the 4Vn cod stock (May to December) was reviewed for the 1989 fishing year. Evidence of higher mixing than usual in 1989 with cod from the Gulf of St. Lawrence (4T) precluded analytical assessment due to violation of a basic assumption of SPA. However, the research survey index suggests that the population is supporting the present fishing effort with no adverse effects. Indications of good incoming year-classes give an optimistic outlook for this fishery.

#### RÉSUMÉ

On a procédé à une étude du stock de morue de la division 4Vn pour l'année de pêche 1989 (mai-décembre). Un mélange avec le stock de morue du golfe Saint-Laurent (4T) apparemment supérieur à la normale ayant faussé les hypothèses fondamentales d'ASP, on n'a pu effectuer d'évaluations analytiques. Toutefois, d'après les indices des missions de recherche, il apparaît que la population peut sans difficulté supporter l'effort de pêche actuel. Des indications de recrutement futur de bonnes classes d'âge permettent d'être optimistes quant à l'avenir de cette pêche.

## INTRODUCTION

The cod fishery in NAFO subdivision 4Vn (Sydney Bight) is managed as two stocks at different times of the year. From January to April large aggregations of 4T (Gulf of St. Lawrence) cod overwinter in this area and catches during this period are considered to be comprised mainly of these Gulf fish. After the return migration to the Gulf near the end of April, the fishery for cod in 4Vn is presumed to exploit a resident stock. This report summarizes the information available for this latter stock; that is, the cod fishery from May to December, inclusive.

This fishery has been closely controlled in recent years with trip limits and bycatch allowances imposed on all size vessels, both mobile and fixed gear, during the entire fishing season (see Appendix for 1989 catch controls). These management constraints have kept catch at or below 10,000 tonnes for the last three years. This year, with the addition of catch information derived from observer reports (1982, 1983) to the beginning of the existing time series, eight years of catch-at-age data were available. However, extensive stock mixing (with 4T cod) during the May - December period precluded formal analytical assessment using this extended data set. While it is not possible to estimate fishing pressure on this stock, evidence from research surveys and biological stock parameters suggest it can support current fishing levels with no adverse effects.

## NOMINAL CATCH

Annual nominal catches for Canada and other countries, together with associated TACs over the period 1970 to 1990, are presented in Table 1. The annual totals of these landings are compared to the corresponding TACs in Fig. 1. Landings have decreased over the last four years probably due mainly to management controls. The TAC for this year and last (1988) was set at 7500 tonnes, and whereas last year the TAC was overrun by 1518 tonnes, the allocation schedule this year managed to constrain landings to this target level. The contribution by gear type to the total catch by all countries over the past 20 years is presented in Table 2 and Fig 2. The Canadian catch for the last two years is broken down on the basis of tonnage class by gear type, and gear type by month in Tables 3 and 4. Since the implementation of Canadian jurisdiction 12 years ago, longliner catch has exceeded trawler catch (mean values 57% and 22%, respectively), except for 1985 when landings were equal. This year, 1989, longliners and otter trawlers contributed 47% and 29%, respectively to total landings in 4Vn. Small boats (TC 1) took the bulk of the catch for both types of hook and line fishery; whereas, TC 2 vessels took most of the catch for the trawl and seine fishery. Two catches, coded as "Newfoundland gillnet" in the statistical data, were mainly responsible for the rather large entry of 136 tonnes for TC 3, "other" type fishing gear (Table 3); this is unusual and requires verification. The monthly pattern of catch was typical for the area, with the largest landings occurring in May and December, at the beginning and end of the season.

## RESEARCH SURVEY

Abundance-at-age as derived from July research surveys over the past 20 years is presented in Table 5. Total abundance and biomass indices for the same period are shown in Fig. 3. The rising trend seen last year was continued with number and weight per tow reaching 135.47 and 177.77 kg, respectively. However, the bulk of this increase could be ascribed to one alone of the total of 18 sets made in 4Vn. This large set in stratum 41 (51 to 100 fm) captured 1489.4 cod

(corrected for distance towed) weighing a total of 2070.2 kg. If this large set is omitted from the data set the abundances indices become 25.61 (mean no./tow) and 23.61 kg (mean wt/tow). Although high variabilities of the mean catch per tow (Table 6) are unavoidable with the low number of sets taken in this subdivision, it is highly probable that abnormally large sets are more a reflection of local aggregations due to preferred hydrographic conditions than of the result of an increase in overall abundance (Smith and Lambert 1989, Smith 1990).

As was seen in the 1988 survey, the 1982 year-class continues to be dominant. In the 1989 survey, the second and third largest year-classes are 1984 and 1981, respectively.

#### COMMERCIAL CATCH AT AGE

Table 7 provides details on the data used to estimate the age composition of the commercial catch. As mentioned earlier, the catch at age series was extended backwards by including data from 1982 and 1983 derived from observer data on otter trawl catch. As in previous assessments, age composition of handline catch was considered equivalent to that of longlines; similarly, that of seiners was presumed the same as otter trawlers. Thus it was possible to partition the catch between a summer and an autumn period by using one gear as a proxy for the other when biological samples were not available for the catch of a specific gear.

Observer sample data is not equivalent to port sample data since the former describe catch set by set whereas the latter describe the landings of a trip, or an aggregation of sets. Therefore, observer length frequency information for individual sets was combined and a grand mean calculated by first weighting by set catch and secondly weighting by trip catch.

The total catch, disaggregated by age and by major gear, is given in Table 8(a). The disproportionate catch of older fish over younger fish by longliners relative to trawlers is clearly evident in Fig 4. The dominant year-class for the former is 1982 (7 yr olds) but 1984 (5 yr olds) for the latter. When all gears are combined (Table 8(b)) the dominant group in 1989 is age 5. Although the strong year-class of 1980 appears this year as the highest number of nine-year-olds to occur during the eight-year period, it now comprises only 9% of the total catch in numbers, down from 37% in 1986. Cod less than 6 years old now make up 35% of the total catch; the numbers of 3 and 4 year-olds are by far the largest in the time series.

#### CATCH PER UNIT EFFORT

Much of the catch continues to be reported without associated effort information. For the major gear sector, longliners, the number of trips in which effort was recorded along with catch have averaged less than 7% over the last ten years.

#### ESTIMATION OF STOCK PARAMETERS

An analytical assessment was attempted using the ADAPT framework developed by Gavaris (1988). Using research vessel catch at age series (1982 to 1989), a number of formulations were tested with less than satisfactory results. Parameter estimates were marginally significant at best, and age by age plots of predicted versus observed abundance indicated a very poor fit of the SPA model. In the past the failure of analytical methods was assumed to be due to the brevity of the catch at age time series; however, with the addition this year of three years of data the situation has not improved. Clearly other factors are involved in the failure of the analytical analysis.

One obvious shortcoming is the variability of the research vessel catch. Subdivision 4Vn is small relative to other subdivisions which also must be surveyed; hence, of necessity, the number of sets that can be made here is limited. As a result one or two very large (or small) sets can have a large influence on the mean catch. Also the intermixing of cod stocks in the region presents another major problem that can seriously distort the catch at age.

#### STOCK MIXING PROBLEM

Cod from the Gulf of St. Lawrence (4T) overwinter in Sydney Bight (4Vn) and presumably dominate the cod catch there during January to April, inclusive. This migration has been well documented by a number of tagging studies carried out over the past 60 years (see McKenzie 1956 for summary of early work). Therefore, for the purposes of management, the catch between May and December is assumed to be comprised mainly of a resident 4Vn stock. However, there is evidence that Gulf cod sometimes arrive in the Bight early and/or leave late. Thus catch at either end of the 4Vn season can be seriously 'contaminated' by 4T cod. Furthermore, tag returns indicate that not all cod leave 4Vn to return to the Gulf in the summer. Sinclair and Smith (1984) have shown that significant numbers of Gulf cod remain in subdivision 4Vn during the summer; 9.3% of returns from tagging in the Gulf (1979 - 1981) were from 4Vn during the May to December period.

In addition to mixing with Gulf cod, 4Vn cod are also intermingled with 4Vs cod during the summer. This is harder to detect since these cod do not differ noticeably in length-at-age. However, tagging returns clearly indicate movement between Sydney Bight and eastern Scotian Shelf banks, and in particular Banquereau. McKenzie (1956) reported that cod tagged off Glace Bay in July and August were returned during winter months from Banquereau, and to a lesser extent, Misaine and Sable Island Banks. This was confirmed by Martin and Jean (1964) who tagged cod on Banquereau Bank during the winter and recovered them in 4Vn during the summer.

This year, from a variety of sources, there was considerable evidence of stock mixing. Fishermen reported that large quantities of small fish had appeared in the Bight by early December (Gulf cod are considerably smaller at age than cod on the Scotian Shelf). Weight-at-age (Table 9) and length-at-age (Table 10) values calculated from commercial sample data support this. Ages 5 to 11 in 1989 were substantially lighter than the corresponding ages a year earlier; in fact ages 9 to 11 (1989) weighed less than their average weights the year previous (i.e. ages 8 to 10 in 1988). The same pattern is evident in the length-at-age data. Nearly one half the port samples of the commercial catch were taken in November and December so it is likely the mean May to December values in Tables 9 and 10 are biased toward the characteristics of fish present at the end of the year. Growth curves constructed with these age and length data representing cod present in 4Vn in summer and fall differed significantly. The growth characteristics of those present in the latter part of the season did not differ significantly from those of 4T cod. However, it appears 4T cod were present in 4Vn during the summer months as well. Although their numbers were no doubt substantially lower than later in the year, they were sufficient to affect the age-at-length of cod taken in the research survey which was conducted in July (Table 11). The same pattern of smaller lengths-at-age as was seen in the commercial catch (whole season) is evident in the summer survey data too. The same anomaly of apparent negative growth is present in research cruise data; cod decrease about 4 cm in size between ages 7 and 8.

## STATE OF THE STOCK

Obviously any form of assessment based on VPA would give misleading results if applied to an unknown blend of populations. If the mixing of immigrant stocks with the resident were rare or predictable, remedial action could be taken in the form of exclusion of 'contaminated' data, or by application of corrective factors. Mixing of cod populations in this area occurs regularly, but unfortunately, to an unknown degree. Only when it surpasses some threshold level does it become conspicuous, as this year, 1989 and probably in 1984. Thus it is not possible to produce any reliable estimate of fishing mortality, not only by VPA, but neither by total mortality (Z) calculations based on biomass changes between years.

As noted earlier, catch rate information for this fishery is scarce and how representative it is of the whole fleet is unknown. The best index we have of the well-being of the stock comes from the groundfish research cruise data. Despite the annual variability in catch (Fig. 3) there is no indication of a downward trend; in fact a moving average of these data reveal an upward trend (Fig. 5). Much of the catch in 4Vn over the past six years has been provided by the exceptional 1980 year-class though, and with its inevitable demise perhaps this trend will not be sustained. However, as Table 8b and Fig. 6 indicate, the 1984 and 1985 year-classes show promise.

The catch in this fishery has averaged about 10,000 tonnes over the past ten years and there is no reason to believe that the present TAC of 7,500 cannot be sustained.

## ACKNOWLEDGEMENTS

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Table 1. Nominal cod catch (t) by country in Subdivision 4Vn (May–Dec.) and annual Total Allowable Catch (TAC).

Year	Canada	France	Spain	Portugal	Others	Total	TAC
1970	8701	34	1141	–	12	9888	–
1971	8469	1	2161	–	–	10631	–
1972	6729	745	1171	459	–	9104	–
1973	5245	–	241	189	73	5748	–
1974	4836	–	852	84	212	5984	10000
1975	3363	–	89	360	186	3998	10000
1976	5746	211	–	–	–	5957	10000
1977	7786	135	–	–	–	7921	3500
1978	5496	53	–	–	–	5549	3500
1979	6301	73	–	–	–	6374	3400
1980	9976	214	–	–	–	10190	5000
1981	12476	172	–	–	–	12648	*
1982	12101	232	–	–	–	12333	**
1983	9192	170	–	–	–	9362	14000
1984	10443	–	–	–	1	10444	14000
1985	12491	–	–	–	3	12494	12000
1986	11766	4	–	–	1	11771	12000
1987 <sup>1</sup>	10248	–	–	–	< 1	10248	9000
1988 <sup>1</sup>	9018	–	–	–	< 1	9018	7500
1989 <sup>1</sup>	7569	–	–	–	–	7569	7500
1990							7500

\* initially set at 7500 t, increased in September to 10,000 t.

\*\* initially set at 10500 t, increased November 1 to 14,000 t.

<sup>1</sup> Preliminary statistics

Table 2. Nominal catch (t) of cod in Subdivision 4Vn (May–December) by gear type for all countries, 1970–1989.

Year	Otter Trawls	Seines	Longlines	Handlines	Misc.	Total
1970	4859	83	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	2448	863	5101	924	26	9362
1984	3344	1112	4831	1112	45	10444
1985	5081	1162	4823	1408	20	12494
1986	3552	1258	5764	1182	15	11771
1987 <sup>1</sup>	1867	1185	6272	842	82	10248
1988 <sup>1</sup>	1323	1091	5888	623	93	9018
1989 <sup>1</sup>	2202	865	3603	709	190	7569

<sup>1</sup> Preliminary statistics.



Table 3. Nominal catch of cod by Canadian vessels in 4Vn (May–Dec.) by tonnage class and gear. Percentage of gear total catch by tonnage class is in parentheses.

Tonnage (GT)	Otter Trawls	Seines	Longlines	Handlines	Other	Total
1988						
0–24.9	45 ( 3)	481 (44)	4272 (73)	602 (97)	26 (28)	5426
25–49.9	516 (39)	551 (51)	1397 (24)	21 ( 3)	49 (53)	2534
50–149.9	353 (27)	59 ( 5)	40 ( 0)	–	17 (18)	469
150–499.9	155 (12)	–	179 ( 3)	–	–	334
500–999.9	241 (18)	–	–	–	–	241
1000+	13 ( 1)	–	–	–	1 ( 1)	14
<b>Total</b>	<b>1323</b>	<b>1091</b>	<b>5888</b>	<b>623</b>	<b>93</b>	<b>9018</b>
1989						
0–24.9	121 ( 5)	363 (42)	2855 (79)	708 (> 99)	37 (19)	4075
25–49.9	1032 (47)	485 (56)	740 (21)	1 (< 1)	37 (19)	2274
50–149.9	284 (13)	17 ( 2)	8 (< 1)	–	136 (72)	445
150–499.9	126 ( 6)	–	–	–	–	445
500–999.9	639 (29)	–	–	–	–	639
1000+	< 1 (< 1)	–	–	–	–	< 1
<b>Total</b>	<b>2202</b>	<b>865</b>	<b>3603</b>	<b>709</b>	<b>190</b>	<b>7549</b>

Table 4. Nominal catch (Canada) for the cod fishery in 4Vn (May–December) by month and year.

a) 1988

Gear	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
Longlines	866	486	676	792	981	1174	693	220	5888
Handlines	7	24	214	218	92	46	20	2	623
Otter Trawls	690	128	40	33	177	63	55	137	1323
Seines	521	284	183	35	30	19	13	6	1091
Shrimp Trawl	2	6	4	–	–	5	1	–	18
Other	47	3	2	21	–	2	–	–	75
<b>Total</b>	<b>2133</b>	<b>931</b>	<b>1119</b>	<b>1099</b>	<b>1280</b>	<b>1309</b>	<b>782</b>	<b>365</b>	<b>9018</b>

b) 1989

Gear	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
Longlines	492	478	310	367	536	708	675	37	3603
Handlines	3	49	163	199	182	98	14	1	709
Otter Trawls	826	143	99	82	87	42	69	854	2202
Seines	395	269	20	7	19	14	58	83	865
Shrimp Trawl	1	3	< 1	–	–	< 1	–	–	4
Other	89	78	1	1	17	–	< 1	–	186
<b>Total</b>	<b>1806</b>	<b>1020</b>	<b>593</b>	<b>656</b>	<b>841</b>	<b>862</b>	<b>816</b>	<b>975</b>	<b>7569</b>

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

Year	AGE														No. tow	Kg. tow
	1	2	3	4	5	6	7	8	9	10	11	12	13+	UK		
1970	-	6.35	1.77	4.78	10.90	10.46	4.50	2.59	0.84	-	0.29	0.14	0.13	0.21	42.96	57.47
1971	-	1.17	42.40	10.09	26.51	16.16	10.65	3.59	1.97	0.54	-	-	0.56	0.40	114.05	128.20
1972	-	0.52	0.28	2.35	0.30	1.61	1.47	0.39	0.27	0.25	0.19	-	0.37	0.37	8.39	22.12
1973	-	-	2.62	4.48	18.59	0.73	3.06	2.91	0.46	0.22	-	-	-	0.22	35.28	52.58
1974	-	-	0.61	1.36	2.79	3.21	0.40	0.50	0.26	0.22	0.11	-	-	-	9.47	14.44
1975	-	0.61	6.42	8.58	4.65	0.81	1.00	0.58	0.21	0.33	-	0.11	-	0.16	23.47	22.12
1976	-	6.49	2.25	1.48	1.93	1.55	0.73	1.79	1.65	1.41	0.24	0.23	0.47	-	20.21	43.41
1977	-	0.25	6.26	4.01	2.74	1.90	0.72	0.21	0.24	0.14	0.21	0.24	0.15	0.09	17.16	24.58
1978	-	0.66	9.13	19.31	5.54	4.38	1.53	1.17	0.44	0.43	-	-	0.11	0.12	42.84	67.55
1979	-	1.30	0.79	5.15	2.51	0.59	1.72	0.56	0.29	0.15	-	0.17	0.45	-	13.66	27.58
1980	-	1.88	10.52	3.97	23.58	16.40	5.15	1.16	0.45	0.37	0.37	-	-	-	63.84	85.55
1981	0.33	4.36	16.91	36.48	12.02	25.45	11.50	1.26	0.93	0.86	0.24	0.16	0.31	0.17	110.98	161.81
1982	-	2.53	1.74	5.77	10.22	7.61	9.25	3.41	1.32	0.45	0.10	0.23	-	0.10	42.73	74.82
1983	-	4.37	22.11	7.90	10.64	10.04	1.70	3.41	1.52	0.66	0.25	-	0.43	0.27	63.30	78.60
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	102.30
1985	-	0.48	3.75	19.10	125.95	52.13	22.38	7.26	1.44	0.77	0.67	-	0.37	3.63	237.94	295.97
1986	-	1.33	6.36	11.13	8.11	17.55	6.38	4.92	2.17	1.02	0.55	0.10	0.22	0.09	59.93	83.83
1987	-	0.21	3.70	4.14	5.13	8.89	6.63	2.80	1.18	0.62	0.97	0.31	-	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	1.70	0.50	0.24	0.32	0.23	120.39	171.24
1989	-	4.60	4.39	11.60	29.76	17.64	32.08	25.53	8.25	1.30	0.33	-	-	-	135.47	177.77

Table 6. 4Vn Cod (May–December): Standard errors of research vessel stratified mean catch per tow for those ages used in the calibration of the SPA.

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Age	1982	1983	1984	1985	1986	1987	1988	1989
3	1.00	11.31	3.83	1.40	3.40	1.11	.97	1.02
4	3.33	2.82	5.77	16.37	3.27	.95	7.58	9.20
5	5.23	2.66	7.04	113.94	1.00	1.00	6.16	25.32
6	3.03	2.63	4.48	45.96	1.98	1.59	14.69	15.66
7	3.27	.36	1.85	18.79	1.13	1.05	11.37	28.57
8	1.11	.64	1.21	5.19	1.51	.46	7.86	22.69
9	.39	.53	.98	1.04	.84	.28	2.34	7.28
10	.26	.38	.68	.53	.63	.16	.66	1.10
11	.04	.15	.32	.35	.17	.19	.30	.33

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Table 7. Data used to generate the 1982, 1983 and 1989 catch at age estimates for 4Vn Cod (May-Dec.).

7a) 1982. Length-weight parameters:  $a = 0.014543466$ ,  $b = 2.870058$ .

Gear	Time Period	No. of samples Length (age)	Number Measured	Number Aged	Catch (t)
Longlines	May-Aug.	6 (8)	2063	430	3784
	Sept.-Dec.	8 (9)	2301	455	3503
Handlines	May-Aug. <sup>1</sup>	0 (0)	0	0	699
	Sept.-Dec. <sup>1</sup>	0 (0)	0	0	661
Otter Trawls	May-Aug. <sup>2</sup>	0 (0)	0	0	646
	Sept.-Dec.	18 (9)	2190	455	1827
Seines	May-Aug.	2 (8)	675	430	606
	Sept-Dec. <sup>3</sup>	0 (0)	0	0	118

<sup>1</sup> Used Longline samples.

<sup>2</sup> Used Seine samples.

<sup>3</sup> Used Otter trawl samples.

7b) 1983. Length-weight parameters:  $a = 0.01155461$ ,  $b = 2.934948$ .

Gear	Time Period	No. of samples Length (age)	Number Measured	Number Aged	Catch (t)
Longlines	May-Aug.	5 (7)	1694	408	2069
	Sept.-Dec.	20 (6)	7741	272	3032
Handlines	May-Aug. <sup>1</sup>	0 (0)	0	0	552
	Sept.-Dec. <sup>1</sup>	0 (0)	0	0	372
Otter Trawls	May-Aug.	3 (7)	1085	408	684
	Sept.-Dec.	10 (6)	2085	272	1523
Seines	May-Aug. <sup>2</sup>	0 (0)	0	0	690
	Sept-Dec. <sup>2</sup>	0 (0)	0	0	174

<sup>1</sup> Used Longline samples.

<sup>2</sup> Used Otter trawl samples.

7c) 1989. Length-weight parameters:  $a = 0.00812589$ ,  $b = 3.01788342$ .

Gear	Time Period	No. of samples Length (age)	Number Measured	Number Aged	Catch (t)
Longlines	May-Aug.	6 (7)	2040	342	1647
	Sept.-Dec.	10 (9)	3425	421	1956
Handlines	May-Aug. <sup>1</sup>	0 (0)	0	0	414
	Sept.-Dec. <sup>1</sup>	0 (0)	0	0	295
Otter Trawls	May-Aug.	3 (7)	347	342	1150
	Sept.-Dec.	7 (9)	1639	421	1052
Seines	May-Aug. <sup>2</sup>	0 (0)	0	0	691
	Sept-Dec. <sup>2</sup>	0 (0)	0	0	174

<sup>1</sup> Used Longline samples.

<sup>2</sup> Used Otter trawl samples.

Table 8a. 4Vn Cod (May–December): 1989 Numbers landed at age for by the major gears (thousands).

Age	Longline	Handline	Otter Trawl	Seines
1	0	0	0	0
2	0	0	0	0
3	11	2	29	17
4	113	19	235	106
5	398	67	528	195
6	409	72	380	124
7	440	90	277	118
8	317	60	154	58
9	247	49	120	45
10	87	18	34	13
11	29	6	9	4
12	8	2	3	1
13	4	1	0	0
14	5	1	1	0
15	2	1	0	0

Table 8b. 4Vn Cod (May–December): Numbers landed at age (thousands) for 1982–1989.

Age	1982	1983	1984	1985	1986	1987	1988	1989
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	39	25	14	18	4	21	35	61
4	358	222	394	152	222	125	364	485
5	1220	876	1146	1473	1086	853	567	1219
6	758	945	1591	1510	2226	1124	1011	1010
7	1406	538	927	1648	1126	1492	994	949
8	806	821	452	933	695	705	930	604
9	310	288	372	395	361	384	375	473
10	134	219	223	316	191	252	150	156
11	76	65	91	105	89	112	89	49
12	27	46	30	37	56	65	53	14
13	14	21	11	19	21	34	18	5
14	11	7	5	5	8	20	6	7
15	5	7	6	6	5	7	6	3

Table 9. 4Vn Cod (May–December): Average weight (kg) at age for total landings.

Age	1982	1983	1984	1985	1986	1987	1988	1989
1	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–
3	.60	.60	.51	.53	.53	.51	.53	.61
4	.93	.94	.79	.81	.86	.75	.82	.85
5	1.34	1.25	1.14	1.17	1.14	1.10	1.10	1.05
6	1.80	1.63	1.45	1.45	1.45	1.23	1.46	1.25
7	2.10	2.21	2.00	1.94	1.98	1.59	1.69	1.64
8	3.00	2.47	2.38	2.26	2.42	2.21	2.07	1.83
9	3.99	3.67	2.77	2.94	2.95	2.97	2.91	2.05
10	5.56	4.41	3.15	3.19	3.83	3.56	4.81	2.75
11	6.37	6.04	4.22	4.16	5.00	5.46	6.04	4.03
12	7.48	8.26	7.10	7.03	5.86	6.72	6.88	7.69
13	8.91	9.95	8.21	8.14	6.70	7.51	8.93	9.28
14	9.05	11.44	10.75	10.27	9.44	7.19	11.68	10.49
15	9.58	11.71	12.84	15.55	11.00	10.82	11.56	11.69



Table 10. 4Vn Cod (May–December): Average length (cm) at age for total landings.

Age	1982	1983	1984	1985	1986	1987	1988	1989
1	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–
3	40.53	40.39	39.11	38.83	38.87	39.17	38.22	41.16
4	47.32	47.05	45.02	44.90	45.89	44.38	44.34	46.02
5	53.70	51.98	50.90	50.67	50.53	50.47	48.94	49.33
6	59.49	56.81	54.67	54.94	54.95	52.39	53.96	52.30
7	62.75	63.02	60.24	61.00	61.16	57.12	56.76	57.25
8	71.07	65.50	63.35	64.63	65.54	63.77	60.79	59.40
9	78.46	74.93	69.17	67.97	70.22	70.37	68.20	61.69
10	88.14	79.75	71.10	70.88	76.80	74.77	80.93	67.92
11	92.38	88.80	77.69	78.07	84.21	86.23	87.48	77.10
12	97.70	98.79	92.65	92.65	88.96	92.43	91.44	95.54
13	103.84	105.25	97.29	97.19	93.17	95.91	99.94	101.67
14	104.41	110.38	105.17	106.22	104.94	94.52	109.50	105.88
15	106.52	111.24	120.81	112.63	110.62	108.35	109.10	109.78

Table 11. 4Vn Cod (May–December): Average length (cm) at age from research surveys.

Age	1982	1983	1984	1985	1986	1987	1988	1989
1	–	–	21.51	–	–	–	29.00	–
2	26.08	23.85	26.82	27.55	29.18	27.34	24.60	25.27
3	37.31	33.24	34.72	32.36	34.31	33.29	33.54	32.28
4	41.01	44.90	41.10	36.36	41.00	40.01	40.66	43.28
5	54.21	50.65	56.15	47.77	45.69	42.98	45.83	47.82
6	58.68	57.54	59.16	55.82	53.97	52.95	51.71	50.32
7	61.27	65.68	69.63	58.63	60.73	56.87	56.50	52.47
8	70.29	70.26	73.19	65.57	66.39	61.77	59.59	52.11
9	74.43	76.56	74.85	64.00	70.80	72.10	67.91	63.25
10	81.78	96.50	80.80	61.00	82.14	78.14	85.50	74.99
11	79.00	94.76	106.43	81.48	76.49	80.97	86.05	91.00
12	103.00	–	101.33	–	64.00	80.30	101.72	–
13	–	103.00	–	93.79	82.88	–	110.42	–
14	–	–	103.00	106.00	–	–	–	–
15	–	–	112.00	–	–	–	–	–

Figure 1. Nominal landings for 4Vn cod (May-Dec.) 1970-1989

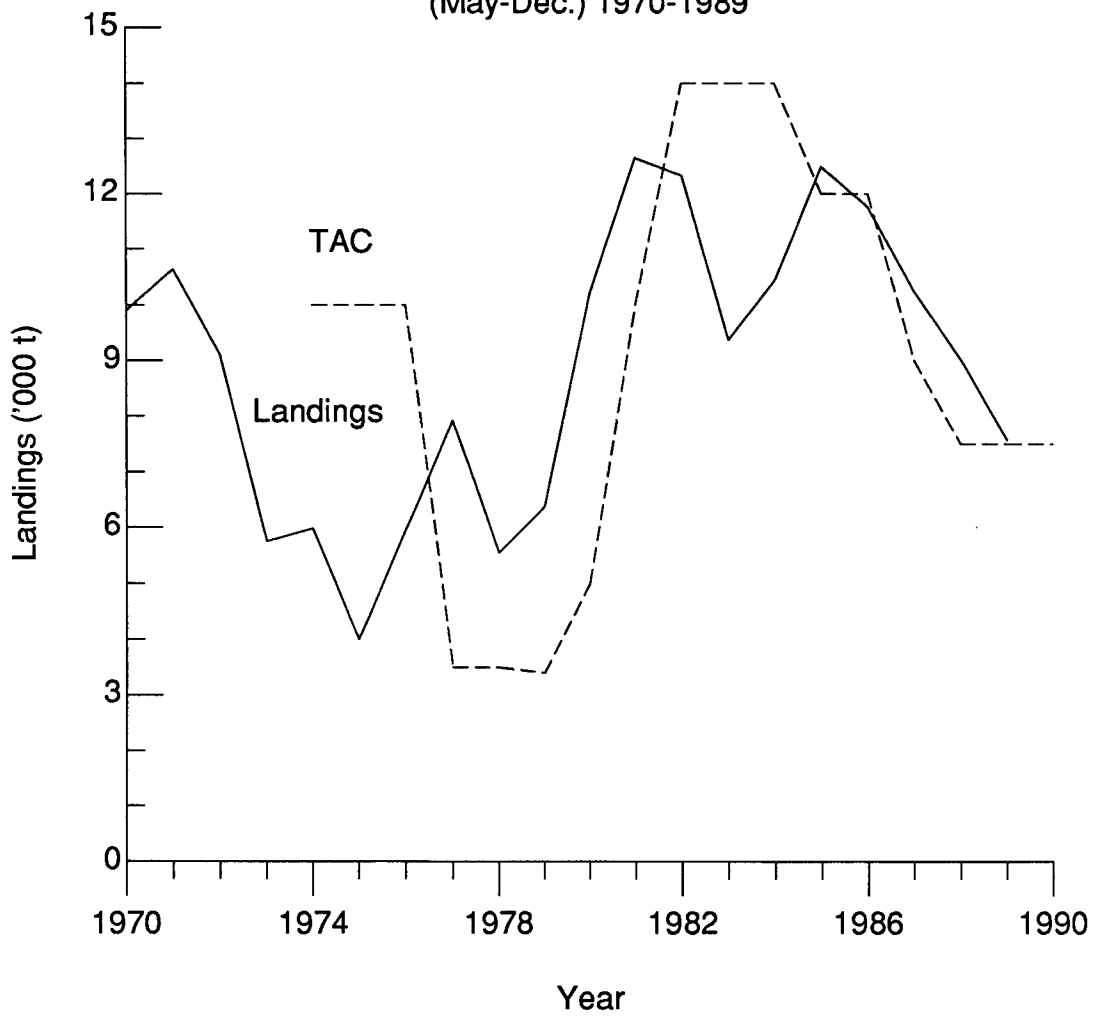


Figure 2. Cumulative catch by gear.  
4Vn Cod (May-Dec.).

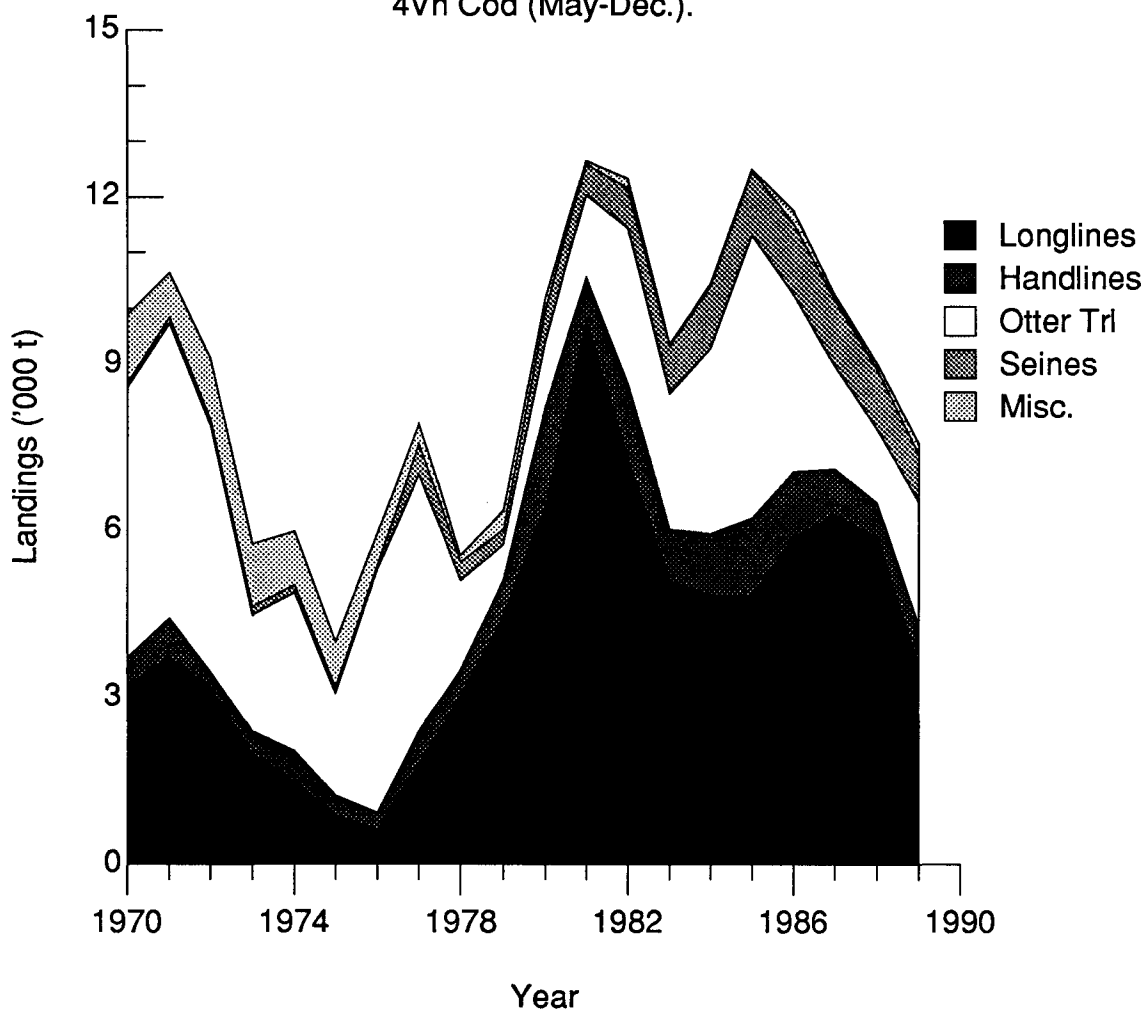


Figure 3. Research survey mean number and mean weight per tow (4Vn cod).

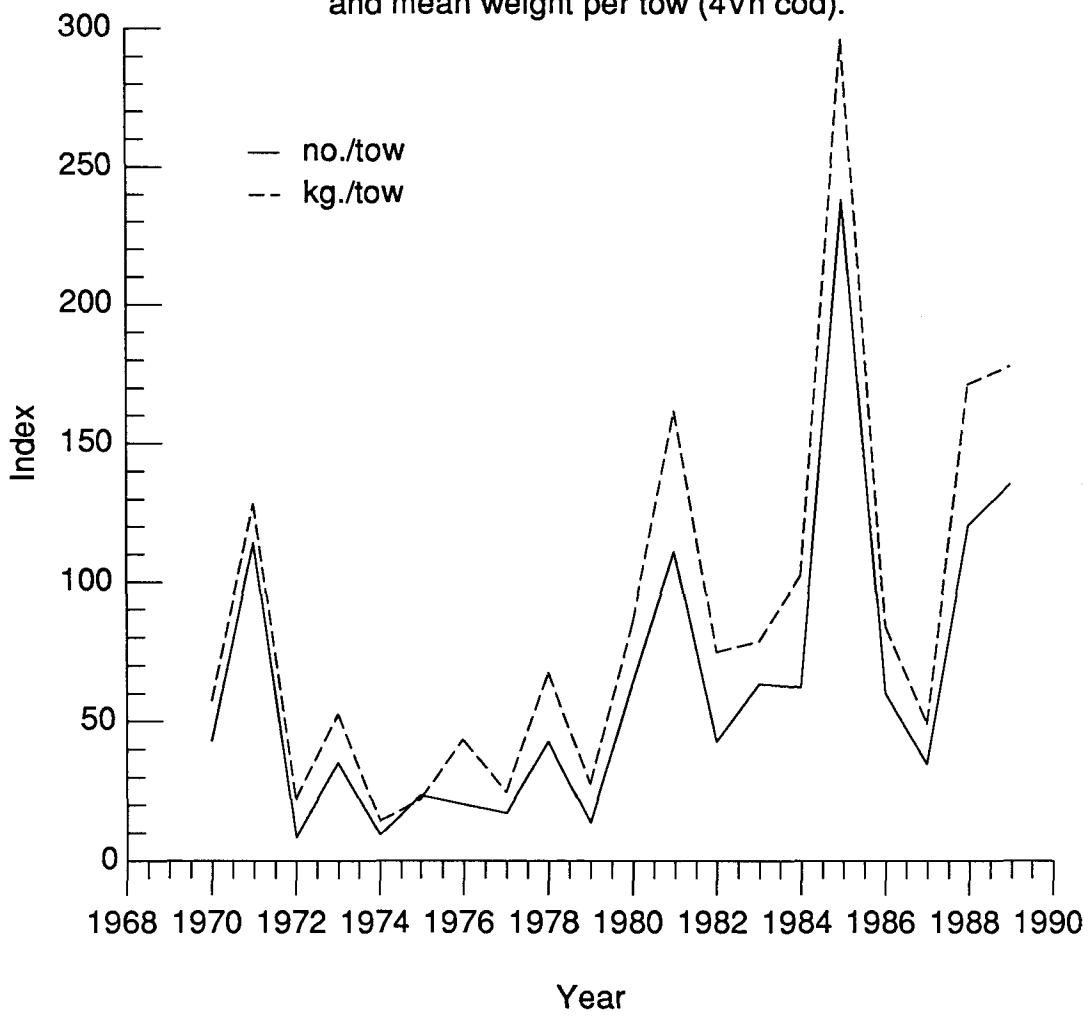


Figure 4. Numbers (thousands) landed by age and gear type. 4Vn cod (M-D.), 1989

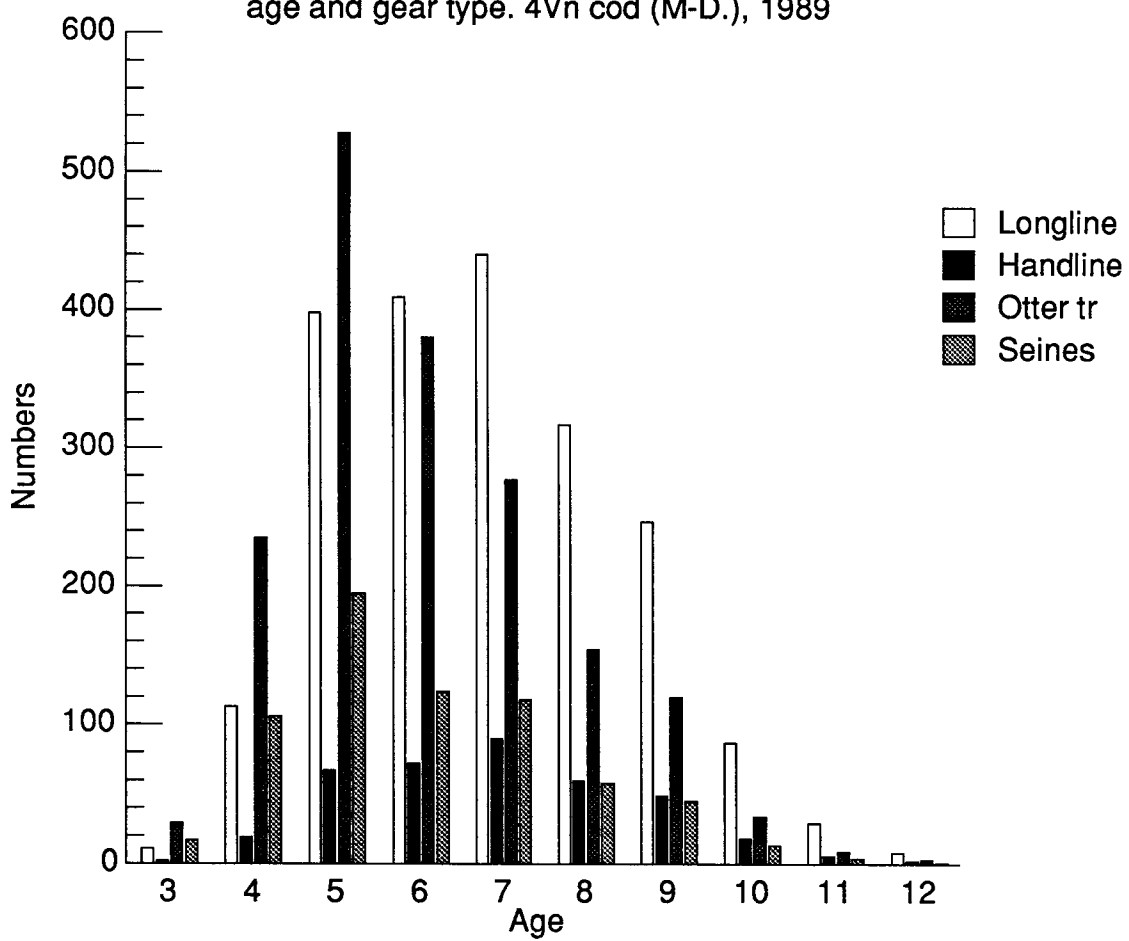


Figure 5. Trend in research vessel catch

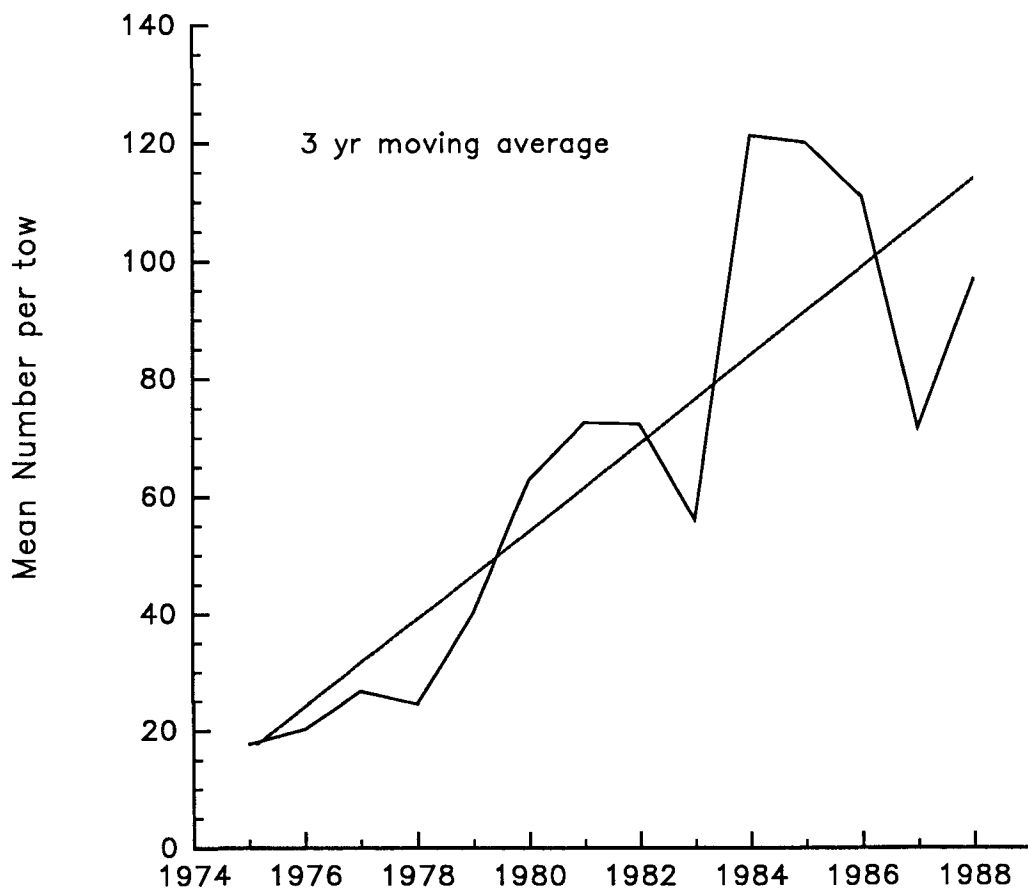


Figure 6. Year-class contribution at age to total catch





## APPENDIX

### 4VN COD (MAY-DEC) ALLOCATION SCHEDULE AND MANAGEMENT MEASURES IN 1989.

GEAR	SEASON	CLOSURE	ALLOCATION <sup>1</sup>	LANDINGS <sup>2</sup>	MANAGEMENT MEASURE
<b>Fixed Gear</b>					
< 45'	May 1 - Oct 31	May 1	3300	3550	May 1:6,800 kg trip limit Nov 1:6,800 kg trip limit Dec 1:13,600 kg trip limit
	Nov 1 - Dec 31	Nov 1	840	758	
45' - 64'	May 1 - June 30	May 1	37	37	May 1:6,800 kg trip limit
	July 1 - Aug 31	July 1	23	11	July 1:6,800 kg trip limit
	Sept 1 - Oct 31	Sept 1	40	11	Sept 1:6,800 kg trip limit
	Nov 1 - Dec 31	Nov 1	140	93	Nov 1:6,800 kg trip limit Dec 1:13,600 kg trip limit
65' - 100'	May 1 - Dec 31	May 1	70	138	May 1:1,500 kg trip limit
<b>Mobile Gear</b>					
<45'	May 1 - July 31	May 1	690	1133	May 1:4,500 kg trip limit
	Sept 1 - Dec 31	Sept 1	300	82	May 26:1,500 kg trip limit
	Nov 1 - Dec 31	Nov 1	700	580	June 1:4,500 kg trip limit June 30:0 kg limit; 0% bycatch July 10: 5% bycatch only Sept 1:450 kg trip limit Nov 1:450 kg trip limit Dec 1:6,800 kg trip limit
45' - 65'	May 1 - July 31	May 1	200	167	May 1:3,200 kg trip limit
	Sept 1 - Dec 31	Sept 1	315	145	June 16:10% bycatch only Sept 1:1,800 kg trip limit Oct 1:3,200 kg trip limit Dec 1:9,000 kg trip limit
<65' (sector overlap)	May 1 - Dec 31	May 1	180	114	
65' - 100' (shrimp fleet)	May 1 - Dec 31	May 1	70	2	
65' - 100' (groundfish fleet)	May 1 - Dec 31	May 1	70	1	
All vessels >100'	May 1 - Dec 31	May 1	525	433	

1. Derived from final allocation schedule as per the 1989 Canadian Atlantic Quota Report (31/12/89).
2. Preliminary statistics only.