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**Update on the status of 4Vn cod:  
1992 - 1993**

by

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## ABSTRACT

4Vn is a well-known area of mixing of cod stocks, and depending on the time of year, resident cod in the area can be caught along with cod from stocks originating in the Gulf of St. Lawrence (4T) and to a lesser extent from further east on the Scotian Shelf (4Vs). This mixing is most severe during the winter but can occur at other times of the year. Tagging studies and analyses of fleet movements have indicated which fish move where and what routes they take; however, it remains difficult to ascertain to what extent the cod from different stocks intermingle when they co-occur in Sydney Bight. It is believed that failure to account for increasing proportions of 4T cod in 4Vn catches led to overfishing of the resident stock.

The catch of mobile gear over the past six or seven years has remained relatively stable. However, the number of cod caught during the summer months decreased, while the amount of cod taken in the late autumn increased. It is now believed that the majority of cod caught in the summer were resident fish and that those caught in the late fall were mostly Gulf of St. Lawrence cod. Thus as a shortfall of resident cod developed it was made up for by increased catches of 4T fish. On the other hand, smaller inshore longliners which do not fish as much in the late autumn did not exploit migrating Gulf cod to the same extent and their catches have shown a steady decline for several years, reaching an all time low this past year. It is believed the fortunes of the longline fleet today mirror those of the cod stock. Longliners have been unable to catch their allocation of cod since 1989. These boats have had no difficulty in finding fish and reaching their quota in the past; therefore it is felt their failure to obtain cod is a reflection of the lack of availability of fish. In addition, a downward trend in the catch rate of longliners in recent years is consistent with this view.

This stock is probably as low as it has ever been. In the 70's when at similar levels, the stock recovered due to several successive years of good recruitment. Part of the reason for this was possibly that, despite the small population size, there was good representation of ages among the remaining fish. Today this is not true as there are very few older fish in the population; only 3% of the population in 1993 were over age 10, down from 9% in 1983. There has been no good recruitment since 1987. Recovery is dependent on recruitment so the remaining spawners need to be protected.

## RÉSUMÉ

La subdivision 4Vn est bien connue pour la mixité de ses stocks de morue; selon l'époque de l'année, les captures dans cette subdivision peuvent comprendre, outre la morue du stock résident, de la morue provenant du golfe du Saint-Laurent (4T) et, quoique dans une moindre mesure, de la morue appartenant au stock situé plus à l'est sur le plateau néo-écossais (4Vs). Le mélange des stocks est plus prononcé l'hiver, mais il peut se produire à n'importe quel autre moment de l'année. Des études de marquage et des analyses des déplacements des bateaux ont permis de déterminer quel poisson migre, vers quel endroit et par quel chemin; toutefois, il est difficile de savoir dans quelle mesure les morues de divers stocks se mélangent lorsqu'elles se retrouvent dans le Sydney Bight. On croit que la surpêche dans le stock résident peut être attribuée au fait que l'on n'a pas tenu compte de la présence d'une proportion croissante de morue de 4T dans les prises de 4Vn.

Les prises des bateaux de pêche aux engins mobiles au cours des six ou sept dernières années sont demeurées relativement stables. Toutefois, le nombre de morues capturées a diminué en été et augmenté à la fin de l'automne. On estime maintenant que la majorité de la morue prise l'été provenait du stock résident et que celle capturée en automne était essentiellement de la morue du golfe du Saint-Laurent. Le stock résident devenant insuffisant, les prises de morue de 4T ont augmenté en compensation. Par ailleurs, les petits palangriers côtiers, qui pêchent peu aux approches de l'hiver, n'ont pas autant exploité la morue en provenance du Golfe, et leurs prises ont accusé un recul constant pendant plusieurs années, atteignant leur plus bas niveau de tous les temps l'an dernier. On croit que les résultats obtenus actuellement par la flottille de palangriers reflètent l'état du stock de morue. Les palangriers ne sont pas parvenus à capturer leur allocation de morue depuis 1989. Or, ils n'avaient autrefois aucune difficulté à trouver ce poisson et à pêcher leur quota. On croit donc que leur insuccès présent à cet égard traduit l'absence de morue, ce que vient confirmer la tendance régressive des taux de prises des palangriers ces dernières années.

Le stock est probablement à son plus bas. Dans les années 70, après avoir chuté à des niveaux comparables, il s'était reconstitué grâce à plusieurs années successives de bon recrutement. Cela était peut-être dû en partie à une bonne représentation des classes d'âge dans la population restante, malgré la petitesse de cette dernière. Tel n'est pas le cas à l'heure actuelle, la population comptant très peu de poissons de grand âge; la proportion d'individus âgés de plus de 10 ans est passée de 9% en 1983 à 3% en 1993. Comme le rétablissement du stock dépend du recrutement, qui n'a pas été bon depuis 1987, il convient de protéger les reproducteurs restants.

## INTRODUCTION

The cod fishery in NAFO Subdivision 4Vn has declined drastically during recent years. Throughout most of the 80's, catch quotas restrained the fishery, but since 1990 catch has been substantially less than the TAC. Whereas vessels using mobile gear have generally managed to maintain a catch close to their allocation, the longline fleet has fared less well. Mixing of Gulf of St. Lawrence (4T) cod with the resident stock and inability to apportion landings according to stock appears to have been the cause of overfishing of the 4Vn stock.

4T cod overwinter in the Sydney Bight - Banquero Bank region, leaving the Gulf in the late autumn and returning in the spring. During this period the catch of cod in 4Vn comprises both Gulf and resident cod, albeit the 4T cod make up the bulk, being a much larger stock. Thus, unknown quantities of 4Vn cod are being caught during the overwintering period. Furthermore, the dragger fleet which had traditionally caught the bulk 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.

This report will give an overview of the cod fishery for 1992 and 1993, present an update on the status of the 4Vn stock based on information on commercial landings and data from research cruises and summarise the findings of a test fishery carried out in 4Vn in the autumn of 1993.

## DESCRIPTION OF FISHERY

The nominal catches for 1992 and 1993 were 4461t and 702 t respectively(Fig 1, Table 1). The 1992 catch was less than half of the 10000 t quota. Fixed gear were allocated 6600 t but

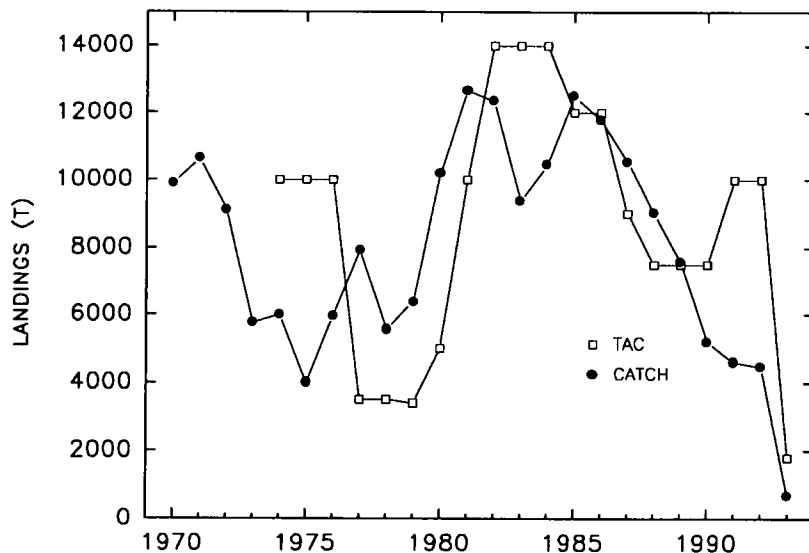


Figure 1. Annual landings and corresponding TAC for 4Vn cod.

managed to take only 20% of that amount; whereas, mobile gear achieved 97% of its 2700 t allocation (Tables 2 & 3). Due to the declining trends of both 4T and 4Vn cod stocks, the fishery in 4Vn was closed in December as the winter migration was well underway and the annual stock mixing had begun, making allocation of catch to the appropriate stock very difficult. At this time the quota for 4Vn for the next year (1993) was lowered to 1800 t. In 1993, midyear assessment of the status of the 4Vn stock indicated no change and as a result the fishery was closed at the end of September. The allocation schedule and list of management measures implemented in 1992 and 1993 can be found in the Appendix.

## COMMERCIAL CATCH

### *Landings*

With the exception of 1993 when the fishery was closed in September, otter trawl catch has remained relatively stable for the past six years. On the other hand, fixed gear catch continues a

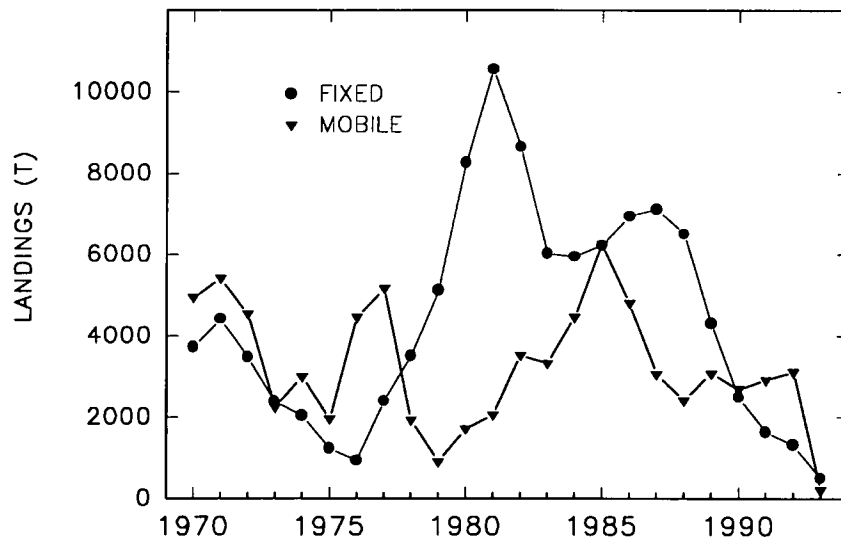


Figure 2. Annual landings by major gear type for 4Vn cod.

decline begun in the late eighties; catches are now on par with those of the mid 70's, the lowest recorded for this gear sector (Fig 2). Traditionally the major gear involved in the cod fishery in 4Vn, the small inshore longliner, has depended on inshore stocks and has been less inclined or less able to exploit the migrant Gulf cod which after rounding Cape North tend to move more offshore, down the Laurentian Channel edge. Longline catch, which has been falling sharply for more than five years, is probably quite indicative of the abundance of resident fish. The annual accumulated catch up until the fishery was closed in September of 1993 was the lowest on record (421 t) for this period. This amount was 56% less than during the same time period the year previous. Although it is true that part of this decrease was due to the fact that some fixed gear operators had tied up their boats due to low catch rates, the shortfall cannot be wholly attributed to decrease in fishing effort.

The pattern of landings for fixed gear during the past ten years has changed little; fairly uniform levels of catch through the early summer with a steady increase during the latter part of part of summer and into the autumn (Table 4). The proportion by season of annual landings for fixed gear has varied little (Fig 3). However, the trend of increasing catches for mobile gear in late autumn has continued. In 1992, otter trawlers caught nearly 65% of their annual take in the month of November;

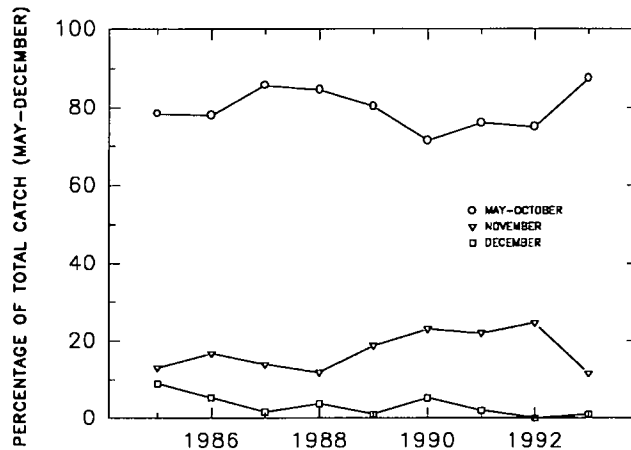


Figure 3. Proportion of annual landings of longliners by specific period for 4Vn cod.

the largest tonnage ever landed in this month (Fig 4 & Table 4). The main reason for the huge increase for this month was the advance announcement of the upcoming closure of the fishery in December of that year. In 1993, with the closure of the fishery in September, the highest proportion of the landings for that year were taken in August, the month during which catches have been historically quite low. The only landings of cod after September were bycatch from mobile vessels involved in the redfish fishery, and catch from the late autumn test fishery in 4Vn carried out by small longliners.

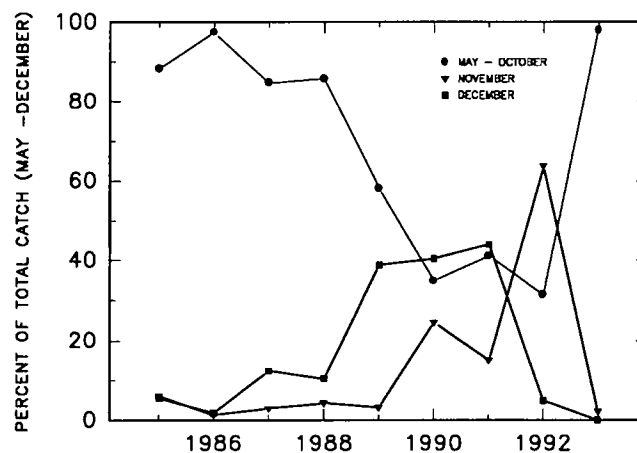


Figure 4. Proportion of annual landings of otter trawlers by specific period for 4Vn cod.

Since 1989 the allocation to the fixed gear sector has been far in excess of the landings realised. In the past this sector has demonstrated its capacity to capture its allowance with no difficulty, yet its landings have continued to fall during the early 90's (Fig 5).

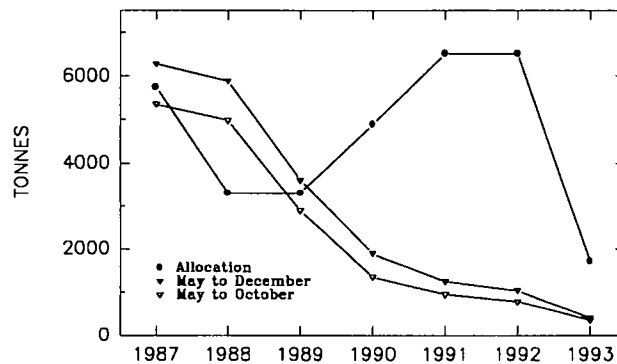


Figure 5. Longliner cod allocation and associated landings by year in 4Vn.

*Catch rate.*

Over at least the past ten years there has been no trend in the catch rate of mobile gear in 4Vn. However, there is evidence of a trend in the limited longline catch rate information that is available. Many longliners do not carry official logbooks, but from the logs of the few larger boats (TC2) that do, there can be seen a decrease in the catch rate (Fig 6) over the past five years. Analyses of catch rates in the past, particularly for fixed gear which have taken the bulk of the catch in

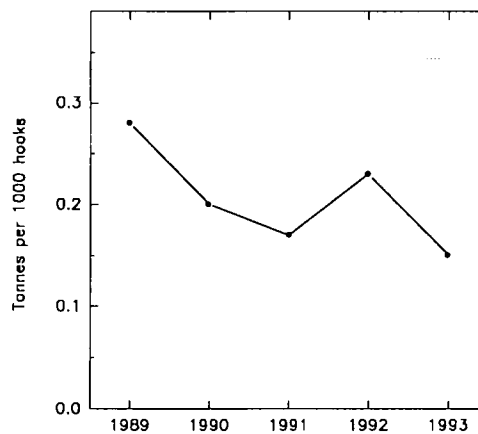


Figure 6. Catch rate for TC2 longliners - 4Vn cod.

the past, have shown no significant trend over time (Smith & Lambert 1989). This is probably because of the low amount of catch that has been reported with information on associated effort. However, in recent years the average amount of catch reported with effort for longline vessels has risen from an average of about 5% to over 10%.

*Biological Indices*

In 1992 and 1993 landings were made up of 70% and 63%, respectively, of 1986 and 1987 year-classes (Table 5). As the text table shows the numbers of older cod have fallen to very low levels. The dominance of the 1987 year-class in particular can be seen in Fig 7. From 1988 the numbers of cod in the 2-5 year-old range rose steadily until 1992. During the same period the numbers of older fish decreased; as a result the proportion of younger fish in the population increased rapidly to a high of nearly 65% in 1991.

10 year mean	Age group as % of total.		
	6 & 7	>8	>10
1983	40	24	6
1993	36	36	9
1993	65	15	3

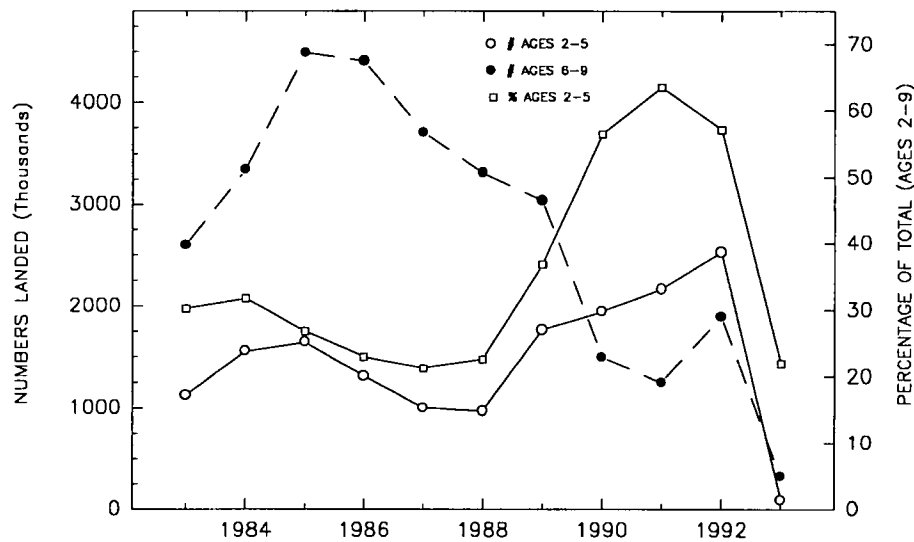


Figure 7. Change in abundance of young and old age groups in commercial catch of 4Vn cod.

With the exception of 1993, which was an abnormal year (see below), weight and length-at-age continued their downward trend of the last ten years (Fig 8, Tables 6 & 7). Since 1982, the average cod in 4Vn landings is about 1.2 kg lighter and about 14 cm shorter for the same age. Figure 8 also shows a decline in the average age of the population during the late 80's and early 90's as the 1987 year-class entered the fishery. The changes in the indices shown in Figures 7 and 8 are difficult to interpret. The downward trend of weight and length-at-age witnessed during the last decade may be a reflection of increasing proportions of slower growing 4T cod in 4Vn landings; certainly the 1993 values, which are higher and based on landings to September only (thus presumably not including Gulf cod), support this explanation. However, this same downward trend can be seen in cod taken in the July (see research survey, next section) when there is probably little mixing with Gulf cod in comparison to other times of year.



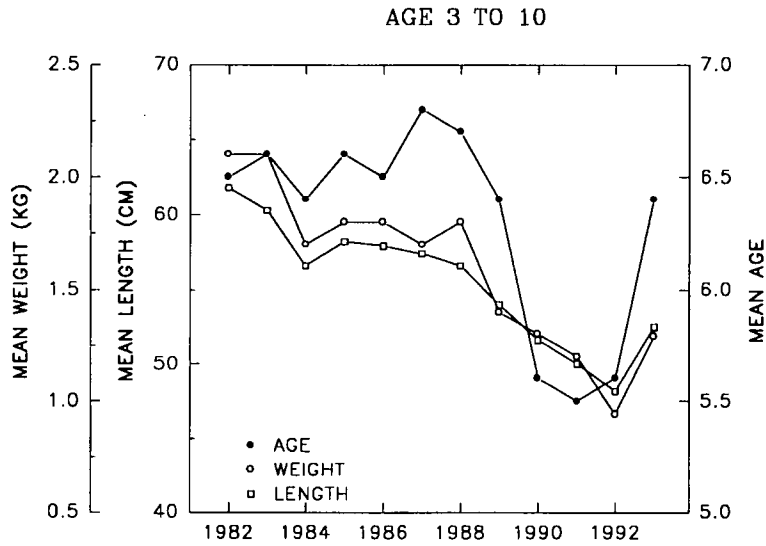


Figure 8. Annual mean values of weight, length and age for cod in commercial catch from 4Vn.

### JULY GROUND FISH SURVEY

Survey catch recently has been in the lower range of values experienced over the past 15 years. The index rose in 1992 but fell again in 1993 (Fig 9). It is not thought that the 1992 value is indicative of true abundance. As in the case of 1985 and 1989, one large set accounted for most of the fish caught in 4Vn. The variance values associated with the mean number per tow indicate the lack of reliability of the estimate in these years.

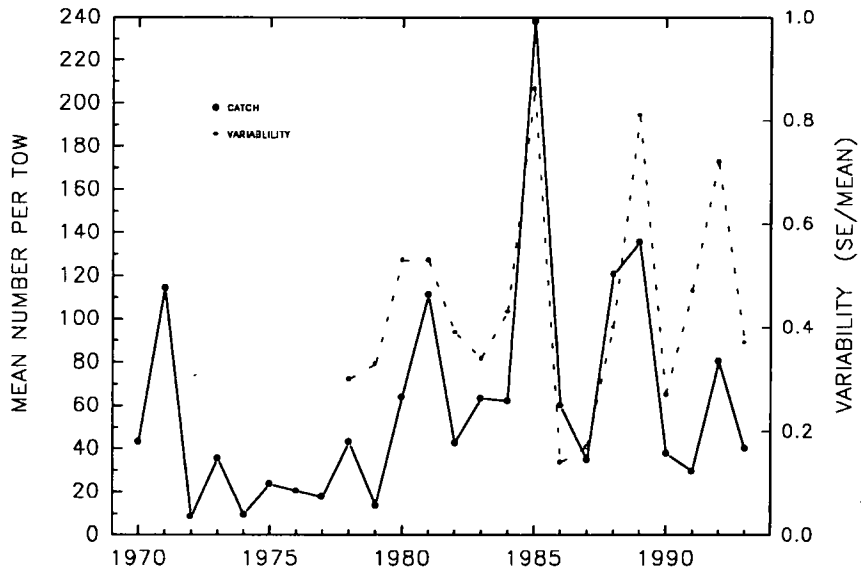


Figure 9. Abundance of 4Vn cod - July groundfish research cruise.

In order to damp the effect of these peak values and to get an idea of long term trends a five year running average was calculated (Fig 10). This smoothed curve indicates a strong downward trend since the mid 1980's.

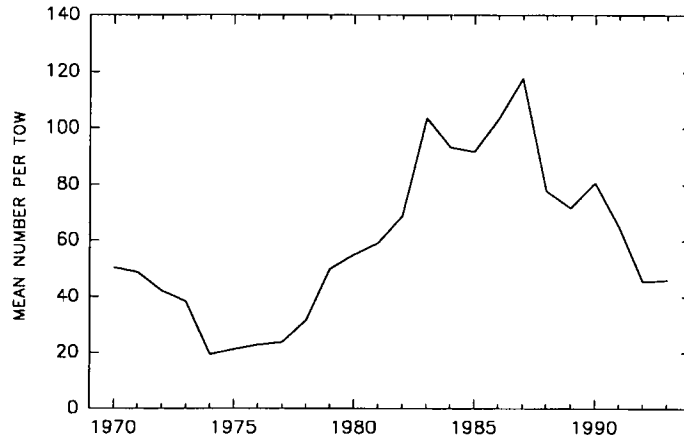


Figure 10. Five-year running average of abundance of 4Vn cod - July research cruise.

Estimates were made of total mortality calculated from numbers-at-age. Again the high variability inherent in catches made by the research survey in 4Vn render these estimates unreliable; values of Z were frequently negative and exhibited a wide range (-1.6 to 2.9). Although no accurate estimate of mortality can be made from such calculations, there does seem to have been an increasing trend since the mid 80's as shown by a five year running average of estimates (Fig 11).

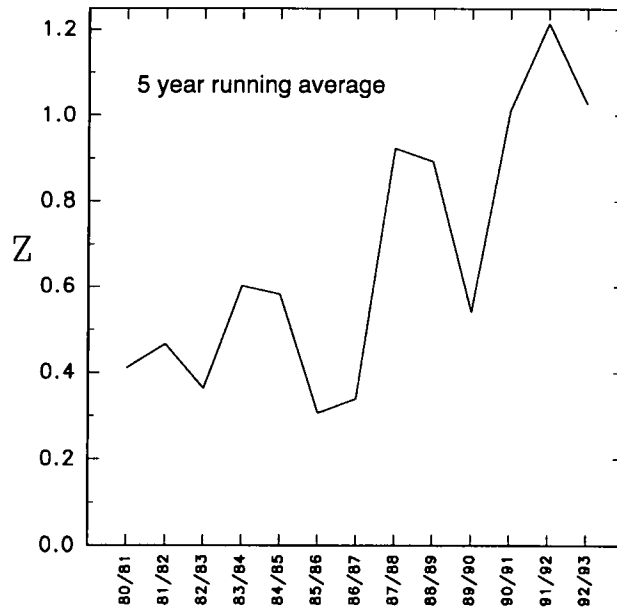


Figure 11. Total mortality estimates (calculated from numbers-at-age) of 4Vn cod from groundfish research cruises, 1980-1993.

As in the case of commercial landings, the 1987 year-class dominates the research catch, comprising 55% of the catch in 1992 and 37% in 1993 (Table 8). The preponderance of this year-class is reflected in the mean length of cod in research catches (Fig 12). From 1988 until 1990, mean size fell as young fish from the '87 year-class entered the population. After 1990, mean size increased as the 1987 year-class, which now began to dominate the population as three yr-olds, began to grow in length.

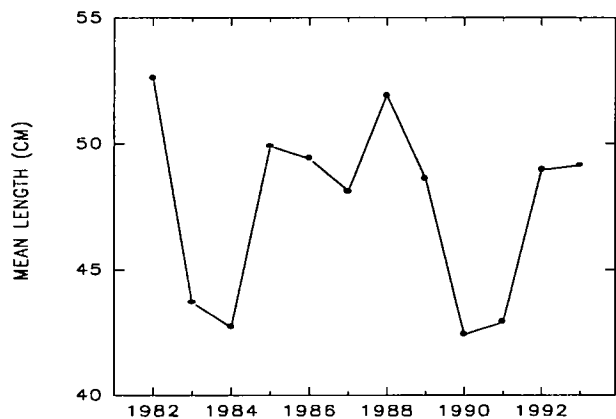


Figure 12. Mean length (ages 3-10) of 4Vn cod from annual July groundfish research survey.

The strong effect of this one year-class on the population characteristics is not only due to the lack of older fish in the population, but also to the lack of recruitment in recent years. In fact, since 1980 there has only been one year, 1987, when recruitment was better than average (Fig 13). Four

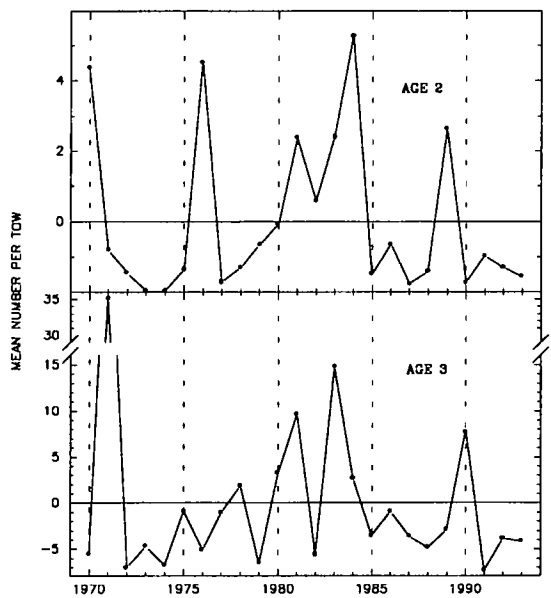


Figure 13. Recruitment of cod in 4Vn. Deviation from mean annual average number per tow from July groundfish research cruises.

years of better than average recruitment in the late 70's sustained the fishery throughout most of the 80's; however, with only one better than average year-class in the 80's, the inevitable occurred and the population went into steep decline. Fig 13 should be interpreted with caution, bearing in mind the inherent year to year variability in research catches. However, although the magnitude of deviations cannot be reliably compared between years, historically, positive deviations after age 1 have generally been shown to coincide with good year-classes.

### INSHORE SURVEY

An inshore research survey has been carried out in the western half of Sydney Bight since 1991. One of the aims of this survey is to monitor the abundance of juvenile cod in the area. A region of juvenile aggregation was found near the Bird Islands. Cod in this location are invariably in the 7-20 cm length (one & two yr-old) range. Other than a location in the Bras d'Or Lakes, this was the only place in the survey area where one year-old fish were found consistently. The abundance of young fish was much greater in 1991 than in the two subsequent years when very few young cod were found (Fig 14). With only three years to compare in this series it is not possible yet to say whether this is a

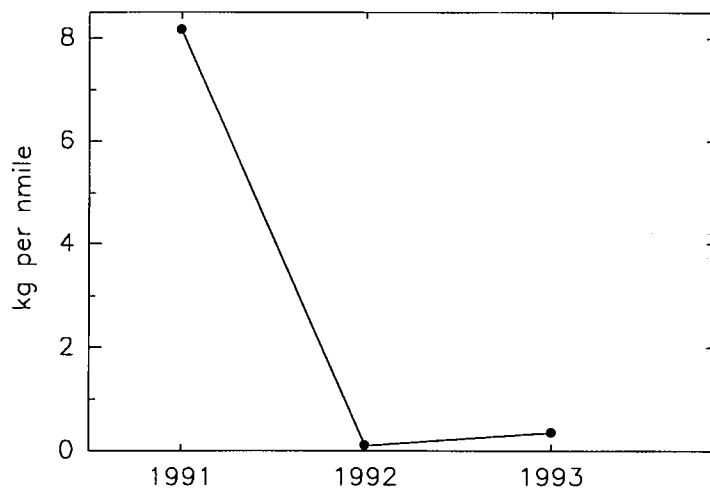


Figure 14. Abundance of one year-old cod off Bird Islands, Sydney Bight.

reliable index. Nevertheless, the decrease in one year-olds seen in the inshore survey is consistent with the decline in abundance of two-year-olds from the July survey. With little to compare it to, the 1991 inshore survey value cannot be interpreted as other than higher than the values of the subsequent two years. One year-old cod rarely show up in the July groundfish survey in 4Vn and their abundance in this survey is normally not a good indicator of recruitment (only four occurrences since 1970, two of which corresponded with good year-classes). Nonetheless, one year-old cod were present in the 1991 July survey, although subsequently in 1992 and 1993 the numbers of two and three year-old cod were lower than average. It is of interest to note here that the 1990 year-class in adjacent 4VsW also appears better than average.

## TEST FISHERY

A so-called test<sup>1</sup> fishery was allowed in 4Vn and the northern part of 4Vsb as a condition of abandonment of the blockade of Glace Bay Harbour in early October of 1993. Details of this fishery have been reported in Lambert (1994). The fishery was carried out by six inshore longliners during a six-week period between October 15 and November 30; about 70 tonnes of cod were caught.

Average catch rate ranged between about 50 and 500 kg per 1000 hooks. Catch rates were fair initially, then rose to a peak near the middle of November before falling rapidly to very poor levels by the end of the fishery (Fig 15). Although at peak, the highest catch rates were experienced in the west of 4Vn, the most sustained catch rates were found further east.

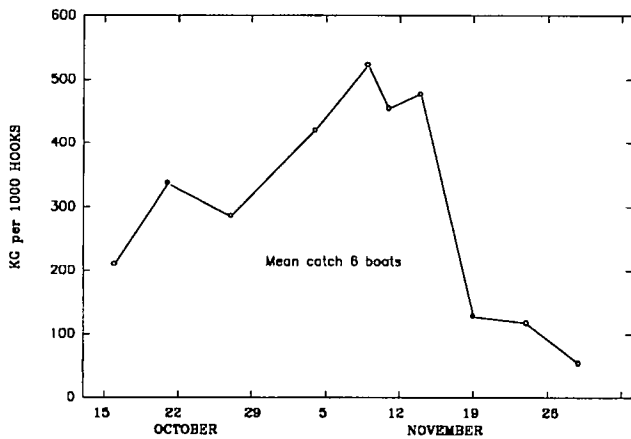


Figure 15. Mean catch rate in 4Vn Test fishery.

Length frequency information showed a sharp increase in average size at the beginning of the fishery with a steady downward trend in size after about the second week. This trend was particularly evident in the extreme west of the fishing zone (Area 1) in the White Point Bank area (Fig 16). This pattern in length frequency, together with trends in landings, seems to indicate the movement of Gulf of St. Lawrence cod (which, at any given age, are smaller than Eastern Scotian Shelf cod) into the Sydney Bight area. Calculated from the eastward progression of modes in catch and length frequency, the estimated rate of migration was about 12 naut.

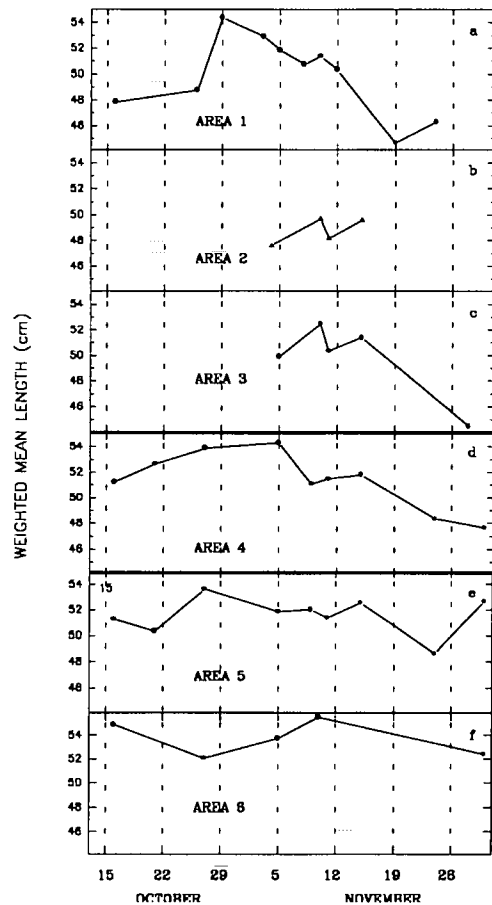


Figure 16. Weighted mean length of cod over time in six fishing areas in 4Vn. (Area 1 to 6 equivalent to west to east)

<sup>1</sup> Although the descriptor "test" was applied to this fishery it should not be construed as, in the usual sense, a trial fishery used to determine whether a full-scale commercial fishery should be opened after a period of closure.

mi. (21 km) a day. The first Gulf cod apparently arrived around October 29, with the bulk of migrating fish arriving about November 5.

### LOGLINER FISHING LOG

Logbook records from 1987 to 1992 for a longliner operating in the White Point Bank - St Pauls Island region show patterns of catch rates in November that are very similar to those of the test

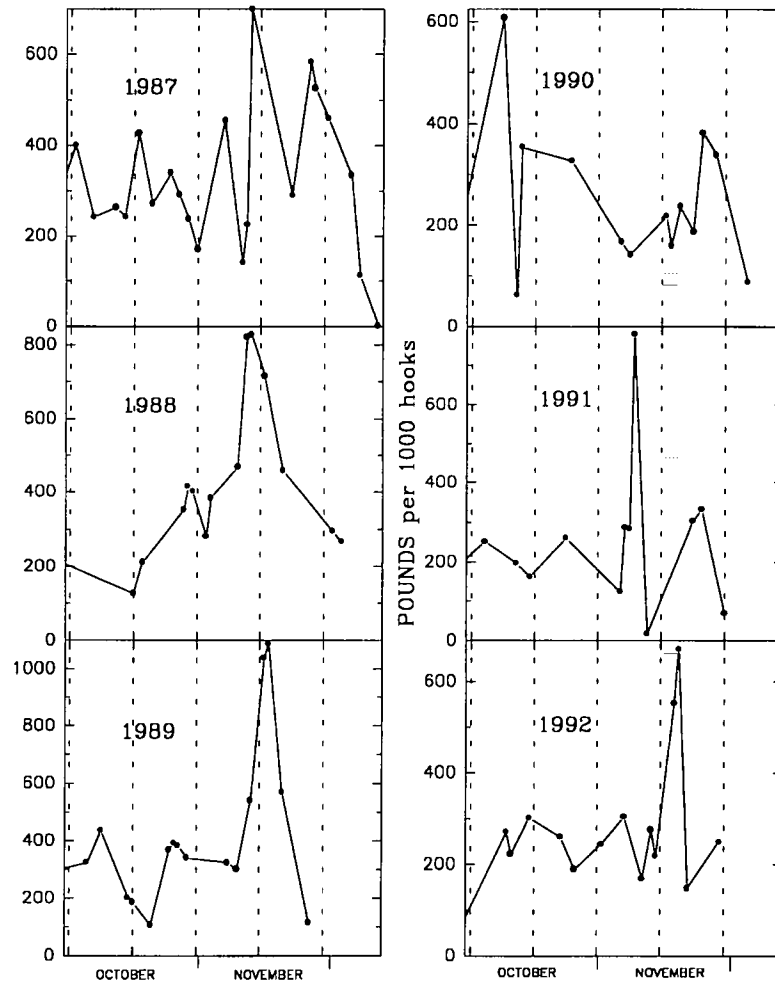


Figure 17. Longliner logbook record of cod catch rate in White Point Bank area of 4Vn.

fishery: catches rose around the end of October and peaked around the middle of November before dropping off rapidly to very low levels by the beginning of December (Fig 17). Concurrently, the numbers of large cod in the catch often rose substantially first, but always fell to very low levels or were absent by the beginning of December. At the same time the numbers of small cod rose sharply and comprised the whole catch by the time fishing ended for the year (Fig 18).

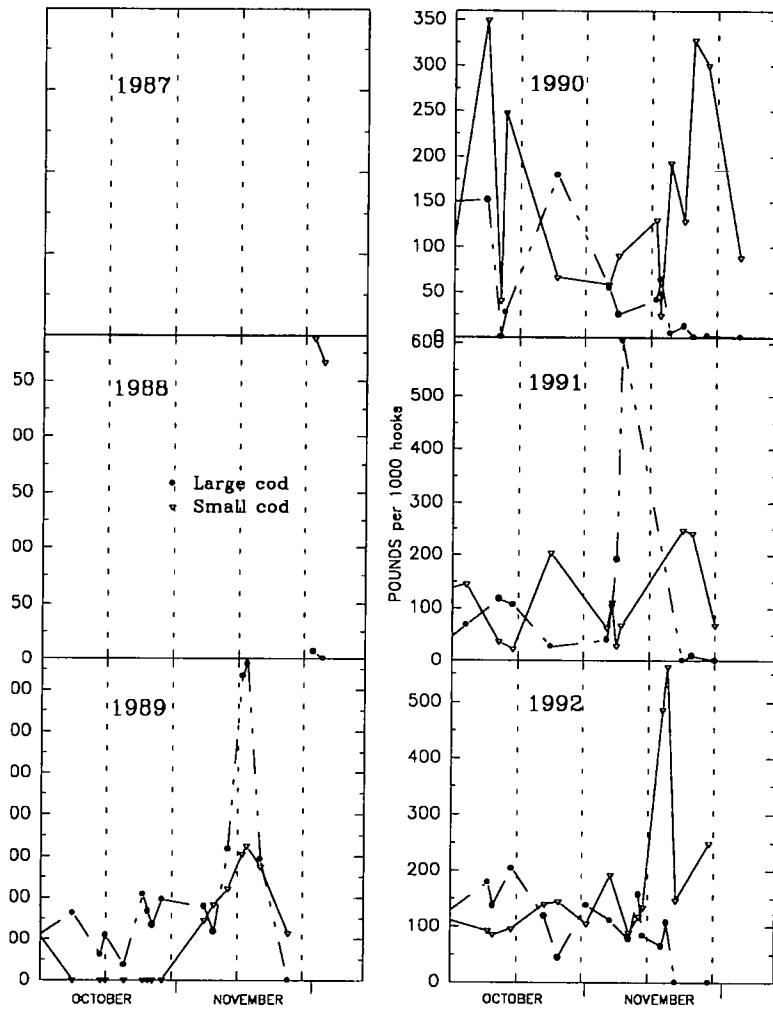


Figure 18. Longliner logbook record of cod catch rate by size in White Point Bank area of 4Vn.

Based on peaks in catch rate and changes in proportions of large and small fish in the catch from Figures 17 & 18, the estimated times of arrival of 4T cod at the western boundary of 4Vn are:-

1987	November 10
1988	November 10
1989	November 14
1990	? October 6 & November 22
1991	November 7
1992	November 16
1993	November 5

Not including 1990 which is difficult to interpret it would appear that the arrival of 4T fish varied by less than two weeks over the seven year period.

## DISCUSSION

Clearly many cod of Gulf origin have been attributed to the 4Vn resident stock in the past. Although it has been recognised for years that some proportion of cod caught in 4Vn during December originated from 4T (CAFSAC 1982 ) it was not realised until recently (Lambert 1992) that this catch was seriously compromising advice for the 4Vn cod stock. Furthermore, although tag returns and commercial fleet movements (Lambert 1993) indicated that Gulf of St. Lawrence cod entered the Sydney Bight area as early as November it was not known to what extent. Recent evidence from the 4Vn test fishery and from the longliner personal logbook information presented herein and also catch rate information from 4T areas adjacent to 4Vn (personal communication, A. Sinclair, DFO Moncton) indicate that the number of Gulf immigrants is substantial.

For the past eight years the average time of arrival of the 4T migrants in the White Point Bank area appears to be about November 10. The travel time across 4Vn is probably about one to two weeks (Lambert 1994). Just how much of the cod taken in 4Vn during November should be apportioned to which stock is difficult to say. In recent years with the great decline in resident fish, more of the fleet appear to have moved to the 4Vn boundary to exploit the incoming 4T cod. However, during early November at least, there have been fairly good catches of cod in the Scaterie Bank area which are almost certainly not Gulf cod.

In the spring during the return migration, 4T cod are probably caught in 4Vn during May (part of the 4Vn fishing season). However, at this time of year the fishing fleet (mobile in particular) expend most of their effort exploiting resident spawning fish which are highly aggregated between White Point and Smokey Banks in the so-called "Gutter". The fishery on these spawning fish has in the past continued through May and June.

In the face of this accumulated evidence it was decided at the 1994 DFO Regional Assessment meeting to attribute all cod caught in 4Vn during November and December to 4T, southern Gulf of St. Lawrence, thereby confining the 4Vn assessment 'year' to the months of May to October, inclusive.

The most telling indicator of the status of the 4Vn cod stock is the catch record of the fixed gear sector. The fortunes of these vessels have mirrored the decline in the resident 4Vn stock for at least the past five years. Most fixed gear catch is taken between May and October, and thus being dependent mainly on resident cod, longline landings have fallen markedly in recent years. Vessels using mobile gear, on the other hand, have maintained landings at a fairly constant level by increasing their catch in November and December as cod became less available during the summer months. The clearest sign of lack of cod during the May to October period has been the fixed gear sector's inability to achieve its annual share of the 4Vn quota for the past four years. The fixed gear has adequately demonstrated its capacity to take its allocation of fish in the past and even though some fishermen have tied up their boats or left the fishery due to poor fishing conditions, the number of boats still active in the fishery are more than enough to catch the quantities of cod allowed in recent years were they available.

Although the lack of success of the fixed gear fleet best attests to the diminished status of 4Vn cod, there is no absence of additional evidence to support this view. Most of these other factors, although not compelling on their own, form a convincing supporting argument when taken as a whole:

- ♦ The CPUE of TC2 longliners does show a definite decrease over the past five years, albeit arguable as to how representative this index is of the whole fixed gear fleet.



- ♦ The July groundfish research survey index, although quite variable and unreliable in any given year, shows a definite downward trend since the mid 1980's.
- ♦ Similarly unreliable in any given year, estimates of total mortality from the July survey show an upward trend since the mid 80's.
- ♦ This same survey also shows no indication of good recruitment since 1987. In support of this bleak picture of recruitment, abundance of one year-old cod as estimated by an inshore juvenile survey carried out over the past three years in Sydney Bight also appears to be low. The lack of recruitment is particularly serious because there is only one year-class of any size remaining; that is the 1987 year-class which comprises about 50% of the fishable population. Since there are very few old fish left in the stock future recruitment depends heavily on these seven year-old fish.
- ♦ In common with adjacent, declining cod stocks (4T & 4VsW), there has been a continuing downward trend in length and weight at age over most of the past ten years in 4Vn. Although some of this can likely be attributed to increasing proportions of 4T cod in the catch, particularly during the past five years, the same trend can be seen in research survey indices as well and presumably the research catch (taken in July) does not suffer from the same "contamination" by 4T cod as the commercial catch.
- ♦ The conclusion that there has been a general decline of the 4Vn cod resource over most of the past ten years is largely supported by those closest to the fishery; that is, the inshore fishermen of the region. After a detailed survey (1990) of the fishing practices of longline fishermen in the Scotia-Fundy in which about 100 fishermen were interviewed in Cape Breton, Kenchington & Halliday (1994) reported that "Of all the area covered by this survey where anyone still attempted to go longlining in 1990, Sydney Bight undoubtedly had by far the worst resource problems." Sydney Bight was the only area in all of those surveyed where substantial numbers of interviewees had stopped longlining in 1990 due to financial losses in the previous year. The only areas where cod were still reported caught in viable amounts were off Ingonish and Dingwall in the north-western extremes of 4Vn and also Scaterie Bank and south-east toward the boundary of 4VsW.

A sample of some of the comments of fishermen recorded in 1990 by Kenchington & Halliday (1994) indicative of the decline of the 4Vn stock that still shows no sign of reversing are:

"Around 1985, I took 6000 to 7000 [lb] per set on 12 tubs. Now I get 3500 to 4000 on 20 tubs (Victoria County)."

"Set 100 tubs per trip now. Get what you used to take on 30 or 40 tubs, 4 or 5 years ago. The sizes of the fish are down noticeably too (larger Cape Breton County boat)."

"4000 to 5000 lb on 10 tubs a few years ago. Now only get 1500 to 2000 lb on a good day (Cape Breton County)."

"Used to get 3000 to 4000 lb per day jigging. Now only get 200 to 300 (Cape Breton County)."

As Kenchington & Halliday (1994) summarised "Thus, while many interviewees could remember far richer fishing years ago, their present concerns were of a very recent and very marked decline in resource abundance."

Thus while no one piece of information shows conclusively that the 4Vn cod stock is in a poor state, the cumulative weight of a number of pieces of evidence lead to the inescapable conclusion that the stock is in a depressed condition and that strong conservation measures are called for. 4Vn cod would appear to be in a more precarious position now than in the late 1970's when catches were equally low; for then, at the low point, a succession of good year-classes allowed the stock to rebuild through the 80's. No such recruitment is in sight at the moment. At present the stock has little or no resilience and there is no justification for reopening the fishery which is now closed. Until the spawning biomass comprises a wider range of age-groups, and is less dependent on one year-class, and until good recruitment is a certainty, pressures to reopen the fishery should be resisted.

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TABLE 1. Nominal cod catch (t) by country in Subdivision 4Vn (May to December).

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	10541	10			1	10552	9000
1988	9001					9001	7500
1989	7465					7465	7500
1990	5110					5110	7500
p 1991	4602					4602	10000
p 1992	4461					4461	10000
p 1993	702					702	1800

\* Initially set at 7500 t, increased in September to 10,000 t.  
 \*\* Initially set at 10,500 t, increased in November to 14,000t.  
 p Preliminary statistics.

TABLE 2. Nominal catch (t) of cod in Subdivision 4Vn (May to December) by gear type for all countries, 1970 - 1993.

YEAR	OTTER TRAWL	SEINE	LONGLINE	HANDLINE	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	212494
1986	3552	1258	5764	1182	15	11771
1987	2034	1285	6369	848	16	10552
1988	1377	1109	5858	626	31	9001
1989	2129	851	3610	718	157	7465
1990	2029	593	1889	591	8	5110
1991	p 2213	694	1249	389	49	4602
1992	p 2629	468	1043	232	88	4461
1993	p 138	60	406	77	21	702

p Preliminary statistics.

TABLE 3(a). Nominal catch (1992) by Canadian vessels in 4Vn (May -December) by tonnage class and gear.

TONNAGE	OTTER TRAWL	SEINE	LOGLINE	HANDLINE	OTHER	TOTAL
0-24.9	44	207	797	231	30	1309
25-49.9	941	246	156	<1		1343
50-149.9	991	6	13			1010
150-499.9	62	8	78		58	206
500-999.9	404					404
1000+	2					2
Unknown	186					186
<b>TOTAL</b>	<b>2629</b>	<b>468</b>	<b>1043</b>	<b>232</b>	<b>88</b>	<b>4461</b>

TABLE 3(b). Nominal catch (1993) by Canadian vessels in 4Vn (May -December) by tonnage class and gear.

TONNAGE	OTTER TRAWL	SEINE	LOGLINE	HANDLINE	OTHER	TOTAL
0-24.9	2	41	352	77	21	492
25-49.9	3	19	54			76
50-149.9	10				<1	10
150-499.9	2					2
500-999.9	113					113
1000+	4					4
Unknown	5					5
<b>TOTAL</b>	<b>138</b>	<b>60</b>	<b>406</b>	<b>77</b>	<b>21</b>	<b>702</b>

TABLE 4(a). Nominal Canadian catch (1992) of 4Vn cod by month.

GEAR	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
Longline	97	35	44	108	262	236	257	4	1043
Handline	1	6	73	75	53	21	2		232
Otter trawl	484	83	13	13	71	160	1674	129	2629
Seine	202	105	17	2	4	9	128		468
Other	58	4	24	2					88
<b>TOTAL</b>	<b>844</b>	<b>233</b>	<b>171</b>	<b>202</b>	<b>390</b>	<b>426</b>	<b>2062</b>	<b>133</b>	<b>4461</b>

TABLE 4(b). Nominal Canadian catch (1993) of 4Vn cod by month.

GEAR	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
Longline	13	3	30	183	115	11	47	4	406
Handline	<1	4	40	25	7	<1	1		77
Otter trawl	117	4	4	9	1	1	3		138
Seine	8	43	5	2	1	<1	1		60
Other		16	5						21
<b>TOTAL</b>	<b>138</b>	<b>70</b>	<b>83</b>	<b>219</b>	<b>124</b>	<b>12</b>	<b>52</b>	<b>4</b>	<b>702</b>

Table 5. 4Vn Cod (May to December): Numbers (thousands) landed at age.

AGE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	9	1	0	0
3	39	25	14	18	4	21	35	61	347	77	122	1
4	358	222	394	152	222	125	364	485	822	1040	343	39
5	1220	876	1146	1473	1086	853	567	1219	765	1046	2060	50
6	758	945	1591	1510	2226	1124	1011	1010	667	530	1139	122
7	1406	538	927	1648	1126	1492	994	949	315	320	363	146
8	806	821	452	933	695	705	930	604	358	225	294	40
9	310	288	372	395	361	384	375	473	159	171	100	12
10	134	219	223	316	191	252	150	156	145	57	52	5
11	76	65	91	105	89	112	89	49	35	43	41	2
12	27	46	30	37	56	65	53	14	15	16	28	4
13	14	21	11	19	21	34	18	5	6	10	3	1
14	11	7	5	5	8	20	6	7	1	1	2	0
15	5	7	6	6	5	7	6	3	0	1	1	0

TABLE 6. 4Vn cod (May - December): Average weight (kg) at age for total landings.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0.56	0.32	0	0
3	0.60	0.60	0.51	0.53	0.53	0.51	0.53	0.61	0.61	0.59	0.48	0.20
4	0.93	0.94	0.79	0.81	0.86	0.75	0.82	0.85	0.87	0.74	0.57	0.50
5	1.34	1.25	1.14	1.17	1.14	1.10	1.10	1.05	1.11	1.06	0.78	1.04
6	1.80	1.63	1.45	1.45	1.45	1.23	1.46	1.25	1.41	1.33	1.02	1.07
7	2.10	2.21	2.00	1.94	1.98	1.59	1.69	1.64	1.65	1.72	1.32	1.42
8	3.00	2.47	2.38	2.26	2.42	2.21	2.07	1.83	2.42	1.66	1.39	1.91
9	3.99	3.67	2.77	2.94	2.95	2.97	2.91	2.05	2.27	2.37	2.00	2.77
10	5.56	4.41	3.15	3.19	3.83	3.56	4.81	2.75	2.40	2.84	2.14	3.25
11	6.37	6.04	4.22	4.16	5.00	5.46	6.04	4.03	3.25	3.29	2.13	5.99
12	7.48	8.26	7.10	7.03	5.86	6.72	6.88	7.69	6.76	3.86	2.70	3.54
13	8.91	9.95	8.21	8.14	6.70	7.51	8.93	9.28	9.10	5.96	8.21	5.25
14	9.05	11.44	10.75	10.27	9.44	7.19	11.68	10.49	3.53	9.53	7.97	5.11
15	9.58	11.71	12.84	15.55	11.00	10.82	11.56	11.69	14.53	16.47	14.51	12.39

TABLE 7. 4Vn cod (May to December): Average length (cm) at age for total landings.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	40.00	0	0	0
3	40.53	40.39	39.11	38.83	38.87	39.17	38.22	41.16	40.75	40.90	39.78	30.40
4	47.32	47.05	45.02	44.90	45.89	44.38	44.34	46.02	46.00	44.13	42.12	40.03
5	53.70	51.98	50.90	50.67	50.53	50.47	48.94	49.33	49.69	49.18	46.14	50.34
6	59.49	56.81	54.67	54.94	54.95	52.39	53.96	52.30	53.63	52.72	49.63	50.35
7	62.75	63.02	60.24	61.00	61.16	57.12	56.76	57.25	56.24	56.93	53.42	54.77
8	71.07	65.50	63.35	64.63	65.54	63.77	60.79	59.40	63.43	56.19	54.07	59.86
9	78.46	74.93	69.17	67.97	70.22	70.37	68.20	61.69	61.75	61.37	59.89	66.48
10	88.14	79.75	71.10	70.88	76.80	74.77	80.93	67.92	59.33	63.95	60.19	68.80
11	92.38	88.80	77.69	78.07	84.21	86.23	87.48	77.10	66.86	68.52	60.45	84.33
12	97.70	98.79	92.65	92.65	88.96	92.43	91.44	95.54	88.18	69.34	63.89	71.06
13	103.84	105.25	97.29	97.19	93.17	95.91	99.94	101.67	98.42	80.80	90.32	79.76
14	104.41	110.38	105.17	106.22	104.94	94.52	109.50	105.88	69.43	94.54	86.80	79.22
15	106.52	111.24	120.81	112.63	110.62	108.35	109.10	109.78	114.26	117.06	112.74	127.00



TABLE 8. 4Vn cod (May to December): Research vessel abundance indices (mean number per tow & mean weight per tow) by age group.

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	NK	NO TOW	KG TOW
1970	0.00	6.35	1.77	4.78	10.90	10.46	4.50	2.59	0.84	0.00	0.29	0.14	0.13	0.21	42.96	57.47
1971	0.00	1.17	42.40	10.09	26.51	16.16	10.65	3.59	1.97	0.54	0.00	0.00	0.56	0.40	114.05	128.20
1972	0.00	0.52	0.28	2.35	0.30	1.61	1.47	0.39	0.27	0.25	0.19	0.00	0.37	0.37	8.39	22.12
1973	0.00	0.00	2.62	4.48	18.59	0.73	3.06	2.91	0.46	0.22	0.00	0.00	0.00	0.22	35.28	52.58
1974	0.00	0.00	0.61	1.36	2.79	3.21	0.40	0.50	0.26	0.22	0.11	0.00	0.00	0.00	9.47	14.44
1975	0.00	0.61	6.42	8.58	4.65	0.81	1.00	0.58	0.21	0.33	0.00	0.11	0.00	0.16	23.47	22.12
1976	0.00	6.49	2.25	1.48	1.93	1.55	0.73	1.79	1.65	1.41	0.24	0.23	0.47	0.00	20.21	43.41
1977	0.00	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	0.00	0.66	9.13	19.31	5.54	4.38	1.53	1.17	0.44	0.43	0.00	0.00	0.11	0.12	42.84	67.55
1979	0.00	1.30	0.79	5.15	2.51	0.59	1.72	0.56	0.29	0.15	0.00	0.17	0.45	0.00	13.66	27.58
1980	0.00	1.88	10.52	3.97	23.58	16.40	5.15	1.16	0.45	0.37	0.37	0.00	0.00	0.00	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	0.00	2.53	1.74	5.77	10.22	7.61	9.25	3.41	1.32	0.45	0.10	0.23	0.00	0.10	42.73	74.82
1983	0.00	4.37	22.11	7.90	10.64	10.04	1.70	3.41	1.52	0.66	0.25	0.00	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	0.00	0.48	3.75	19.10	125.90	52.13	22.38	7.26	1.44	0.77	0.67	0.00	0.37	3.63	237.94	295.97
1986	0.00	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	0.00	0.21	3.70	4.14	5.13	8.89	6.63	2.80	1.18	0.62	0.97	0.31	0.00	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	0.00	4.60	4.39	11.60	29.76	17.64	32.08	25.53	8.25	1.30	0.33	0.00	0.00	0.00	135.47	177.77
1990	0.00	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	1.00	0.50	11.10	5.34	3.21	0.74	0.70	0.14	0.30	0.30	0.00	0.06	0.00	23.66	25.23
1992	0.00	0.66	3.44	5.13	44.36	15.15	4.88	3.66	1.31	0.82	0.23	0.40	0.30	0.00	80.34	105.59
1993	0.00	0.40	3.18	6.18	5.70	14.67	7.36	1.74	0.50	0.05	0.06	0.07	0.00	0.00	39.96	47.67

## APPENDIX

### Quota Report for Cod 4Vn (May 1 -Dec 31) 1992

Fleet Sector	Quota(t)	June 2	Aug 12	Nov 4	Dec 31	Comment
Fixed <45	5,920	10 (0%)	171 (3%)	882 (15%)	1172 (20%)	Closed 1 Dec 92
Fixed 45-64	586	5 (1%)	5 (1%)	5 (1%)	9 (2%)	Closed 1 Dec 92
Mobile <45 Sector Overlap Quota 4T	133	7 (5%)	61 (46%)	105 (79%)	148 (112%)	Closed 1 Dec 92
Mobile <65 ITQ	2,121	259 (12%)	476 (22%)	771 (36%)	1895 (89%)	Closed 1 Dec 92
Mobile <65 Historical Overlap 4Rs,3Pn	220	0 (0%)	0 (0%)	0 (0%)	220 (100%)	Closed 1 Dec 92
Mobile <65 Bycatch Fishery 4T Overlap	40	2 (5%)	9 (23%)	9 (23%)	9 (23%)	Closed 1 Dec 92
Fixed 65-100	93	157 (168%)	152 (163%)	154 (166%)	149 (160%)	Closed 6 May 92
Mobile 65-100 Shrimp	93	0 (0%)	0 (0%)	0 (0%)	7 (8%)	Closed 1 Dec 92
Mobile 65-100 Groundfish Vessels (EA's)	94	0 (0%)	0 (0%)	0 (0%)	175 (187%)	Closed 1 Dec 92
All >100	700	55 (8%)	143 (20%)	98 (14%)	407 (58%)	Closed 1 Dec 92
<b>Totals</b>	10,000				4,191	

### Quota Report for Cod 4Vn (May 1 -Dec 31) 1993

Fleet Sector	Quota (t)	June 2	Aug 4	Nov 4	Dec 31	Comment
Fixed <45 (May 1 - July 31)	165	1	56(34%)	111(67%)	111(67%)	
Fixed <45 (Aug 1 - Sept 30)	455		0	331(74%)	329(74%)	Closed Sept 2,93
Fixed <45 (Oct 1 - Nov 30)	455			1	59(13%)	Closed Oct 1,93
Fixed 45-64	105	0	0	2(2%)	2(2%)	Closed Sept 2,93
Mobile <45 Sector Overlap Quota 4T	24	0	30(125%)	30(125%)	30(125%)	Closed June 22,93
Mobile <65 ITQ	368	3	23(6%)	35(10%)	36(10%)	Closed Sept 1,93
Mobile <65 Historical Overlap 4Rs,3Pn	40	0	0	2(5%)	2(5%)	Closed Sept 1,93
Mobile <65 Bycatch Fishery 4T Overlap	7	0	0	0	0	Closed Sept 1,93
Fixed 65-100	17	0	0	0	0	Closed Sept 2,93
Mobile 65-100 Shrimp	17	0	0	0	0	Closed Sept 1,93
Mobile 65-100 Groundfish Vessels (EA's)	17	0	0	1(7%)	1(7%)	Closed Sept 1,93
All >100	126	6	12(10%)	16(12%)	18(14%)	Closed Sept 1,93
<b>Totals</b>	1,786				588	