DFO Atlantic Fisheries
Research Document 94/33

MPO Pêches de l'Atlantique
Document de recherche 94/33

# An Assessment of the Cod Stock in NAFO Subdivision 3Ps

by

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ABSTRACT

Catch averaged slightly over 30,000 t from 1977 to the mid 1980's when there was an increase to about 57,000 t in 1986 and 1987. Since that time there has been a decline in catches to about 32,000 t in 1992 and further to only 15,000 t in 1993, the lowest level in the time series. Sequential population analysis was not considered appropriate for this stock due to problems with the survey data time series and stock mixing uncertainties. The research vessel data suggest that population numbers and biomass have been declining since the late 1980's. Research survey biomass continues to be low in 1994. The numbers of older (age 6+) fish found during surveys have declined, lengths-at age are decreasing particularly at older ages. Total mortality estimates from survey data are showing an increasing trend over the last decade. In response to questions regarding stock structure identification and possible stock overlap with adjoining divisions, research survey coverage has been increased and the timing of the survey has been changed. Information collected from inshore fishermen related to the fishery in Placentia Bay are presented. Fishermens' observations and landings data for the winter and spring inshore fisheries suggest that an increase in fish availability has occurred in the past four years. However, without directly assessing changes in effort, it is difficult to determine how this may relate to changes in abundance. Based on research vessel data, it is expected that the stock will remain low in 1995. There are no indications of good recruitment after the relatively strong year-class of 1989.

Résumé

En moyenne, les prises se sont situées un peu au-dessus de 30 000 t de 1977 au milieu des années 1980, puis ont atteint environ 57 000 t en 1986 et 1987. Elles ont depuis diminué, tombant à environ 32 000 t en 1992 puis au minimum de la série chronologique, soit 15 000 t seulement, en 1993. L'analyse séquentielle de population n'a pas été jugée adéquate pour ce stock, en raison de difficultés inhérentes à la série chronologique des données des relevés de recherche et aux incertitudes concernant le mélange des stocks. Les données des navires de recherche indiquent que l'effectif et la biomasse de la population diminuent depuis la fin des années 1980. La biomasse anticipée d'après les relevés de recherche continue d'être basse en 1994. Il est apparu au cours de ces relevés que le nombre de poissons de plus grand âge (6 +) est en recul, que les longueurs selon l'âge diminuent elles aussi, particulièrement chez les poissons plus âgés. Les estimations de mortalité totale fondées sur les relevés de recherche dénotent une tendance à la hausse au cours de la dernière décennie. Pour donner suite aux questions sur la structure du stock et sur le chevauchement possible de ce dernier avec ceux des divisions adjacentes, on a étendu la zone visée par les relevés de recherche et modifié le calendrier de ces derniers. On présente ici des données sur la pêche dans la baie de Placentia recueillies auprès des pêcheurs côtiers. D'après les observations des pêcheurs et les données sur les débarquements de l'hiver et du printemps dans la pêche côtière, un accroissement de la disponibilité du poisson s'est manifesté ces quatre dernières années. Toutefois, sans évaluation directe des changements dans l'effort, il est difficile de déterminer comment ce phénomène peut se traduire par des changements dans l'abondance. Selon les données des navires de recherche, le stock devrait rester faible en 1995. Il n'y a pas d'indice de bon recrutement depuis la classe d'âge relativement forte de 1989.

INTRODUCTION

Nominal catches in Subdivsion 3Ps were highest from 1959 to 1974 (average of 62,000t) peaking at 84,000t in 1961 (Table 1; Figure 1). Catches gradually declined to 27,000t in 1978 but rose again and averaged 36,000t until 1984. From 1985 to 1987, catches averaged 50,000t, mainly due to increased catches by France, but were relatively stable at about 42,000t from 1988 to 1991. The 1992 catch was only about 32,000t, reflecting a decline in French offshore and Canadian inshore catches by about 8,500t and 3,300t respectively. The 1993 catch was 15,000t, the lowest in the time series. The bulk of the catch came from the Canadian inshore fixed gear fishery. St. Pierre and Miquelon (SPM) inshore landings totalled about 40t. There was no EU-France trawler catch reported in 1994. The fishery was closed by the Canadian government on August 31 1993 and remains closed in 1994. Total landings are therefore lower than had the fishery continued to the end of the year.

Since 1976 only Canada and France have participated in the fishery. Catches by inshore gears (trap, gillnet, longline and handline) have traditionally accounted for the largest portion of the total Canadian catches. These have ranged between 20,000t and 29,000t since 1976 with a decline to 15,000t in 1993 (Figure 1). The longline fishery takes the largest portion of the total inshore catch followed by gillnet, trap and handline (Figure 2).

Nominal catches reported for 1993 (Table 2) were obtained from the Department of Fisheries and Oceans (Canada) and from French scientists at the IFREMER laboratory at St. Pierre (France).

In recent years an increasing portion of the Canadian winter otter trawl catch has been taken in deeper waters. However, there was no winter fishery in 1994 due to a moratorium.

Catch and average weight-at-age

A summary of the sampling used to derive the Canadian catch-at-age in 1993 is given in Table 3. The following relationship was applied in deriving the average weights-at-age; log weight = 3.0879 x log length -5.2106. The discrepancy between reported and calculated catch from these average weights in 1993 was less than 1%. Catch numbers and average weights at age are shown in Tables 4 and 5. The 1987 and 1989 year classes (ages 6 and 4) were most abundant in the total catch. Age 4 dominated cod trap catches while age 6 fish were dominant in the gillnet and mobile (otter trawl) gear. Longline catches which normally contribute the largest portion of catch in Div. 3Ps took predominantly age 4 and 6 in 1993. There was no sampling from the St. Pierre inshore catch as landings were very low.

Tables 6 - 8 show catch (numbers and biomass) and average weights-at-age for the 1959-93 period. Average weight at age generally declined from 1992 to 1993 particularly in the older ages.

Research vessel surveys

Stratified-random surveys have been conducted in Subdivision 3Ps during winter-spring by Canada since 1972 and France for the 1978-1992 period. The two survey series are similar with regard to the stratification scheme used (Figure 3), method of sampling, and analysis of results but differ in the type of fishing gear used and the daily timing of the survey (daylight hours only for French survey). Canadian surveys were conducted by the research vessels A. T. Cameron (1972-82), the Alfred Needler (1983-84) and the Wilfred Templeman (1985-94). From the limited amount of comparable fishing data available it has been concluded that the three had similar fishing power and that no adjustments were necessary. The French survey has been conducted by the research vessels Cryos (1978-91) and Thalassa (1992). Comparable fishing data between these two vessels was not available. Although the same fishing gear and survey design were used, it was the opinion of French scientists that the results from the two vessels might not be comparable. The French discontinued their surveys after 1992.

Canadian surveys have covered strata in depth ranges to 300 fathoms since 1980 while similar coverage by French surveys occurred only in 1981, 1983, and 1990-92. Since the 1993 survey new strata were added to those already surveyed, covering the outside part of Placentia Bay (5 strata) and the 400-500 fathom zone south of the Halibut Channel. All of these strata were fished in the 1994 survey.

To account for incomplete coverage of strata in certain years for both surveys, estimates of biomass and abundance for non-sampled strata were obtained using a multiplicative model. Results from both survey series are highly variable.

Biomass estimates from Canadian surveys (Tables 9 and 11; Figure 4) showed an increasing trend in the mid 1980's peaking at 85,000t in 1988. This was followed by a decline in 1989, increases in both 1990 and 91, and a substantial decline to about 10,000t in February 1993 and 8,000t in April 1993, the lowest levels observed in the 1978-94 time series. The 1994 survey results indicate an increase in the trawlable biomass to approximately 15,000t. Abundance estimates (Tables 10 and 11) followed a similar pattern.

French surveys (Tables 12, 13; Figure 4) showed an increasing trend from 1978 to 1986 followed by declines in the late 1980's. Increases in both 1990 and 1991 were followed by a substantial decline in 1992 to the lowest values observed in the time series.

Mean number-per-tow estimates from the Canadian surveys (Table 14) indicated that in 1994, the 1989 year-class was most abundant.

Results from the French survey (Tables 15) in 1992 also indicate that the 1989 and 1990 year-classes were abundant.

There was concern that the low estimates observed during the 1992 survey may have in part resulted from an apparent distribution change. In order to address this, two surveys were conducted in 1993, one in February and another in April. The later survey was conducted as recommended by CAFSAC because it was expected that at that time fewer cod would be outside the surveyable area. A further decline in the biomass index was observed in the April survey and the 1992-1993 results were among the lowest observed in the time series.

Results from research surveys to 1993 indicated that cod were being found in proportionally higher numbers in deeper water over time (Figures 5). The commercial fishery was also catching cod in deeper water than normally found and to some extent at depths greater than those covered during the survey. In some years the survey has included coverage of the 300-400 ftm depth range. Only in the February 1993 survey was a significant portion (20%) of the total survey biomass found in this area. In 1994, (Figure 6) approximately 4% of the biomass was found in the deeper areas.

Since 1991, bottom water temperatures from surveys have generally increased from the lows experienced during the mid-1980s and in 1990 but large spatial areas with negative temperature anomalies have continued into the spring of 1994, particularly on the eastern portion of St. Pierre Bank, on the continental slope areas and in Placentia Bay. Possible impacts of these changes cannot be determined.

Data from the commercial fishery as well as research vessel surveys suggest that changes in the stock distribution have occurred in recent years. There has been a tendency for survey catches to be larger in deeper waters; i.e. the Laurentian Channel and Southern Halibut Channel. Catches in depths <100 ftm have been very low since 1990. Some commercial catches in 1992 were reported from greater depths than those included in the survey. This is generally an area that is difficult to survey because of rough bottom conditions.

Commercial catch and effort data

During previous assessments, various problems were noted with the catch rate data from Canada and France. These may have resulted from technological changes within and between fleets, possibly learning over time, considerable fluctuation in catch, fishing area restrictions and variations in age structure of catch. Since these may have had a significant impact on CPUE trends, the commercial CPUE have not been used for calibration purposes.

Estimation of stock parameters

A formulation of ADAPT was applied which incorporated the research vessel indices of both Canada (1978-1994) and France (1978-1991) and assumed flat-topped partial recruitment. Residual patterns indicated some strong year effects and suggested a poor fit. Results also indicated that F may have increased in recent years and that abundance at older ages (6+) had declined (Table 16).

Research vessel survey total catch at age data (ages 1 to 21) weighted by survey stratum area, were used to examine the age distribution of 3Ps cod over the period 1972 to 1993. The proportional age distribution of 3Ps cod indicates that in recent years (1989 through 1993) some of the older age classes were beginning to disappear from the population (Figure 7). The complete absence of age-2 cod in 1993 also suggests that the 1991 year class may have failed. The slope of the relationship between the log of the proportion at age from the weighted mean catch/tow data versus age (a catch-curve estimate of total mortality; Z) for ages 6 to 15, 6 to 12 and 6 to 12 using a 3 point moving average, indicate a high degree of interannual variation. Mortality was generally higher (ranging between -0.4 and -0.9 depending on age classes used) during the period 1972-1982 relative to the 1983 to 1993 period (ranging between -0.25 and -0.7 depending on age classes used). The most dramatic change occured during the period 1982 to 1983. Nevertheless, total mortality estimates are showing an increasing trend over the last decade and are approaching the levels observed during the previous decade (Figure 8).

Assessment Results

Although there were some questions concerning the reliability of the research surveys as indicators of stock abundance, they suggest that there has been a decline in the resource for the past 3 years. This is consistent with declining length at age, increased total mortality from catch curve analyses and a loss of older age groups. Similar to stocks in adjoining divisions, 3Ps cod appear to have declined since the mid-eighties.

Despite general declines in the 3Ps cod fishery, 1993 inshore landings from the north end of Placentia Bay increased, and inshore fishers in the area reported a good abundance of fish. Further study is required to determine the relationship of the Placentia Bay cod to the overall stock complex because inshore fishers in other parts of 3Ps have reported declines.

Based on RV data which indicate biomass and abundance among the lowest observed, it is expected that the stock will remain low in 1995.

The stock affinities of catch in research surveys and commercial catches need to be better clarified in order to determine the status of this stock.

Table 1. Cod catches (MT) from Subdivision 3Ps, 1959-93.

| Year | Can (N) Offshore (Mobile) | Can (N) Inshore (fixed gear) | Can(M) | France STPM M Inshore | France STPM M Offshore | Metro | Spain | Portugal | Other | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 2,726 | 32,718 | 4,784 | 3,078 | - | 4,952 | 7,794 | 3,647 | 471 | 60,170 |
| 1960 | 1,780 | 40,059 | 5,095 | 3,424 | 210 | 2,460 | 17,223 | 262 | 2,123 | 72,636 |
| 1961 | 2,167 | 32,506 | 3,883 | 3,793 | 347 | 11,490 | 21,015 | 4,985 | 3,434 | 83,620 |
| 1962 | 1,176 | 29,888 | 1,474 | 2,171 | 70 | 4,138 | 10,289 | 1,873 | 1,560 | 52,639 |
| 1963 | 1,099 | 30,447 | 331 | 1,112 | 645 | 324 | 10,826 | 209 | 6,828 | 51,821 |
| 1964 | 2,161 | 23,897 | 370 | 1,002 | 1,095 | 2,777 | 15,216 | 169 | 9,880 | 56,567 |
| 1965 | 2,459 | 25,902 | 1,203 | 1,863 | 707 | 1,781 | 13,404 | - | 4,535 | 51,854 |
| 1966 | 5,473 | 23,785 | 583 | 1,157 | 2,050 | 4,607 | 23,678 | 519 | 4,355 | 66,207 |
| 1967 | 3,861 | 26,331 | 1,259 | 2,244 | | 3,204 | 20,851 | 980 | 4,044 | 62,774 |
| 1968 | 5,538 | 22,938 | 585 | - | 880 | 1,126 | 26,868 | 8 | 18,611 | 77,556 |
| 1969 | 4,269 | 20,009 | 849 | 1,415 | 1,062 | 15 | 28,141 | 57 | 7,982 | 63,799 |
| 1970 | 4,650 | 23,410 | 2,166 | 1,307 | 663 | 35 | 35,750 | 143 | 8,734 | 76,858 |
| 1971 | 8,657 | 26,651 | 731 | 1,196 | 455 | 2,730 | 19,169 | 81 | 2,778 | 62,448 |
| 1972 | 3,323 | 19,276 | 252 | 990 | 446 | - | 18,550 | 109 | 1,267 | 44,213 |
| 1973 | 3,107 | 21,349 | 181 | 976 | 189 | - | 19,952 | 1,180 | 5,707 | 52,641 |
| 1974 | 3,770 | 15,999 | 657 | 600 | 348 | 5,366 | 14,937 | 1,246 | 3,789 | 46,712 |
| 1975 | 741 | 14,332 | 122 | 586 | 189 | 3,549 | 12,234 | 1,350 | 2,270 | 35,373 |
| 1976 | 2,013 | 20,978 | 317 | 722 | 182 | 1,501 | 9,236 | 177 | 2,007 | 37,133 |
| 1977 | 3,333 | 23,755 | 2,171 | 845 | 407 | 1,734 | - | - | - | 32,245 |
| 1978 | 2,082 | 19,560 | 700 | 360 | 1,617 | 2,860 | - | - | 45 | 27,221 |
| 1979 | 2,381 | 23,413 | 863 | 495 | 3,794 | 2,060 | - | - | - | 33,006 |
| 1980 | 1,809 | 29,427 | 715 | 214 | 1,722 | 2,681 | - | - | - | 37,568 |
| 1981 | 2,696 | 26,068 | 2,321 | 333 | 3,768 | 3,706 | - | - | - | 38,892 |
| 1982 | 2,639 | 21,351 | 2,948 | 1,009 | 3,771 | 2,184 | - | - | - | 33,902 |
| 1983 | 2,100 | 23,915 | 2,580 | 843 | 4,775 | 4,238 | - | - | - | 38,451 |
| 1984 | 895 | 22,865 | 1,969 | 777 | 6,773 | 3,671 | - | - | - | 36,950 |
| 1985 | 4,529 | 24,854 | 3,476 | 642 | 9,422 | 8,444 | - | - | - | 51,367 |
| 1986 | 4,981 | 24,208 | 2,120 | 389 | 13,653 | 11,939 | - | - | - | 57,290 |
| 1987 | 3,693 | 26,589 | 2,517 | 551 | 15,214 | 8,737 | - | - | - | 57,301 |
| 1988 | 3,663 | 19,742 | 2,303 | 282 | 10,011 | 7,373 | - | - | 4 | 43,377 |
| 1989 | 3,098 | 23,208 | 2,361 | 335 | 9,646 | 892 | - | - | - | 39,540 |
| 1990* | 2,990 | 20,047 | 3,289 | 158 | 14,769 | - | - | - | - | 41,253 |
| 1991* | 3,395 | 21,297 | 2,596 | 204 | 15,583 | - | - | - | - | 43,075 |
| 1992* | 3,905 | 17,940 | 2,628 | 2 | 7,050 | - | - | - | - | 31,525 |
| 1993* | 1987 | 11,533 | 1,351 | 40 | - | - | - | - | - | 14,911 |

*Provisional.

Table 2. Cod landings by Canada during 1993 from Subdivision 3Ps by month and gear.

| | Can (N) | | | | | | | Can (SF) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OT | MWT | D.S. | GN | LL | HL | Trap | OT | MWT | GN | LL | Total |
| Jan | 617 | | 33 | 181 | 499 | 42 | | 548 | | | 83 | 2003 |
| Feb | 762 | 3 | | 215 | 104 | 51 | 3 | 89 | 1 | | 95 | 1323 |
| Mar | 482 | 14 | 1 | 175 | 87 | 7 | | 4 | 11 | | 163 | 944 |
| Apr | 1 | 12 | | 310 | 77 | 60 | 451 | 12 | 39 | | 178 | 1140 |
| May | 51 | | 7 | 359 | 288 | 76 | 562 | | | | 17 | 1360 |
| Jun | 1 | | | 603 | 419 | 147 | 628 | | | | 28 | 1826 |
| Jul | | | 2 | 1480 | 579 | 305 | 1722 | | | | 24 | 4112 |
| Aug | | | | 492 | 913 | 215 | 26 | | | 12 | 42 | 1700 |
| Sep[a] | | | | 52 | 104 | 114 | 1 | | | | | 271 |
| Oct | | | | 2 | 12 | 72 | | | | | | 86 |
| Nov | | | | 1 | 2 | 68 | | 3 | | | | 74 |
| Dec | | | 1 | | | 29 | | 1 | 1 | | | 32 |
| Tot | 1914 | 29 | 44 | 3870 | 3084 | 1186 | 3393 | 657 | 52 | 12 | 630 | 14871 |

[a]A moratorium on commercial fishing was imposed effective August 31, 1993.

Table 3. Commercial sampling by Canada used to estimate catch at age for Subdivision 3Ps in 1993.

| Gear | Month | Number Measured | Number Aged | Weight Total (t) | Cumulative Total (t) |
|---|---|---|---|---|---|
| OT | Jan | 4919 | | 1198 | |
| +Seine | Feb | 3870 | 580 | 854 | |
| | Mar | 1627 | | 551 | |
| | Apr | 113 | | 12 | |
| | May | 229 | 43 | 51 | |
| | Jun | | | 1 | 2696 |
| GN | Mar | 363 | | 175 | |
| | Apr | 277 | 574 | 310 | |
| | May | | | 359 | |
| | Jun | | | 603 | |
| | Jul | 284 | 245 | 1480 | |
| | Aug | 272 | | 504 | 3882 |
| Trap | Mar | | | | |
| | Apr | | 574 | 451 | |
| | May | 2362 | | 562 | |
| | Jun | 2119 | | 628 | |
| | Jul | 10511 | 245 | 1722 | |
| | Aug | | | 26 | 3393 |
| LL | Jan | 418 | 188 | 499 | |
| | Feb | | | 104 | |
| | Mar | 467 | | 87 | |
| | Apr | | 574 | 77 | |
| | May | | | 288 | |
| | Jun | 268 | | 419 | |
| | Jul | | 245 | 579 | |
| | Aug | 2642 | | 913 | 3714 |
| HL | Mar | | | 7 | |
| | Apr | 980 | 574 | 60 | |
| | May | | | 76 | |
| | Jun | | | 147 | |
| | Jul | | 245 | 305 | |
| | Aug | 100 | | 215 | 1186 |
| Totals | | 31821 | 4087 | | 14871 |

Table 4. Cod catch and average weight at age by gear from the Canadian fishery in NAFO Subdivision 3Ps during 1993.

| | Mobile gear | | | | | Longline | |
|---|---|---|---|---|---|---|---|
| Age | < 65' | > 65' | Codtrap | Gillnet | Handline | Inshore | Offshore |
| | | | Numbers (x $10^{-3}$) | | | | |
| 3 | | | 254 | | | 21 | |
| 4 | 35 | 197 | 2363 | 70 | 300 | 675 | |
| 5 | 65 | 345 | 783 | 186 | 186 | 416 | 8 |
| 6 | 108 | 567 | 574 | 782 | 298 | 701 | 50 |
| 7 | 36 | 247 | 130 | 459 | 95 | 258 | 80 |
| 8 | 13 | 104 | 16 | 124 | 16 | 84 | 34 |
| 9 | 2 | 29 | 1 | 36 | 3 | 8 | 10 |
| 10 | 1 | 18 | | 7 | | 9 | 3 |
| 11 | 3 | 27 | | 13 | 1 | 3 | 6 |
| 12 | | 7 | | 3 | | 2 | |
| 13 | | 3 | | 7 | | 1 | 2 |
| 14 | | 2 | | 3 | | | 1 |
| 15 | | | | | | | |
| 16 | | 1 | | | | | |
| 17 | | | | | | 1 | |
| 18 | | | | | | | |
| 19 | | | | 1 | | | |
| 20 | | | | | | | |
| WT | 359 | 2337 | 3393 | 3882 | 1186 | 2784 | 630 |
| | | | Ave. wt. - kg | | | | |
| 3 | | | .35 | | | .39 | |
| 4 | .83 | .82 | .63 | .95 | .79 | .71 | |
| 5 | 1.04 | 1.03 | .95 | 1.52 | 1.12 | 1.12 | 1.83 |
| 6 | 1.16 | 1.17 | 1.22 | 1.94 | 1.42 | 1.45 | 2.49 |
| 7 | 1.52 | 1.83 | 1.47 | 2.46 | 1.91 | 2.02 | 3.16 |
| 8 | 1.54 | 2.29 | 1.90 | 3.35 | 2.83 | 2.67 | 3.90 |
| 9 | 2.46 | 3.46 | 2.73 | 4.82 | 4.48 | 3.90 | 5.84 |
| 10 | 3.31 | 4.53 | | 4.66 | | 3.40 | 5.33 |
| 11 | 1.80 | 4.55 | | 5.24 | 4.63 | 4.93 | 5.28 |
| 12 | | 7.59 | | 6.88 | | 8.09 | |
| 13 | | 8.92 | | 6.63 | | 4.90 | 6.13 |
| 14 | | 7.76 | | 8.94 | | | 7.21 |
| 15 | | | | | | | |
| 16 | | 16.36 | | | | | |
| 17 | | | | | | 10.11 | |
| 18 | | | | | | | |
| 19 | | | | 10.11 | | | |

Table 5. Catch, average weight and average length from the Canadian commercial fishery for cod in NAFO Subdivision 3Ps during 1993.

| | AVERAGE | | CATCH | | |
|---|---|---|---|---|---|
| AGE | WEIGHT | LENGTH | MEAN | STD. ERR. | C. V. |
| 3 | 0.355 | 34.685 | 278 | 44.27 | 0.16 |
| 4 | 0.680 | 42.583 | 3712 | 109.63 | 0.03 |
| 5 | 1.077 | 49.265 | 2035 | 107.60 | 0.05 |
| 6 | 1.480 | 54.536 | 3156 | 101.76 | 0.03 |
| 7 | 2.127 | 60.994 | 1334 | 66.73 | 0.05 |
| 8 | 2.824 | 66.179 | 401 | 34.60 | 0.09 |
| 9 | 4.341 | 76.404 | 89 | 11.66 | 0.13 |
| 10 | 4.302 | 76.147 | 38 | 8.02 | 0.21 |
| 11 | 4.683 | 77.222 | 52 | 9.42 | 0.18 |
| 12 | 7.494 | 92.689 | 13 | 3.01 | 0.23 |
| 13 | 6.845 | 89.525 | 14 | 3.57 | 0.26 |
| 14 | 8.238 | 95.172 | 5 | 1.67 | 0.33 |
| 15 | | | | | |
| 16 | 16.360 | 120.292 | 1 | 0.01 | 0.01 |
| 17 | 12.508 | 109.252 | 1 | 1.14 | 0.83 |
| 18 | | | | | |
| 19 | 10.112 | 103.000 | 1 | 1.04 | 1.17 |

TABLE 6 . CATCH NUMBERS AT AGE (THOUSANDS) FROM THE COMMERCIAL COD FISHERY IN NAFO SUBDIVISION 3PS FOR THE YEARS 1959-93.

| | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 1001 | 567 | 450 | 1245 | 961 | 1906 | 2314 | 349 | 2871 | 1143 | 774 | 756 | 2384 | 731 | 945 | 1887 | 1840 | 4110 | 935 |
| 4 | 13940 | 5496 | 5586 | 6749 | 4499 | 5785 | 9636 | 13662 | 10913 | 12602 | 7098 | 8114 | 6444 | 4944 | 4707 | 6042 | 7329 | 12139 | 9156 |
| 5 | 7525 | 23704 | 10357 | 9003 | 7091 | 5635 | 5799 | 13065 | 12900 | 13135 | 11585 | 12916 | 8574 | 4591 | 11386 | 9987 | 5397 | 7923 | 8326 |
| 6 | 7265 | 6714 | 15960 | 4533 | 5275 | 5179 | 3609 | 4621 | 6392 | 5853 | 7178 | 9763 | 7266 | 3552 | 4010 | 6365 | 4541 | 2875 | 3209 |
| 7 | 4875 | 3476 | 3616 | 5715 | 2527 | 2945 | 3254 | 5119 | 2349 | 3572 | 4554 | 6374 | 8218 | 4603 | 4022 | 2540 | 5867 | 1305 | 920 |
| 8 | 942 | 3484 | 4680 | 1367 | 3030 | 1881 | 2055 | 1586 | 1364 | 1308 | 1757 | 2456 | 3131 | 2636 | 2201 | 1857 | 723 | 495 | 395 |
| 9 | 1252 | 1020 | 1849 | 791 | 898 | 1891 | 1218 | 1833 | 604 | 549 | 792 | 730 | 1275 | 833 | 2019 | 1149 | 1196 | 140 | 265 |
| 10 | 1260 | 327 | 1376 | 571 | 292 | 652 | 1033 | 1039 | 316 | 425 | 717 | 214 | 541 | 463 | 515 | 538 | 105 | 53 | 117 |
| 11 | 631 | 406 | 446 | 187 | 143 | 339 | 327 | 517 | 380 | 222 | 61 | 178 | 85 | 205 | 172 | 249 | 174 | 17 | 57 |
| 12 | 545 | 407 | 265 | 140 | 99 | 329 | 68 | 389 | 95 | 111 | 120 | 77 | 125 | 117 | 110 | 80 | 52 | 21 | 43 |
| 13 | 44 | 283 | 560 | 135 | 107 | 54 | 122 | 32 | 149 | 5 | 67 | 121 | 62 | 48 | 14 | 32 | 6 | 4 | 31 |
| 14 | 0 | 27 | 58 | 241 | 92 | 27 | 36 | 22 | 3 | 107 | 110 | 14 | 57 | 45 | 29 | 17 | 2 | 3 | 11 |
| 3+ | 39280 | 46411 | 45203 | 30677 | 25014 | 26623 | 29471 | 42834 | 38336 | 39032 | 34813 | 41713 | 38662 | 22768 | 30130 | 30743 | 27232 | 29085 | 23465 |
| 4+ | 38279 | 45844 | 44753 | 29432 | 24053 | 24717 | 27157 | 41885 | 35465 | 37889 | 34039 | 40957 | 35778 | 22037 | 29185 | 28856 | 25392 | 24975 | 22530 |
| 5+ | 24339 | 40348 | 39167 | 22683 | 19554 | 18932 | 17521 | 28223 | 24552 | 25287 | 26941 | 32843 | 29334 | 17093 | 24478 | 22814 | 18063 | 12836 | 13374 |
| 6+ | 16814 | 16644 | 28810 | 13680 | 12463 | 13297 | 11722 | 15158 | 11652 | 12152 | 15356 | 19927 | 20760 | 12502 | 13092 | 12827 | 12666 | 4913 | 5048 |

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 502 | 135 | 368 | 1022 | 130 | 760 | 203 | 206 | 306 | 585 | 935 | 1071 | 2006 | 812 | 1233 | 278 |
| 4 | 5146 | 3072 | 1625 | 2888 | 5092 | 2682 | 4521 | 4718 | 5103 | 2956 | 4951 | 8995 | 8622 | 7981 | 3393 | 3712 |
| 5 | 6096 | 10321 | 5054 | 3136 | 4430 | 9174 | 4538 | 11473 | 10253 | 11023 | 4971 | 7842 | 8195 | 10028 | 6960 | 2035 |
| 6 | 4006 | 5066 | 8156 | 4652 | 2348 | 4080 | 7018 | 6118 | 11228 | 9763 | 6471 | 2863 | 3329 | 5907 | 5590 | 3156 |
| 7 | 1753 | 2353 | 3379 | 5855 | 2861 | 1752 | 2221 | 5072 | 4283 | 5453 | 5046 | 2549 | 1483 | 2164 | 1989 | 1334 |
| 8 | 653 | 721 | 1254 | 1622 | 2939 | 1150 | 584 | 1496 | 2167 | 1416 | 1793 | 1112 | 1237 | 807 | 635 | 401 |
| 9 | 235 | 233 | 327 | 539 | 640 | 1041 | 542 | 417 | 650 | 1107 | 630 | 600 | 692 | 620 | 270 | 89 |
| 10 | 178 | 84 | 114 | 175 | 243 | 244 | 338 | 377 | 224 | 341 | 284 | 223 | 350 | 428 | 193 | 38 |
| 11 | 72 | 53 | 56 | 67 | 83 | 91 | 134 | 333 | 171 | 149 | 123 | 141 | 142 | 108 | 173 | 52 |
| 12 | 27 | 24 | 45 | 35 | 30 | 37 | 35 | 131 | 143 | 78 | 75 | 57 | 104 | 76 | 81 | 13 |
| 13 | 17 | 13 | 21 | 18 | 11 | 18 | 8 | 24 | 79 | 135 | 53 | 29 | 47 | 50 | 43 | 14 |
| 14 | 10 | 10 | 25 | 2 | 7 | 8 | 8 | 12 | 23 | 50 | 31 | 26 | 22 | 22 | 42 | 5 |
| 3+ | 18695 | 22085 | 20424 | 20011 | 18814 | 21037 | 20150 | 30377 | 34630 | 33056 | 25363 | 25508 | 26229 | 29003 | 20602 | 11127 |
| 4+ | 18193 | 21950 | 20056 | 18989 | 18684 | 20277 | 19947 | 30171 | 34324 | 32471 | 24428 | 24437 | 24223 | 28191 | 19369 | 10849 |
| 5+ | 13047 | 18878 | 18431 | 16101 | 13592 | 17595 | 15426 | 25453 | 29221 | 29515 | 19477 | 15442 | 15601 | 20210 | 15976 | 7137 |
| 6+ | 6951 | 8557 | 13377 | 12965 | 9162 | 8421 | 10888 | 13980 | 18968 | 18492 | 14506 | 7600 | 7406 | 10182 | 9016 | 5102 |

TABLE 7. AVERAGE WEIGHTS AT AGE (KG.) FORM THE COMMERCIAL COD FISHERY IN NAFO SUBDIVISION 3PS FOR THE YEARS 1959-93.

| | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.55 | 0.45 | 0.41 | 0.52 | |
| 4 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.68 | 0.70 | 0.65 | 0.72 | |
| 5 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 | 1.30 | 1.08 | 1.01 | 1.13 | |
| 6 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.68 | 1.86 | 1.75 | 1.65 | 1.66 | |
| 7 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.67 | 2.45 | 2.55 | 2.48 | |
| 8 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.21 | 3.42 | 2.99 | 3.68 | 3.60 | |
| 9 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.19 | 4.10 | 4.30 | 5.40 | |
| 10 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 5.08 | 4.94 | 5.16 | 6.49 | 6.95 | |
| 11 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 6.03 | 5.92 | 5.17 | 7.00 | 7.29 | |
| 12 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 6.76 | 7.20 | 8.20 | 8.64 | |
| 13 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.05 | 8.78 | 7.75 | 9.53 | 9.33 | |
| 14 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 9.16 | 10.90 | 8.72 | 10.34 | 9.58 | |

| | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0.48 | 0.45 | 0.58 | 0.66 | 0.64 | 0.54 | 0.56 | 0.63 | 0.63 | 0.58 | 0.60 | 0.46 | 0.36 |
| 4 | 0.79 | 0.77 | 0.84 | 1.04 | 0.98 | 0.75 | 0.77 | 0.82 | 0.81 | 0.86 | 0.75 | 0.68 | 0.68 |
| 5 | 1.32 | 1.17 | 1.33 | 1.40 | 1.36 | 1.18 | 1.21 | 1.09 | 1.16 | 1.27 | 1.17 | 1.04 | 1.08 |
| 6 | 1.80 | 1.78 | 1.99 | 1.97 | 1.93 | 1.84 | 1.63 | 1.67 | 1.63 | 1.85 | 1.74 | 1.59 | 1.48 |
| 7 | 2.30 | 2.36 | 2.58 | 2.64 | 2.51 | 2.43 | 2.31 | 2.17 | 2.25 | 2.45 | 2.37 | 2.25 | 2.13 |
| 8 | 3.27 | 2.88 | 3.26 | 3.77 | 3.43 | 3.15 | 3.02 | 2.92 | 3.37 | 3.00 | 2.91 | 2.90 | 2.82 |
| 9 | 4.36 | 3.91 | 3.77 | 4.75 | 4.35 | 4.30 | 4.33 | 3.58 | 4.11 | 4.22 | 3.69 | 4.05 | 4.34 |
| 10 | 5.68 | 5.28 | 5.04 | 5.56 | 5.06 | 5.50 | 5.11 | 4.98 | 5.18 | 5.09 | 4.23 | 5.55 | 4.30 |
| 11 | 7.41 | 6.18 | 6.56 | 6.01 | 5.42 | 6.19 | 6.20 | 5.61 | 6.29 | 6.35 | 6.34 | 6.69 | 4.68 |
| 12 | 9.04 | 8.62 | 8.45 | 9.04 | 9.37 | 8.72 | 6.98 | 6.60 | 7.30 | 7.60 | 7.68 | 8.02 | 7.49 |
| 13 | 8.39 | 8.64 | 10.06 | 11.20 | 11.95 | 8.05 | 7.08 | 7.46 | 7.75 | 8.31 | 8.64 | 9.30 | 6.85 |
| 14 | 9.56 | 11.41 | 11.82 | 10.40 | 10.85 | 11.91 | 8.34 | 8.92 | 8.73 | 10.37 | 9.72 | 11.60 | 8.24 |

TABLE 8. CATCH BIOMASS AT AGE (t) FROM THE COMMERCIAL COD FISHERY IN NAFO SUBDIVISION 3PS FOR THE YEARS 1959-93.

| | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 280 | 159 | 126 | 349 | 269 | 534 | 648 | 266 | 804 | 320 | 217 | 212 | 308 | 205 | 265 | 528 | 515 | 1151 | 514 |
| 4 | 9619 | 3792 | 3854 | 4657 | 3104 | 3992 | 6649 | 3427 | 7530 | 8695 | 4898 | 5599 | 4446 | 3411 | 3248 | 4169 | 5057 | 8376 | 6226 |
| 5 | 8127 | 25600 | 11186 | 9723 | 7658 | 6086 | 6263 | 14110 | 13932 | 14186 | 12512 | 13949 | 9260 | 4958 | 12297 | 10786 | 5829 | 8557 | 10824 |
| 6 | 12205 | 11280 | 26813 | 7615 | 8862 | 3701 | 6063 | 7763 | 10739 | 9833 | 12059 | 16402 | 12207 | 5967 | 6737 | 10693 | 7629 | 4830 | 5969 |
| 7 | 11700 | 8342 | 8678 | 13716 | 6065 | 7068 | 7810 | 12286 | 5638 | 8573 | 10930 | 15298 | 19723 | 11047 | 9653 | 6096 | 14081 | 3132 | 2456 |
| 8 | 3024 | 11184 | 15023 | 4388 | 9726 | 6038 | 6597 | 5091 | 4378 | 4199 | 5640 | 7884 | 10051 | 8462 | 7065 | 5961 | 2321 | 1589 | 1351 |
| 9 | 5133 | 4182 | 7581 | 3243 | 3682 | 7753 | 4994 | 7515 | 2476 | 2251 | 3247 | 2993 | 5228 | 3415 | 8278 | 4711 | 4904 | 574 | 1110 |
| 10 | 6401 | 4201 | 6990 | 2901 | 1483 | 3312 | 5248 | 5278 | 1605 | 2159 | 3642 | 1087 | 2748 | 2352 | 2616 | 2733 | 533 | 269 | 578 |
| 11 | 3805 | 2448 | 2689 | 1128 | 862 | 2044 | 1972 | 3118 | 2291 | 1339 | 368 | 1073 | 513 | 1236 | 1037 | 1501 | 1049 | 103 | 337 |
| 12 | 3815 | 2849 | 1855 | 980 | 693 | 2303 | 476 | 2723 | 665 | 777 | 840 | 539 | 875 | 819 | 770 | 560 | 364 | 147 | 291 |
| 13 | 354 | 2278 | 4508 | 1087 | 861 | 435 | 982 | 258 | 1199 | 40 | 539 | 974 | 499 | 386 | 113 | 258 | 48 | 32 | 272 |
| 14 | 0 | 247 | 531 | 2208 | 843 | 247 | 330 | 202 | 27 | 980 | 1008 | 128 | 522 | 412 | 266 | 156 | 18 | 27 | 120 |
| 3+ | 64463 | 76563 | 89835 | 51994 | 44109 | 48512 | 48030 | 68036 | 51285 | 53352 | 55899 | 66138 | 66879 | 42672 | 52344 | 48152 | 42348 | 28787 | 30049 |
| 4+ | 64183 | 76404 | 89709 | 51645 | 43840 | 47979 | 47382 | 67770 | 50482 | 53032 | 55682 | 65926 | 66071 | 42467 | 52079 | 47624 | 41833 | 27636 | 29534 |
| 5+ | 54564 | 72612 | 85854 | 46988 | 40736 | 43987 | 40733 | 58343 | 42952 | 44336 | 50785 | 60327 | 61625 | 39055 | 48831 | 43455 | 36776 | 19260 | 23308 |
| 6+ | 46437 | 47011 | 74669 | 37265 | 33078 | 37901 | 34470 | 44233 | 29020 | 30150 | 38273 | 46378 | 52365 | 34097 | 36534 | 32669 | 30947 | 10703 | 12485 |

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 226 | 55 | 191 | 491 | 59 | 441 | 134 | 132 | 165 | 328 | 589 | 675 | 1163 | 487 | 567 | 99 |
| 4 | 3602 | 1997 | 1170 | 2282 | 3921 | 2253 | 4702 | 4624 | 3827 | 2276 | 4060 | 7286 | 7415 | 5986 | 2307 | 2524 |
| 5 | 6584 | 10424 | 5711 | 4140 | 5183 | 12201 | 6353 | 15603 | 12099 | 13338 | 5418 | 9097 | 10408 | 11733 | 7238 | 2192 |
| 6 | 7011 | 8359 | 13539 | 8374 | 4179 | 8119 | 13825 | 11808 | 20660 | 15914 | 10807 | 4667 | 6159 | 10278 | 8888 | 4671 |
| 7 | 4295 | 6000 | 8380 | 13466 | 6752 | 4520 | 5863 | 12731 | 10408 | 12596 | 10950 | 5735 | 3633 | 5129 | 4475 | 2837 |
| 8 | 1952 | 2653 | 4514 | 5304 | 8464 | 3749 | 2202 | 5131 | 6826 | 4276 | 5236 | 3747 | 3711 | 2348 | 1842 | 1132 |
| 9 | 963 | 1002 | 1766 | 2350 | 2502 | 3925 | 2575 | 1814 | 2795 | 4793 | 2255 | 2466 | 2920 | 2288 | 1094 | 386 |
| 10 | 918 | 545 | 792 | 994 | 1283 | 1230 | 1879 | 1908 | 1232 | 1743 | 1414 | 1155 | 1782 | 1810 | 1071 | 163 |
| 11 | 372 | 371 | 408 | 496 | 513 | 597 | 805 | 1805 | 1058 | 924 | 690 | 887 | 902 | 685 | 1157 | 244 |
| 12 | 194 | 197 | 389 | 316 | 259 | 313 | 316 | 1227 | 1247 | 544 | 495 | 416 | 790 | 584 | 650 | 97 |
| 13 | 132 | 124 | 196 | 151 | 95 | 181 | 90 | 287 | 636 | 956 | 395 | 225 | 391 | 432 | 400 | 96 |
| 14 | 87 | 108 | 240 | 19 | 80 | 95 | 83 | 130 | 274 | 417 | 277 | 227 | 228 | 214 | 487 | 41 |
| 3+ | 26337 | 31836 | 37296 | 38383 | 33290 | 37623 | 38828 | 57199 | 61227 | 58105 | 42586 | 36583 | 39502 | 41973 | 30176 | 14483 |
| 4+ | 26111 | 31780 | 37105 | 37892 | 33232 | 37182 | 38694 | 57068 | 61061 | 57777 | 41997 | 35908 | 38338 | 41486 | 29609 | 14384 |
| 5+ | 22509 | 29784 | 35935 | 35611 | 29311 | 34929 | 33992 | 52444 | 57234 | 55501 | 37937 | 28622 | 30923 | 35500 | 27302 | 11860 |
| 6+ | 15925 | 19359 | 30224 | 31471 | 24128 | 22728 | 27639 | 36841 | 45136 | 42163 | 32519 | 19525 | 20516 | 23768 | 20064 | 9669 |

**Table 9.** Cod abundance estimates (thousands of fish) from research vessel surveys in NAFO Division 3Ps.

| DEPTH range (fath) | Stratum number | Stratum Area sq. mi. | ATC 207 1973 | ATC 221 1974 | ATC 234 1975 | ATC 247 1976 | ATC 261 1977 | ATC 273 1978 | ATC 287 1979 | ATC 302 1980 | ATC 316 1981 | ATC 330 1982 | AN 9 1983 | AN 26 1984 | WT 26 1985 | WT 45 1986 | WT 55+56 1987 | WT 68 1988 | WT 81 1989 | WT 91 1990 | WT 103 1991 | WT 118 1992 | WT 135 1993 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mar 20-30 | Mar 16-23 | Apr 19-30 | Jun 2-13 | Apr 14-26 | Feb 21-28 | 16-Feb 5-Mar | 19-Mar 2-Apr | Mar 7-26 | 28-May 9-Jun | 22-Apr 8-May | Apr 9-18 | Mar 7-26 | Mar 6-23 | 13-Feb 22-Mar | 27-Jan 14-Feb | Feb 1-16 | 31-Jan 20-Feb | Feb 2-20 | Feb 5-25 | Apr 1-21 |
| 0-30 | 314 | 974 | 27 | 1170 | 11 | 1060 | 73 | 0 | 254 | 279 | 307 | 2237 | 1859 | 91 | 21 | 0 | 0 | 42 | 8 | 24 | 0 | 0 | 0 |
| | 320 | 1320 | 545 | 329 | 113 | 941 | 245 | 429 | 942 | 528 | 10354 | 1362 | 1589 | 1870 | 476 | 99 | 129 | 180 | 238 | 0 | 83 | 11 | 0 |
| 31-50 | 308 | 112 | 34 | 122 | 65 | 34 | 166 | 21 | 74 | 59 | 46 | 235 | 238 | 395 | 563 | 0 | 13 | 13 | 4 | 8 | 4 | 8 | 46 |
| | 312 | 272 | 240 | 225 | 221 | 257 | 628 | 378 | 157 | 98 | 92 | 296 | 347 | 153 | 1644 | 31 | 51 | 20 | 7 | 0 | 10 | 0 | 0 |
| | 315 | 827 | 0 | 62 | 39 | 745 | 1304 | 175 | 621 | 171 | 0 | 145 | 489 | 410 | 177 | 786 | 147 | 103 | 133 | 217 | 35 | 18 | 0 |
| | 321 | 1189 | 0 | 100 | 17 | 312 | 67 | 179 | 333 | 196 | 402 | 1227 | 785 | 342 | 77 | 27 | 54 | 162 | 20 | 11 | 57 | 0 | 11 |
| | 325 | 944 | 12 | 46 | 0 | 35 | 29 | 567 | 850 | 35 | 213 | 85 | 124 | 71 | 0 | 27 | 47 | 24 | 18 | 35 | 102 | 21 | 0 |
| | 326 | 166 | 0 | 3 | 0 | 91 | 1 | 0 | 12 | 6 | 0 | 69 | 62 | 0 | 6 | 0 | 19 | 19 | 0 | 6 | 19 | 0 | 0 |
| 51-100 | 307 | 395 | 2645 | 2622 | 431 | 778 | 1090 | 1186 | 2090 | 949 | 5505 | 2372 | 569 | 193 | 2006 | 5802 | 1433 | 4700 | 1710 | 395 | 79 | 59 | 741 |
| | 311 | 317 | 822 | 2861 | 433 | 666 | 125 | 309 | 1124 | 3105 | 690 | 1888 | 1348 | 381 | 3692 | 127 | 2427 | 898 | 103 | 119 | 56 | 12 | 48 |
| | 317 | 193 | 354 | 761 | 127 | 971 | 199 | 255 | 309 | 1391 | 623 | 913 | 2062 | 14 | 1427 | 420 | 420 | 101 | 101 | 7 | 80 | 36 | 36 |
| | 319 | 984 | 872 | 1182 | 638 | 4136 | 2945 | 2221 | 15068 | 2733 | 13000 | 3176 | 2058 | 1637 | 111 | 3241 | 6968 | 6795 | 2401 | 1781 | 936 | 214 | 259 |
| | 322 | 1567 | 219 | 430 | 150 | 2294 | 321 | 706 | 118 | 2641 | 471 | 2632 | 1882 | 509 | 860 | 1382 | 1082 | 206 | 260 | 154 | 210 | 15 | 0 |
| | 323 | 696 | 109 | 212 | 76 | 78 | 138 | 1097 | 597 | 261 | 78 | 392 | 383 | 901 | 871 | 2069 | 3466 | 199 | 112 | 13 | 70 | 9 | 0 |
| | 324 | 494 | 41 | 87 | 17 | 37 | 63 | 118 | 93 | 0 | 152 | 352 | 593 | 321 | 10476 | 178 | 111 | 185 | 0 | 15 | 111 | 15 | 0 |
| 101-150 | 306 | 419 | 153 | 173 | 472 | 110 | 65 | 115 | 440 | 204 | 2810 | 692 | 763 | 47 | 267 | 577 | 6172 | 1329 | 231 | 1342 | 86 | 94 | 865 |
| | 309 | 296 | 141 | 111 | 152 | 89 | 63 | 67 | 870 | 289 | 1811 | 700 | 496 | 56 | 933 | 1700 | 1067 | 1355 | 833 | 733 | 467 | 22 | 700 |
| | 310 | 170 | 61 | 64 | 2039 | 161 | 0 | 183 | 121 | 0 | 651 | 434 | 72 | 57 | 102 | 179 | 115 | 315 | 351 | 421 | 376 | 19 | 172 |
| | 313 | 165 | 111 | 89 | 215 | 54 | 26 | 17 | 1018 | 81 | 266 | 217 | 37 | 12 | 111 | 0 | 173 | 43 | 508 | 81 | 211 | 124 | 62 |
| | 316 | 189 | 880 | 76 | 19 | 110 | 14 | 70 | 85 | 35 | 21 | 82 | 128 | 78 | 38 | 14 | 38 | 24 | 634 | 5881 | 85 | 21 | 57 |
| | 318 | 123 | 9 | 5 | 0 | 0 | 5 | 42 | 503 | 379 | 55 | 92 | 3 | 0 | 40 | 14 | 374 | 9 | 3241 | 53 | 776 | 677 | 586 |
| 151-200 | 705 | 195 | 0 | 55 | 0 | 0 | 48 | 7 | 66 | 432 | 988 | 15 | 5 | 0 | 285 | 366 | 102 | 271 | 22 | 29 | 7 | 29 | 388 |
| | 706 | 476 | 0 | 5 | 23 | 141 | 46 | 102 | 202 | 518 | 250 | 9 | 7 | 0 | 697 | 241 | 5041 | 411 | 27 | 27 | 27 | 150 | 107 |
| | 707 | 93 | 19 | 3 | 0 | 0 | 171 | 44 | 91 | 122 | 59 | 53 | 2 | 0 | 44 | 565 | 565 | 1714 | 93 | 56 | 562 | 373 | 258 |
| | 715 | 132 | 65 | 42 | 10 | 30 | 20 | 149 | 221 | 248 | 84 | 45 | 106 | 25 | 149 | 817 | 367 | 2145 | 74 | 456 | 7124 | 694 | 624 |
| | 716 | 539 | 106 | 40 | 74 | 350 | 20 | 587 | 334 | 223 | 1123 | 81 | 91 | 13 | 170 | 3004 | 1119 | 1432 | 212 | 162 | 113 | 391 | 101 |
| 201-300 | 708 | 117 | 43 | 78 | 0 | 134 | 9 | 100 | 92 | 3636 | 129 | 116 | 0 | 0 | 96 | 202 | 6148 | 9274 | 26 | 60 | 215 | 615 | 448 |
| | 711 | 961 | 68 | 148 | 42 | 269 | 104 | 194 | 441 | 649 | 0 | 0 | 9 | 14 | 54 | 4857 | 258 | 206 | 93 | 240 | 7033 | 159 | 14 |
| | 712 | 973 | 75 | 160 | 47 | 292 | 116 | 211 | 8180 | 146 | 73 | 97 | 0 | 140 | 426 | 162 | 37 | 313 | 82 | 555 | 530 | 285 | 104 |
| | 713 | 950 | 75 | 159 | 0 | 290 | 116 | 210 | 474 | 0 | 214 | 0 | 20 | 140 | 62 | 57 | 713 | 153 | 312 | 9352 | 2585 | 513 | 131 |
| | 714 | 1195 | 207 | 397 | 144 | 696 | 299 | 814 | 1114 | 0 | 56 | 0 | 27 | 354 | 496 | 466 | 157 | 379 | 1749 | 11123 | 13488 | 7240 | 668 |
| 0-30 | | 2294 | 572 | 1499 | 124 | 2001 | 318 | 429 | 1196 | 807 | 10661 | 3599 | 3448 | 1961 | 497 | 99 | 129 | 222 | 246 | 24 | 83 | 11 | 0 |
| 31-50 | | 3510 | 86 | 560 | 342 | 1392 | 2195 | 1320 | 2047 | 562 | 753 | 2057 | 2045 | 1371 | 2466 | 871 | 331 | 341 | 182 | 277 | 227 | 47 | 57 |
| 51-100 | | 4646 | 5062 | 8155 | 1882 | 8960 | 4881 | 5889 | 19399 | 11080 | 20519 | 11725 | 8895 | 3956 | 19443 | 13219 | 15907 | 13084 | 4687 | 2484 | 1542 | 360 | 1084 |
| 101-150 | | 1362 | 1345 | 518 | 2897 | 524 | 173 | 494 | 3037 | 988 | 5614 | 2217 | 1499 | 250 | 1491 | 2484 | 7939 | 3075 | 5798 | 8491 | 2001 | 957 | 2442 |
| 151-200 | | 1435 | 189 | 145 | 107 | 521 | 305 | 891 | 914 | 1543 | 2504 | 203 | 211 | 38 | 1341 | 4993 | 7194 | 5973 | 428 | 710 | 7833 | 1637 | 1478 |
| 201-300 | | 4196 | 468 | 940 | 233 | 1681 | 646 | 1229 | 10301 | 4431 | 472 | 212 | 56 | 648 | 1133 | 5744 | 7313 | 10325 | 2262 | 21350 | 23851 | 8812 | 1365 |
| 301-400 | | 132 | nf | nf | nf | nf | nf | nf | nf | nf | nf | nf | nf | nf | nf | 0* | nf | 4* | 4* | nf | 14 | nf | 363 |
| Total ** | | | 7722 | 11817 | 5585 | 15079 | 8518 | 10252 | 36894 | 19411 | 40523 | 20013 | 16154 | 8224 | 26371 | 27410 | 38813 | 33020 | 13603 | 33336 | 35537 | 11824 | 6426 |
| Mean #/tow | | | 5.9 | 9.02 | 4.27 | 11.52 | 6.51 | 7.82 | 28.18 | 14.82 | 30.95 | 15.28 | 12.34 | 6.28 | 20.14 | 20.93 | 29.64 | 25.22 | 10.39 | 25.46 | 27.14 | 9.03 | 4.91 |
| Unadjusted total for all sampled strata | | | 6412 | 9668 | 4802 | 12738 | 7155 | 5566 | 32741 | 19316 | 40128 | 19763 | 16156 | 7592 | 25546 | 27410 | 38812 | 33025 | 13606 | 31408 | 35551 | 11826 | 6791 |
| Upper limit | | | 10984 | 12638 | 6798 | 18812 | 9898 | 8367 | 236480 | 72479 | 108562 | 25828 | 21863 | 10760 | 165628 | 43048 | 63376 | 157954 | 22271 | 58781 | 68441 | 17177 | 9286 |
| Lower limit | | | 1841 | 6697 | 2805 | 6665 | 4412 | 2766 | -170999 | -33847 | -28307 | 13698 | 10449 | 4425 | -114537 | 11772 | 14248 | -91904 | 4942 | 4036 | 2660 | 6473 | 4295 |

Note shaded numbers are estimates for non sampled strata and only 0-300 fathom strata are used in deriving these estimates.
nf=not fished
* estimated using one tow or all strata in depth range not fished.
** total and mean no. per tow include sampled and estimated values for depths to 300 fathom. Estimates were derived from a multiplicative model using survey data to 1992.

**Table 10.** Cod abundance estimates (thousands of fish) from research vessel surveys in NAFO Division 3Ps.

| DEPTH range (fath) | Stratum number | Stratum Area sq. mi. | ATC 207 1973 Mar 20-30 | ATC 221 1974 Mar 16-23 | ATC 234 1975 Apr 19-30 | ATC 247 1976 Jun 2-13 | ATC 261 1977 Apr 14-26 | ATC 273 1978 Feb 21-28 | ATC 287 1979 16-Feb 5-Mar | ATC 302 1980 19-Mar 2-Apr | ATC 316 1981 Mar 7-26 | ATC 330 1982 28-May 9-Jun | AN 9 1983 22-Apr 8-May | AN 26 1984 Apr 9-18 | WT 26 1985 Mar 7-26 | WT 45 1986 Mar 6-23 | WT 55+56 1987 13-Feb 22-Mar | WT 68 1988 27-Jan 14-Feb | WT 81 1989 Feb 1-16 | WT 91 1990 31-Jan 20-Feb | WT 103 1991 Feb 2-20 | WT 118 1992 Feb 5-25 | WT 135 1993 Apr 1-21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-30 | 314 | 974 | 27 | 1170 | 11 | 1060 | 73 | 0 | 254 | 279 | 307 | 2237 | 1859 | 91 | 21 | 0 | 0 | 42 | 8 | 24 | 0 | 0 | 0 |
| | 320 | 1320 | 545 | 329 | 113 | 941 | 245 | 429 | 942 | 528 | 10354 | 1362 | 1589 | 1870 | 476 | 99 | 129 | 180 | 238 | 0 | 83 | 11 | 0 |
| 31-50 | 308 | 112 | 34 | 122 | 65 | 34 | 166 | 21 | 74 | 59 | 46 | 235 | 238 | 395 | 563 | 0 | 13 | 13 | 4 | 8 | 4 | 8 | 46 |
| | 312 | 272 | 40 | 225 | 221 | 257 | 628 | 378 | 157 | 95 | 92 | 296 | 347 | 153 | 1644 | 31 | 51 | 20 | 7 | 0 | 10 | 0 | 0 |
| | 315 | 827 | 0 | 62 | 59 | 745 | 1304 | 175 | 621 | 171 | 0 | 145 | 489 | 410 | 177 | 786 | 147 | 103 | 133 | 217 | 35 | 18 | 0 |
| | 321 | 1189 | 0 | 100 | 17 | 312 | 67 | 179 | 333 | 196 | 402 | 1227 | 785 | 342 | 77 | 27 | 54 | 162 | 20 | 11 | 57 | 0 | 11 |
| | 325 | 944 | 12 | 48 | 0 | 35 | 29 | 567 | 850 | 35 | 213 | 85 | 124 | 71 | 0 | 27 | 47 | 24 | 18 | 35 | 102 | 21 | 0 |
| | 326 | 166 | 0 | 3 | 0 | 9 | 1 | 0 | 12 | 6 | 0 | 69 | 62 | 0 | 5 | 0 | 19 | 19 | 0 | 6 | 19 | 0 | 0 |
| 51-100 | 307 | 395 | 2645 | 2622 | 431 | 778 | 1090 | 1186 | 2090 | 949 | 5505 | 2372 | 569 | 193 | 2006 | 5802 | 1433 | 4700 | 1710 | 395 | 79 | 59 | 741 |
| | 311 | 317 | 822 | 2861 | 433 | 666 | 125 | 309 | 1124 | 3105 | 690 | 1888 | 1348 | 381 | 3692 | 127 | 2427 | 898 | 103 | 119 | 56 | 12 | 48 |
| | 317 | 193 | 354 | 761 | 127 | 971 | 199 | 259 | 309 | 1391 | 623 | 913 | 2062 | 14 | 1427 | 420 | 420 | 101 | 101 | 7 | 80 | 36 | 36 |
| | 319 | 984 | 872 | 1182 | 638 | 4136 | 2945 | 2221 | 15068 | 2733 | 13000 | 3176 | 2058 | 1637 | 111 | 3241 | 6968 | 6795 | 2401 | 1781 | 936 | 214 | 259 |
| | 322 | 1567 | 219 | 230 | 150 | 2294 | 521 | 706 | 118 | 2641 | 471 | 2632 | 1882 | 509 | 860 | 1382 | 1082 | 206 | 260 | 154 | 210 | 15 | 0 |
| | 323 | 696 | 109 | 312 | 76 | 78 | 138 | 1097 | 697 | 261 | 78 | 392 | 383 | 901 | 871 | 2069 | 3466 | 199 | 112 | 13 | 70 | 9 | 0 |
| | 324 | 494 | 41 | 87 | 27 | 37 | 63 | 115 | 93 | 0 | 152 | 352 | 593 | 321 | 10476 | 178 | 111 | 185 | 0 | 15 | 111 | 15 | 0 |
| 101-150 | 306 | 419 | 153 | 173 | 472 | 110 | 65 | 115 | 440 | 204 | 2810 | 692 | 763 | 47 | 267 | 577 | 6172 | 1329 | 231 | 1342 | 86 | 94 | 865 |
| | 309 | 296 | 141 | 111 | 152 | 89 | 63 | 67 | 870 | 289 | 1811 | 700 | 496 | 56 | 933 | 1700 | 1067 | 1355 | 833 | 733 | 467 | 22 | 700 |
| | 310 | 170 | 51 | 64 | 2039 | 181 | 0 | 183 | 121 | 0 | 651 | 434 | 72 | 57 | 102 | 179 | 115 | 315 | 351 | 421 | 376 | 19 | 172 |
| | 313 | 165 | 111 | 89 | 215 | 54 | 26 | 17 | 1018 | 81 | 266 | 217 | 37 | 12 | 111 | 0 | 173 | 43 | 508 | 81 | 211 | 124 | 62 |
| | 316 | 189 | 880 | 76 | 19 | 110 | 14 | 70 | 85 | 35 | 21 | 182 | 128 | 78 | 38 | 14 | 38 | 24 | 634 | 5881 | 85 | 21 | 57 |
| | 318 | 123 | 9 | 5 | 0 | 0 | 5 | 42 | 503 | 379 | 55 | 92 | 3 | 0 | 48 | 14 | 374 | 9 | 3241 | 33 | 776 | 677 | 586 |
| 151-200 | 705 | 195 | 0 | 55 | 0 | 0 | 48 | 7 | 66 | 432 | 988 | 15 | 5 | 0 | 285 | 366 | 102 | 271 | 22 | 29 | 7 | 29 | 388 |
| | 706 | 476 | 0 | 5 | 23 | 141 | 46 | 102 | 202 | 518 | 250 | 9 | 7 | 0 | 697 | 241 | 5041 | 411 | 27 | 27 | 27 | 150 | 107 |
| | 707 | 93 | 19 | 3 | 0 | 0 | 171 | 46 | 91 | 122 | 69 | 63 | 2 | 0 | 42 | 565 | 565 | 1714 | 93 | 32 | 562 | 373 | 258 |
| | 715 | 132 | 65 | 42 | 10 | 30 | 20 | 149 | 221 | 248 | 84 | 45 | 106 | 25 | 145 | 817 | 367 | 2145 | 74 | 456 | 7124 | 694 | 624 |
| | 716 | 539 | 105 | 40 | 74 | 350 | 20 | 587 | 334 | 223 | 1123 | 81 | 91 | 13 | 170 | 3004 | 1119 | 1432 | 212 | 162 | 113 | 391 | 101 |
| 201-300 | 708 | 117 | 43 | 78 | 0 | 134 | 9 | 100 | 92 | 3636 | 129 | 115 | 0 | 0 | 95 | 202 | 6148 | 9274 | 26 | 80 | 215 | 615 | 448 |
| | 711 | 961 | 68 | 146 | 42 | 269 | 168 | 194 | 441 | 649 | 0 | 0 | 9 | 14 | 54 | 4857 | 258 | 206 | 93 | 240 | 7033 | 159 | 14 |
| | 712 | 973 | 76 | 160 | 47 | 292 | 116 | 211 | 8180 | 146 | 73 | 97 | 0 | 140 | 426 | 162 | 37 | 313 | 82 | 555 | 530 | 285 | 104 |
| | 713 | 950 | 75 | 159 | 0 | 290 | 116 | 210 | 474 | 0 | 214 | 0 | 20 | 140 | 62 | 57 | 713 | 153 | 312 | 9352 | 2585 | 513 | 131 |
| | 714 | 1195 | 207 | 397 | 144 | 696 | 299 | 514 | 1114 | 0 | 56 | 0 | 27 | 364 | 496 | 466 | 157 | 379 | 1749 | 11123 | 13488 | 7240 | 668 |
| 0-30 | | 2294 | 572 | 1499 | 124 | 2001 | 318 | 429 | 1196 | 807 | 10661 | 3599 | 3448 | 1961 | 497 | 99 | 129 | 222 | 246 | 24 | 83 | 11 | 0 |
| 31-50 | | 3510 | 86 | 560 | 342 | 1392 | 2195 | 1320 | 2047 | 562 | 753 | 2057 | 2045 | 1371 | 2466 | 871 | 331 | 341 | 182 | 277 | 227 | 47 | 57 |
| 51-100 | | 4646 | 5062 | 8155 | 1882 | 8960 | 4881 | 5889 | 19399 | 11080 | 20519 | 11725 | 8895 | 3956 | 19443 | 13219 | 15907 | 13084 | 4687 | 2484 | 1542 | 360 | 1084 |
| 101-150 | | 1362 | 1345 | 518 | 2897 | 524 | 173 | 494 | 3037 | 988 | 5614 | 2217 | 1499 | 250 | 1491 | 2484 | 7939 | 3075 | 5798 | 8491 | 2001 | 957 | 2442 |
| 151-200 | | 1435 | 189 | 145 | 107 | 521 | 305 | 891 | 914 | 1543 | 2504 | 203 | 211 | 38 | 1341 | 4993 | 7194 | 5973 | 428 | 710 | 7833 | 1637 | 1478 |
| 201-300 | | 4196 | 468 | 940 | 233 | 1681 | 646 | 1229 | 10301 | 4431 | 472 | 212 | 56 | 648 | 1133 | 5744 | 7313 | 10325 | 2262 | 21350 | 23851 | 8812 | 1365 |
| 301-400 | | 132 | nf | nf | nf | nf | nf | nf | nf | nf | nf | nf | nf | nf | nf | 0* | nf | 4* | 4* | nf | 14 | nf | 363 |
| Total ** | | | 7722 | 11817 | 5585 | 15079 | 8518 | 10252 | 36894 | 19411 | 40523 | 20013 | 16154 | 8224 | 26371 | 27410 | 38813 | 33020 | 13603 | 33336 | 35537 | 11824 | 6426 |
| Mean #/tow | | | 5.9 | 9.02 | 4.27 | 11.52 | 6.51 | 7.82 | 28.18 | 14.82 | 30.95 | 15.28 | 12.34 | 6.28 | 20.14 | 20.93 | 29.64 | 25.22 | 10.39 | 25.46 | 27.14 | 9.03 | 4.91 |
| Unadjusted total for all sampled strata | | | 6412 | 9668 | 4802 | 12738 | 7155 | 5566 | 32741 | 19316 | 40128 | 19763 | 16156 | 7592 | 25546 | 27410 | 38812 | 33025 | 13606 | 31408 | 35551 | 11826 | 6791 |
| Upper limit | | | 10984 | 12638 | 6798 | 18812 | 9898 | 8367 | 236480 | 72479 | 108562 | 25828 | 21863 | 10760 | 165628 | 43048 | 63376 | 157954 | 22271 | 58781 | 68441 | 17177 | 9286 |
| Lower limit | | | 1841 | 6697 | 2805 | 6665 | 4412 | 2766 | -170999 | -33847 | -28307 | 13698 | 10449 | 4425 | -114537 | 11772 | 14248 | -91904 | 4942 | 4036 | 2660 | 6473 | 4295 |

Note shaded numbers are estimates for non sampled strata and only 0-300 fathom strata are used in deriving these estimates.

nf=not fished

* estimated using one tow or all strata in depth range not fished.

** total and mean no. per tow include sampled and estimated values for depths to 300 fathom. Estimates were derived from a multiplicative model using survey data to 1992.

Table 11. Cod abundance and biomass from Canadian Research Vessel Survey.

| DEPTH range (fath) | Stratum number | Stratum Area sq. mi. | abundance WT 150-151 1994 April 5-27 | biomass WT 150-151 1994 April 5-27 |
|---|---|---|---|---|
| 0-30 | 314 | 974 | 24 | 113 |
| | 320 | 1320 | 0 | 0 |
| 31-50 | 308 | 112 | 118 | 42 |
| | 312 | 272 | 0 | 0 |
| | 315 | 827 | 0 | 0 |
| | 321 | 1189 | 0 | 0 |
| | 325 | 944 | 0 | 0 |
| | 326 | 166 | 0 | 0 |
| | 783* | 229 | 0 | 0 |
| 51-100 | 307 | 395 | 4047 | 3468 |
| | 311 | 317 | 184 | 233 |
| | 317 | 193 | 0 | 0 |
| | 319 | 984 | 16 | 4 |
| | 322 | 1567 | 18 | 6 |
| | 323 | 696 | 0 | 0 |
| | 324 | 494 | 12 | *0* |
| | 781* | 446 | 0 | 0 |
| | 782* | 183 | 7 | *0* |
| 101-150 | 306 | 419 | 495 | 424 |
| | 309 | 296 | 111 | 171 |
| | 310 | 170 | 145 | 165 |
| | 313 | 165 | 19 | 17 |
| | 316 | 189 | 57 | 137 |
| | 318* | 129 | 0 | 0 |
| | 779* | 422 | 8 | 1 |
| | 780* | 403 | 0 | 0 |
| 151-200 | 705 | 195 | 224 | 321 |
| | 706 | 476 | 116 | 118 |
| | 707* | 74 | 11 | 2 |
| | 715 | 132 | 1003 | 1514 |
| | 716 | 539 | 227 | 327 |
| 201-300 | 708* | 126 | 4701 | 3798 |
| | 711 | 961 | 72 | 82 |
| | 712 | 973 | 209 | 568 |
| | 713 | 950 | 550 | 919 |
| | 714 | 1195 | 1065 | 1471 |
| 0-30 | | 2294 | 24 | 113 |
| 31-50 | | 3739 | 118 | 42 |
| 51-100 | | 5275 | 4284 | 3711 |
| 101-150 | | 2193 | 835 | 915 |
| 151-200 | | 1416 | 1581 | 2282 |
| 201-300 | | 4205 | 6597 | 6838 |
| total 0-300 | | 19122 | 13439 | 13901 |
| 301-400 | 709 | 158 | 806 | 647 |
| 401-500 | 710 | 176 | 10 | 7 |
| 501-600 | 776 | 173 | | |
| 601-700 | 777 | 208 | | |
| 701-800 | 778 | 194 | | |
| Total all sampled | strata | 20031 | 14255 | 14555 |
| Mean #/tow | | | 9.76 | 9.97 |
| upper limit | | | 24549 | 24053 |
| lower limit | | | 3964 | 5059 |

* strata have been added or area has changed in 1994.

Table 12. Cod abundance (000's) from stratified-random cruises conducted by France in Subdivision 3Ps. Numbers in brackets are estimates for non-sampled strata.

| Depth (m) | Strata | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 314 | 33 | 0 | (73) | 267 | 22 | 133 | 0 | 33 | 33 | 67 | (354) | 33 | 0 | 0 | 0 |
| < 55 | 320 | 36 | 241 | (256) | 784 | 90 | 572 | 663 | 136 | 45 | (785) | 0 | 90 | 181 | 0 | 45 |
| | TOTAL | 69 | 241 | 329 | 1051 | 112 | 705 | 663 | 169 | 78 | 352 | 354 | 123 | 181 | 0 | 45 |
| | 308 | 189 | 12 | 35 | 35 | 161 | 46 | 157 | 50 | 134 | 31 | 38 | 65 | 0 | 12 | 23 |
| 56-90 | 312 | 605 | 99 | 28 | 677 | 456 | 99 | 6837 | 155 | 298 | 0 | 75 | 56 | 5 | 360 | 0 |
| | 315 | 368 | 57 | 0 | 269 | 113 | 85 | 3597 | 28 | 321 | 868 | 265 | 28 | 28 | 0 | 28 |
| | 321 | 20 | 896 | 326 | 502 | 387 | 221 | 147 | 16 | 55 | (628) | 1222 | 0 | 0 | 0 | 0 |
| | 325 | (108) | (152) | (138) | 129 | (567) | 275 | 647 | 65 | 226 | 0 | 485 | 0 | 0 | 0 | 65 |
| | TOTAL | 1290 | 1216 | 527 | 1612 | 1684 | 726 | 11385 | 314 | 1034 | 1527 | 2085 | 149 | 33 | 372 | 116 |
| | 307 | 1948 | 1154 | 3084 | 640 | 4662 | 2958 | 2624 | 785 | 21238 | 4694 | 1136 | 8852 | 1144 | 419 | 189 |
| | 311 | 402 | 1628 | 1158 | 4357 | 3995 | 4147 | 15162 | 1954 | 18038 | 9503 | 16231 | 5973 | 1040 | 265 | 275 |
| | 317 | 0 | 119 | (697) | 724 | 4940 | 1696 | 16436 | 989 | 1182 | 8457 | 5410 | 7993 | 859 | 2260 | 2344 |
| 91-180 | 319 | 1051 | 4583 | 1146 | 3262 | 3516 | 7666 | 5473 | 3909 | 2887 | 5695 | 3639 | 9413 | 13319 | 2186 | 1427 |
| | 322 | 939 | 617 | 5742 | 1149 | 4916 | 5720 | 2603 | 4239 | 4883 | 11270 | 4776 | 6735 | 912 | 134 | 54 |
| | 323 | 349 | 226 | 318 | 1156 | 572 | 3671 | 3683 | 2670 | 4576 | 1907 | 1668 | 1621 | 95 | 24 | 72 |
| | 324 | (479) | (611) | (570) | 0 | (1845) | 2605 | 3147 | 1607 | 727 | 237 | 3164 | 1878 | 85 | 34 | 118 |
| | TOTAL | 5168 | 8938 | 12715 | 11288 | 24446 | 28463 | 49128 | 16153 | 53531 | 41763 | 36024 | 42465 | 17454 | 5322 | 4479 |
| | 306 | 765 | 870 | 698 | 9691 | 2841 | 6333 | 947 | 278 | 14560 | 2956 | 2589 | 3935 | 2759 | 535 | 273 |
| | 309 | 355 | 1642 | 264 | 1453 | 595 | 1500 | 1588 | 872 | 4906 | 831 | 2859 | 5852 | 13611 | 476 | 811 |
| | 310 | 396 | 186 | 15 | 489 | 1095 | 935 | 105 | 9513 | 175 | 382 | 2276 | 146 | 553 | 279 | 303 |
| 181-270 | 313 | 130 | 328 | 11 | 859 | 814 | 678 | 83 | 2359 | 138 | 1432 | 23 | 1639 | 995 | 305 | 28 |
| | 316 | 65 | 95 | 39 | 165 | 423 | 30 | 173 | 4088 | 826 | 215 | 667 | 4871 | 6236 | 1458 | 2637 |
| | 318 | 21 | 8 | (191) | 247 | 34 | 1182 | 604 | 576 | 5810 | 101 | 2786 | 1097 | 1936 | 1692 | 166 |
| | TOTAL | 1732 | 3129 | 1218 | 12904 | 5802 | 10658 | 3500 | 17686 | 26415 | 5917 | 11200 | 17540 | 26090 | 4745 | 4218 |
| | 705 | 254 | 982 | 27 | 423 | 3286 | 672 | 908 | 69 | 224 | 220 | 274 | 267 | 87 | 73 | 0 |
| | 706 | 22 | 0 | 98 | 672 | 3054 | 179 | 532 | 163 | 1981 | 8977 | 791 | 157 | 717 | 378 | 98 |
| | 707 | (140) | 586 | (166) | 13 | 2603 | 183 | 19 | 827 | 1172 | 81 | 80 | 51 | 73 | 105 | 1940 |
| 271-365 | 715 | 922 | 597 | 895 | 628 | 2473 | 588 | 1636 | 917 | 1132 | 961 | 882 | 276 | 2048 | 1311 | 45 |
| | 716 | 123 | 357 | 923 | 455 | 1772 | 1196 | 1058 | 25 | 2258 | 5353 | 4836 | 406 | 1707 | 1329 | 222 |
| | TOTAL | 1461 | 2522 | 2109 | 2191 | 13188 | 2818 | 4153 | 2001 | 6767 | 15592 | 6863 | 1157 | 4632 | 3196 | 2305 |
| 366-545 | 708 | (52) | (68) | (63) | 45 | 353 | 8 | 4 | 315 | 381 | 1543 | 88 | 172 | 297 | 2472 | 357 |
| | 711 | | | | 0 | | 33 | | | | | | 0 | 823 | 702 | 22 |
| | 712 | | | | 0 | | 133 | | | | | | 0 | 2466 | 2666 | 34 |
| | 713 | | | | 21 | | | | | | | | 0 | 1854 | 2017 | 22 |
| | 714 | | | | 137 | | 0 | | | | | | 0 | 9877 | 47664 | 1054 |
| | TOTAL | 52 | 68 | 63 | 203 | 353 | 174 | 4 | 315 | 381 | 1543 | 88 | 172 | 15317 | 55521 | 1489 |
| 0-545 | TOTAL | 9775 | 16115 | 16960 | 29249 | 45585 | 43544 | 68833 | 36638 | 88206 | 67194 | 56614 | 61608 | 63707 | 69156 | 12652 |
| Confidence | | 12225 | 22211 | 19582 | 41387 | 59497 | 52592 | 113553 | 49004 | 136843 | 91756 | 77558 | 82570 | | | |
| Interval | | 7325 | 10019 | 14338 | 16795 | 31673 | 34164 | 24113 | 24272 | 39571 | 42632 | 35670 | 40648 | | | |

Table 13 Cod biomass (MT) from stratified-random cruises conducted by France in Subdivision 3Ps.

| Depth (m) | Strata | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 314 | 17 | 0 | | 1390 | 111 | 30 | 0 | 7 | 13 | 133 | | 17 | 0 | 0 | 0 |
| < 55 | 320 | 108 | 814 | | 3797 | 513 | 2803 | 3526 | 104 | 14 | 0 | 0 | 316 | 222 | 0 | 5 |
| | TOTAL | 125 | 814 | | 5187 | 624 | 2833 | 3526 | 111 | 27 | 133 | 0 | 333 | 222 | 0 | 5 |
| | 308 | 371 | 9 | 150 | 88 | 299 | 151 | 111 | 65 | 100 | 29 | 6 | 25 | 0 | 1 | 3 |
| | 312 | 820 | 270 | 112 | 2304 | 454 | 636 | 1403 | 145 | 343 | 0 | 28 | 55 | 2 | 11 | 0 |
| 56-90 | 315 | 771 | 850 | 0 | 1076 | 821 | 326 | 16918 | 8 | 1813 | 2058 | 2134 | 198 | 41 | 0 | 510 |
| | 321 | 183 | 4785 | 3746 | 2199 | 3746 | 1362 | 1026 | 3 | 543 | 0 | 649 | 0 | 0 | 0 | 0 |
| | 325 | | | | 2101 | | 1332 | 1466 | 81 | 259 | 0 | 453 | 0 | 0 | 0 | 65 |
| | TOTAL | 2145 | 5914 | 4008 | 7768 | 5320 | 3807 | 20924 | 302 | 3058 | 2087 | 3270 | 278 | 43 | 12 | 578 |
| | 307 | 3598 | 2714 | 4428 | 1876 | 9009 | 6269 | 5384 | 2976 | 23172 | 8089 | 565 | 6168 | 215 | 37 | 24 |
| | 311 | 87 | 3199 | 1136 | 5797 | 8202 | 3572 | 19599 | 1276 | 20627 | 1356 | 4815 | 675 | 267 | 8 | 13 |
| | 317 | 0 | 260 | | 813 | 454 | 421 | 21353 | 1502 | 2562 | 1049 | 815 | 973 | 226 | 183 | 243 |
| 91-180 | 319 | 997 | 5810 | 1303 | 4435 | 4078 | 11349 | 8101 | 2831 | 3179 | 5746 | 5434 | 5889 | 3067 | 1907 | 89 |
| | 322 | 605 | 1945 | 3381 | 1793 | 2404 | 967 | 1122 | 2388 | 5944 | 2734 | 215 | 864 | 172 | 11 | 5 |
| | 323 | 91 | 572 | 858 | 822 | 54 | 794 | 803 | 512 | 2399 | 953 | 311 | 60 | 10 | 19 | 14 |
| | 324 | | | | 0 | | 815 | 964 | 594 | 288 | 99 | 171 | 90 | 44 | 8 | 34 |
| | TOTAL | 5378 | 14500 | 11106 | 15536 | 24201 | 24187 | 57326 | 12079 | 58171 | 20026 | 12326 | 14719 | 4001 | 2173 | 422 |
| | 306 | 3080 | 2660 | 2162 | 12197 | 3716 | 11967 | 2296 | 804 | 23131 | 8294 | 4041 | 4691 | 663 | 69 | 33 |
| | 309 | 167 | 2743 | 804 | 2176 | 1122 | 3318 | 3852 | 1581 | 7434 | 1901 | 4827 | 7947 | 6726 | 151 | 172 |
| | 310 | 411 | 190 | 19 | 481 | 1683 | 739 | 229 | 4675 | 169 | 503 | 739 | 164 | 93 | 33 | 32 |
| 181-270 | 313 | 113 | 331 | 1 | 1099 | 1279 | 840 | 170 | 1753 | 142 | 562 | 26 | 373 | 240 | 18 | 5 |
| | 316 | 91 | 121 | 39 | 282 | 544 | 36 | 332 | 38395 | 695 | 334 | 320 | 2324 | 4464 | 481 | 1265 |
| | 318 | 42 | 25 | | 593 | 34 | 5282 | 786 | 1828 | 28349 | 259 | 4558 | 941 | 2096 | 2109 | 304 |
| | TOTAL | 3904 | 6070 | 3025 | 16828 | 8378 | 22182 | 7665 | 49036 | 59920 | 11853 | 14511 | 16440 | 14282 | 2861 | 1811 |
| | 705 | 321 | 1115 | 13 | 574 | 4550 | 984 | 1661 | 99 | 414 | 354 | 394 | 325 | 49 | 46 | 0 |
| | 706 | 11 | 0 | 293 | 952 | 4010 | 375 | 1141 | 333 | 3896 | 13845 | 1413 | 296 | 768 | 422 | 334 |
| | 707 | | 1303 | | 13 | 10980 | 652 | 49 | 2314 | 3338 | 134 | 102 | 118 | 193 | 125 | 1476 |
| 271-365 | 715 | 836 | 832 | 1564 | 827 | 4159 | 1261 | 3806 | 2282 | 2613 | 1908 | 1772 | 542 | 1759 | 783 | 42 |
| | 716 | 178 | 455 | 1169 | 554 | 2104 | 1934 | 2326 | 86 | 2775 | 5685 | 6264 | 439 | 1096 | 842 | 89 |
| | TOTAL | 1346 | 3705 | 3039 | 2920 | 25803 | 5206 | 8983 | 5114 | 13036 | 21926 | 9945 | 1720 | 3865 | 2218 | 1941 |
| | 708 | | | | 85 | 373 | 44 | 8 | 593 | 849 | 6136 | 264 | 429 | 899 | 1771 | 286 |
| | 711 | | | | 0 | | 296 | | | | | | 0 | 1058 | 954 | 64 |
| 365-545 | 712 | | | | 0 | | 300 | | | | | | 0 | 2926 | 3584 | 49 |
| | 713 | | | | 108 | | | | | | | | 0 | 2268 | 1789 | 7 |
| | 714 | | | | 354 | | 0 | | | | | | 0 | 9607 | 58529 | 911 |
| | TOTAL | | | | 547 | 373 | 640 | 8 | 593 | 849 | 6136 | 264 | 429 | 16758 | 66627 | 1317 |
| 0-545 | TOTAL | 12899 | 31002 | 21178 | 48787 | 64699 | 58856 | 98433 | 67235 | 135061 | 62164 | 40316 | 33918 | 39169 | 73891 | 6074 |

**Table 14** MEAN NUMBERS PER TOW AT AGE ADJUSTED FOR MISSING STRATA FOR COD IN SUBDIVISION 3PS FOR THE YEARS 1972-94.

| | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02 | 0.01 | 0.52 | 0.17 | 0.18 | 0.01 | 0.00 | 0.85 | 0.16 | 0.03 | 0.51 | 0.25 | 0.01 | 0.01 | 0.01 | 0.04 | 0.02 | 0.02 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 |
| 2 | 0.62 | 0.66 | 1.60 | 0.34 | 2.52 | 0.15 | 0.49 | 0.35 | 4.52 | 0.53 | 1.95 | 0.47 | 0.21 | 0.27 | 0.26 | 0.37 | 0.42 | 0.28 | 0.06 | 1.18 | 0.11 | 0.00 | 0.07 |
| 3 | 1.09 | 0.77 | 1.58 | 0.97 | 1.65 | 1.98 | 0.76 | 0.53 | 1.37 | 3.02 | 0.99 | 1.02 | 0.32 | 1.71 | 0.54 | 0.83 | 0.78 | 0.68 | 1.31 | 0.73 | 1.13 | 0.41 | 0.29 |
| 4 | 2.24 | 1.17 | 1.13 | 0.88 | 3.03 | 1.73 | 2.76 | 5.47 | 0.97 | 4.97 | 4.91 | 0.55 | 0.58 | 4.37 | 2.54 | 2.01 | 1.18 | 1.33 | 4.98 | 3.87 | 0.89 | 2.79 | 1.78 |
| 5 | 1.50 | 1.31 | 1.53 | 0.54 | 1.39 | 1.33 | 1.18 | 16.15 | 3.29 | 5.46 | 2.25 | 3.05 | 0.44 | 5.66 | 5.40 | 10.26 | 1.79 | 0.97 | 6.22 | 7.33 | 2.74 | 0.69 | 4.20 |
| 6 | 1.00 | 0.37 | 1.42 | 0.50 | 0.86 | 0.68 | 0.85 | 3.39 | 2.91 | 7.05 | 1.05 | 1.56 | 1.88 | 2.61 | 5.83 | 8.01 | 5.90 | 1.01 | 4.16 | 5.26 | 1.82 | 2.65 | 1.30 |
| 7 | 1.33 | 0.73 | 0.39 | 0.45 | 0.52 | 0.22 | 0.61 | 0.76 | 0.53 | 6.63 | 1.42 | 0.54 | 0.75 | 2.44 | 2.28 | 3.82 | 6.14 | 2.29 | 3.13 | 2.88 | 1.05 | 0.72 | 1.40 |
| 8 | 0.78 | 0.29 | 0.32 | 0.17 | 0.48 | 0.11 | 0.42 | 0.37 | 0.49 | 1.33 | 1.48 | 1.06 | 0.39 | 0.77 | 1.71 | 1.60 | 4.13 | 1.42 | 2.89 | 1.78 | 0.55 | 0.36 | 0.48 |
| 9 | 0.33 | 0.38 | 0.25 | 0.11 | 0.11 | 0.16 | 0.25 | 0.13 | 0.14 | 1.31 | 0.40 | 1.99 | 0.48 | 0.45 | 0.99 | 0.97 | 1.85 | 0.82 | 1.24 | 1.53 | 0.29 | 0.15 | 0.09 |
| 10 | 0.20 | 0.09 | 0.13 | 0.07 | 0.09 | 0.06 | 0.24 | 0.11 | 0.13 | 0.31 | 0.11 | 0.92 | 0.75 | 0.44 | 0.34 | 0.39 | 1.04 | 0.46 | 0.67 | 1.06 | 0.26 | 0.10 | 0.04 |
| 11 | 0.08 | 0.02 | 0.04 | 0.02 | 0.06 | 0.01 | 0.08 | 0.03 | 0.10 | 0.06 | 0.08 | 0.45 | 0.18 | 0.44 | 0.28 | 0.31 | 0.90 | 0.51 | 0.36 | 0.78 | 0.08 | 0.12 | 0.03 |
| 12 | 0.05 | 0.02 | 0.03 | 0.01 | 0.06 | 0.03 | 0.03 | 0.01 | 0.11 | 0.08 | 0.03 | 0.17 | 0.13 | 0.49 | 0.32 | 0.24 | 0.44 | 0.15 | 0.16 | 0.30 | 0.05 | 0.03 | 0.02 |
| 13 | 0.03 | 0.00 | 0.02 | 0.01 | 0.00 | 0.03 | 0.03 | 0.01 | 0.04 | 0.08 | 0.02 | 0.07 | 0.05 | 0.20 | 0.18 | 0.24 | 0.18 | 0.13 | 0.12 | 0.15 | 0.01 | 0.04 | 0.01 |
| 14 | 0.05 | 0.01 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.05 | 0.02 | 0.06 | 0.03 | 0.11 | 0.11 | 0.24 | 0.18 | 0.06 | 0.08 | 0.10 | 0.01 | 0.01 | 0.02 |
| 15 | 0.03 | 0.00 | 0.00 | 0.01 | 0.02 | 0.01 | 0.03 | 0.00 | 0.02 | 0.01 | 0.03 | 0.05 | 0.00 | 0.03 | 0.07 | 0.09 | 0.11 | 0.11 | 0.01 | 0.05 | 0.03 | 0.00 | 0.00 |
| 16 | 0.09 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.02 | 0.02 | 0.04 | 0.04 | 0.04 | 0.03 | 0.06 | 0.11 | 0.06 | 0.04 | 0.04 | 0.00 | 0.00 | 0.01 |
| 1+ | 9.45 | 5.85 | 9.00 | 4.26 | 11.48 | 6.49 | 7.73 | 28.18 | 14.81 | 30.92 | 15.28 | 12.26 | 6.24 | 20.05 | 20.90 | 29.48 | 25.18 | 10.30 | 25.43 | 27.09 | 9.03 | 8.07 | 9.74 |
| 2+ | 9.42 | 5.84 | 8.48 | 4.09 | 11.30 | 6.49 | 7.73 | 27.33 | 14.65 | 30.89 | 14.77 | 12.01 | 6.24 | 20.04 | 20.89 | 29.44 | 25.16 | 10.28 | 25.43 | 27.04 | 9.03 | 8.07 | 9.74 |
| 3+ | 8.80 | 5.18 | 6.87 | 3.74 | 8.78 | 6.34 | 7.24 | 26.97 | 10.13 | 30.37 | 12.82 | 11.54 | 6.03 | 19.77 | 20.63 | 29.07 | 24.74 | 10.00 | 25.37 | 25.86 | 8.92 | 8.07 | 9.67 |
| 4+ | 7.72 | 4.41 | 5.29 | 2.77 | 7.13 | 4.36 | 6.48 | 26.45 | 8.76 | 27.34 | 11.82 | 10.52 | 5.71 | 18.06 | 20.09 | 28.24 | 23.96 | 9.31 | 24.06 | 25.14 | 7.79 | 7.66 | 9.33 |

Table 15. MEAN NUMBERS PER TOW AT AGE FROM SURVEYS CONDUCTED BY FRANCE. CATCHES FOR UNSURVEYED DEEP WATER STRATA ASSUMED SAME PROPORTION AS CANADIAN RV.

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.07 | 0.00 | 0.05 | 0.79 | 3.56 | 0.02 | 0.10 | 0.08 | 2.60 | 4.14 | 1.43 | 0.29 | 0.81 | 0.08 |
| 2 | 0.62 | 0.46 | 5.47 | 0.14 | 9.21 | 8.31 | 9.43 | 4.38 | 6.93 | 16.29 | 11.69 | 18.89 | 2.39 | 12.14 | 3.35 |
| 3 | 1.32 | 0.41 | 1.27 | 3.78 | 1.50 | 4.16 | 6.22 | 11.56 | 4.03 | 9.09 | 11.71 | 12.25 | 18.26 | 7.08 | 4.20 |
| 4 | 2.60 | 2.21 | 0.37 | 3.81 | 6.38 | 2.29 | 12.27 | 5.96 | 14.55 | 2.24 | 7.25 | 6.27 | 20.11 | 12.96 | 1.40 |
| 5 | 1.73 | 7.73 | 1.98 | 3.96 | 6.12 | 5.55 | 7.12 | 3.14 | 25.35 | 6.56 | 2.85 | 4.44 | 7.66 | 12.68 | 0.84 |
| 6 | 1.01 | 3.47 | 3.35 | 5.74 | 4.65 | 4.70 | 15.45 | 0.85 | 20.74 | 9.87 | 5.14 | 2.66 | 2.46 | 7.56 | 0.51 |
| 7 | 0.75 | 1.93 | 1.23 | 4.35 | 3.49 | 3.50 | 4.55 | 1.56 | 8.73 | 6.57 | 3.69 | 3.39 | 0.73 | 2.42 | 0.19 |
| 8 | 0.44 | 1.02 | 0.50 | 1.23 | 4.07 | 2.13 | 1.73 | 0.91 | 6.67 | 2.33 | 1.26 | 1.55 | 1.00 | 1.07 | 0.05 |
| 9 | 0.25 | 0.40 | 0.21 | 0.92 | 1.21 | 1.60 | 2.52 | 0.62 | 3.69 | 1.53 | 0.61 | 0.77 | 0.44 | 0.91 | 0.02 |
| 10 | 0.19 | 0.23 | 0.16 | 0.36 | 0.67 | 0.58 | 1.80 | 0.69 | 0.76 | 0.75 | 0.28 | 0.21 | 0.26 | 0.62 | 0.01 |
| 11 | 0.02 | 0.31 | 0.13 | 0.12 | 0.32 | 0.19 | 0.50 | 0.87 | 0.56 | 0.16 | 0.28 | 0.10 | 0.11 | 0.06 | 0.01 |
| 12 | 0.03 | 0.10 | 0.08 | 0.11 | 0.12 | 0.15 | 0.13 | 1.05 | 0.69 | 0.28 | 0.13 | 0.05 | 0.09 | 0.15 | 0.01 |
| 13 | 0.01 | 0.11 | 0.06 | 0.05 | 0.16 | 0.06 | 0.11 | 0.10 | 0.21 | 0.12 | 0.12 | 0.05 | 0.03 | 0.03 | 0.03 |
| 14 | 0.03 | 0.23 | 0.13 | 0.10 | 0.08 | 0.05 | 0.10 | 0.18 | 0.31 | 0.23 | 0.26 | 0.06 | 0.06 | 0.03 | 0.03 |
| 1+ | 8.99 | 18.68 | 14.95 | 24.71 | 38.77 | 36.84 | 61.96 | 31.96 | 93.30 | 58.62 | 49.39 | 52.13 | 53.89 | 58.52 | 10.72 |
| 2+ | 8.99 | 18.61 | 14.95 | 24.66 | 37.98 | 33.28 | 61.94 | 31.86 | 93.22 | 56.02 | 45.25 | 50.70 | 53.60 | 57.71 | 10.64 |
| 3+ | 8.37 | 18.15 | 9.48 | 24.53 | 28.77 | 24.97 | 52.50 | 27.48 | 86.29 | 39.73 | 33.56 | 31.81 | 51.21 | 45.57 | 7.28 |
| 4+ | 7.05 | 17.74 | 8.21 | 20.74 | 27.27 | 20.81 | 46.28 | 15.92 | 82.26 | 30.64 | 21.85 | 19.56 | 32.95 | 38.49 | 3.09 |

Table 16. Results from ADAPT using Canadian (1980-94) and French (1978-91) RV data assuming flat-topped partial recruitment.

POPULATION NUMBERS (000S)

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 39062 | 22835 | 35464 | 64030 | 43411 | 72391 | 64481 | 51926 | 25832 |
| 4 | 60090 | 31527 | 18573 | 28703 | 51498 | 35425 | 58581 | 52609 | 42327 |
| 5 | 26851 | 44541 | 23032 | 13736 | 20887 | 37556 | 26576 | 43871 | 38803 |
| 6 | 12117 | 16467 | 27128 | 14284 | 8409 | 13092 | 22447 | 17653 | 25537 |
| 7 | 4265 | 6296 | 8899 | 14831 | 7486 | 4760 | 7027 | 12028 | 8917 |
| 8 | 1577 | 1906 | 3026 | 4228 | 6845 | 3540 | 2312 | 3744 | 5258 |
| 9 | 626 | 700 | 908 | 1343 | 1994 | 2945 | 1858 | 1364 | 1711 |
| 10 | 418 | 300 | 363 | 448 | 612 | 1053 | 1469 | 1031 | 740 |
| 11 | 156 | 181 | 170 | 194 | 208 | 281 | 642 | 897 | 503 |
| 12 | 143 | 62 | 100 | 88 | 98 | 95 | 148 | 404 | 433 |
| 13 | 52 | 93 | 29 | 41 | 40 | 53 | 45 | 89 | 212 |
| 14 | 24 | 27 | 64 | 5 | 17 | 23 | 27 | 29 | 51 |
| 3+ | 145381 | 124936 | 117757 | 141930 | 141505 | 171213 | 185612 | 185644 | 150325 |

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|---|
| 3 | 34888 | 45367 | 48612 | 56912 | 23459 | 57875 | 27682 |
| 4 | 20872 | 28034 | 36297 | 38831 | 44780 | 18472 | 46269 |
| 5 | 30037 | 14414 | 18473 | 21579 | 23990 | 29442 | 12053 |
| 6 | 22492 | 14618 | 7303 | 8028 | 10252 | 10568 | 17807 |
| 7 | 10749 | 9581 | 6113 | 3389 | 3561 | 3049 | 3594 |
| 8 | 3425 | 3866 | 3279 | 2698 | 1433 | 957 | 696 |
| 9 | 2344 | 1523 | 1543 | 1678 | 1090 | 443 | 209 |
| 10 | 813 | 918 | 677 | 720 | 748 | 331 | 118 |
| 11 | 403 | 357 | 494 | 352 | 273 | 225 | 97 |
| 12 | 257 | 195 | 181 | 277 | 160 | 126 | 28 |
| 13 | 225 | 140 | 92 | 97 | 133 | 62 | 30 |
| 14 | 102 | 62 | 66 | 49 | 37 | 64 | 12 |
| 3+ | 126608 | 119076 | 123130 | 134611 | 109916 | 121614 | 108595 |

FISHING MORTALITY

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0.014 | 0.007 | 0.012 | 0.018 | 0.003 | 0.012 | 0.003 | 0.004 | 0.013 | 0.019 | 0.023 | 0.025 |
| 4 | 0.099 | 0.114 | 0.102 | 0.118 | 0.116 | 0.087 | 0.089 | 0.104 | 0.143 | 0.170 | 0.217 | 0.320 |
| 5 | 0.289 | 0.296 | 0.278 | 0.291 | 0.267 | 0.315 | 0.209 | 0.341 | 0.345 | 0.520 | 0.480 | 0.633 |
| 6 | 0.455 | 0.416 | 0.404 | 0.446 | 0.369 | 0.422 | 0.424 | 0.483 | 0.665 | 0.653 | 0.672 | 0.568 |
| 7 | 0.606 | 0.533 | 0.544 | 0.573 | 0.549 | 0.522 | 0.430 | 0.627 | 0.757 | 0.823 | 0.872 | 0.618 |
| 8 | 0.612 | 0.541 | 0.613 | 0.552 | 0.643 | 0.445 | 0.327 | 0.583 | 0.608 | 0.610 | 0.719 | 0.470 |
| 9 | 0.536 | 0.458 | 0.507 | 0.586 | 0.438 | 0.495 | 0.389 | 0.412 | 0.544 | 0.738 | 0.611 | 0.562 |
| 10 | 0.637 | 0.370 | 0.427 | 0.566 | 0.578 | 0.296 | 0.293 | 0.518 | 0.408 | 0.623 | 0.419 | 0.453 |
| 11 | 0.715 | 0.391 | 0.454 | 0.481 | 0.581 | 0.443 | 0.262 | 0.528 | 0.472 | 0.525 | 0.479 | 0.379 |
| 12 | 0.234 | 0.554 | 0.687 | 0.578 | 0.413 | 0.561 | 0.304 | 0.444 | 0.454 | 0.409 | 0.553 | 0.427 |
| 13 | 0.453 | 0.168 | 1.563 | 0.658 | 0.357 | 0.469 | 0.221 | 0.353 | 0.530 | 1.087 | 0.544 | 0.429 |
| 14 | 0.602 | 0.523 | 0.554 | 0.569 | 0.575 | 0.474 | 0.389 | 0.596 | 0.672 | 0.760 | 0.784 | 0.559 |

| | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|
| 3 | 0.040 | 0.039 | 0.024 | 0.011 |
| 4 | 0.282 | 0.219 | 0.227 | 0.093 |
| 5 | 0.544 | 0.620 | 0.303 | 0.205 |
| 6 | 0.613 | 1.013 | 0.878 | 0.217 |
| 7 | 0.661 | 1.114 | 1.277 | 0.521 |
| 8 | 0.706 | 0.974 | 1.321 | 0.981 |
| 9 | 0.608 | 0.990 | 1.120 | 0.625 |
| 10 | 0.770 | 1.001 | 1.031 | 0.434 |
| 11 | 0.589 | 0.574 | 1.896 | 0.878 |
| 12 | 0.535 | 0.744 | 1.242 | 0.719 |
| 13 | 0.770 | 0.538 | 1.438 | 0.719 |
| 14 | 0.674 | 1.052 | 1.254 | 0.600 |

Table 16 (cont'd).

LOG RESIDUALS FOR CANADIAN RV INDEX

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0.63 | 0.83 | 0.11 | -0.38 | -1.43 | 0.46 | 0.02 | 0.15 | -0.18 | -0.38 | 0.12 |
| 4 | -0.10 | 1.10 | 0.50 | -1.31 | -1.77 | 0.36 | 0.04 | 0.51 | -0.31 | -0.45 | 0.81 |
| 5 | 0.16 | 1.18 | -0.12 | -0.40 | -2.01 | 0.05 | 0.13 | 1.03 | 0.02 | -0.84 | 0.87 |
| 6 | -0.65 | 0.88 | -0.50 | -0.54 | -0.92 | -0.34 | 0.11 | 0.55 | 0.67 | -0.40 | 0.93 |
| 7 | -1.47 | 0.54 | -0.32 | -0.83 | -0.91 | -0.26 | -0.02 | 0.31 | 0.90 | 0.36 | 1.27 |
| 8 | -0.88 | -0.23 | -0.61 | -0.28 | -0.88 | -0.66 | -0.19 | 0.17 | 1.00 | 0.09 | 1.00 |
| 9 | -1.23 | 0.63 | -0.95 | 0.26 | -0.73 | -0.45 | 0.11 | -0.23 | 0.85 | 0.02 | 0.36 |
| 10 | -0.53 | 0.12 | -1.23 | 0.37 | -0.18 | -0.37 | -0.27 | -0.23 | 0.63 | 0.12 | 0.44 |
| 11 | -0.23 | -0.91 | -0.67 | 0.78 | -0.99 | -0.40 | -0.28 | 0.05 | 1.23 | 0.35 | 0.32 |
| 12 | 0.19 | -0.04 | -1.10 | 0.68 | -0.01 | 0.29 | -0.20 | 0.04 | 0.92 | -0.08 | -0.45 |

| | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|
| 3 | 0.41 | -0.05 | -0.33 | |
| 4 | 0.41 | -0.18 | 0.05 | 0.32 |
| 5 | 0.92 | -0.27 | -0.75 | 0.00 |
| 6 | 0.92 | -0.18 | -0.32 | -0.24 |
| 7 | 1.13 | 0.28 | -0.26 | -0.78 |
| 8 | 1.15 | 0.38 | 0.27 | -0.36 |
| 9 | 0.99 | 0.23 | 0.32 | -0.21 |
| 10 | 0.85 | 0.26 | 0.33 | -0.33 |
| 11 | 1.35 | -0.73 | 0.52 | -0.43 |
| 12 | 0.74 | -0.82 | 0.19 | -0.39 |

SUM OF CANADIAN RV RESIDUALS : -10.92932765 MEAN RESIDUAL : -0.07335119228

LOG RESIDUALS FOR FRENCH RV INDEX

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | -1.13 | -1.99 | -1.03 | -0.49 | -1.03 | -0.52 | -0.07 | 0.80 | 0.25 | 0.96 | 0.95 |
| 4 | -1.12 | -0.87 | -1.86 | 0.08 | 0.01 | -0.64 | 0.48 | -0.11 | 0.81 | -0.16 | 0.72 |
| 5 | -1.20 | -0.44 | -0.87 | 0.38 | 0.39 | -0.29 | 0.25 | -1.04 | 0.38 | 0.07 | -0.03 |
| 6 | -1.32 | -0.63 | -0.89 | 0.33 | 0.65 | 0.22 | 0.81 | -1.82 | 0.81 | 0.39 | 0.17 |
| 7 | -0.79 | -0.46 | -0.99 | -0.20 | 0.26 | 0.73 | 0.54 | -1.04 | 0.79 | 0.51 | 0.05 |
| 8 | -0.52 | -0.10 | -1.01 | -0.39 | 0.31 | 0.33 | 0.49 | -0.60 | 0.86 | 0.43 | -0.31 |
| 9 | -0.39 | -0.26 | -0.88 | 0.22 | 0.10 | -0.01 | 0.84 | -0.21 | 1.15 | 0.15 | -0.34 |
| 10 | -0.38 | -0.05 | -0.32 | 0.31 | 0.60 | -0.08 | 0.66 | 0.08 | 0.32 | 0.41 | -0.72 |
| 11 | -1.68 | 0.85 | 0.35 | 0.11 | 1.06 | 0.25 | 0.31 | 0.57 | 0.52 | -0.34 | 0.34 |
| 12 | -1.33 | 0.31 | -0.05 | 0.40 | 0.36 | 0.63 | 0.02 | 1.13 | 0.44 | 0.27 | -0.27 |

| | 1991 | 1992 | 1993 |
|---|---|---|---|
| 3 | 0.96 | 1.20 | 1.14 |
| 4 | 0.34 | 1.44 | 0.86 |
| 5 | 0.20 | 0.59 | 0.99 |
| 6 | 0.24 | 0.06 | 0.94 |
| 7 | 0.44 | -0.50 | 0.65 |
| 8 | 0.09 | -0.15 | 0.55 |
| 9 | -0.09 | -0.74 | 0.42 |
| 10 | -0.67 | -0.50 | 0.33 |
| 11 | -0.97 | -0.53 | -0.88 |
| 12 | -1.17 | -0.92 | 0.14 |

SUM OF RV 2 RESIDUALS : -0.2889779076 MEAN RESIDUAL : -0.0020064127912

Table 16 (cont'd).

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.037770
MEAN SQUARE RESIDUALS ..... 0.516499

| PAR. EST. | STD. ERR. | T-STATISTIC |
|---|---|---|
| 2.77328E4 | 1.45694E4 | 1.90349E0 |
| 4.64173E4 | 1.95021E4 | 2.38012E0 |
| 1.21146E4 | 4.34312E3 | 2.78938E0 |
| 1.79012E4 | 6.32216E3 | 2.83150E0 |
| 3.63142E3 | 1.30460E3 | 2.78356E0 |
| 7.08878E2 | 1.81788E2 | 3.89947E0 |
| 2.11730E2 | 7.30853E1 | 2.89702E0 |
| 1.19292E2 | 4.70357E1 | 2.53621E0 |
| 9.83097E1 | 2.75551E1 | 3.56774E0 |
| 2.80315E1 | 1.93571E1 | 1.44813E0 |
| 2.05715E-5 | 4.12330E-6 | 4.98909E0 |
| 5.75942E-5 | 1.11409E-5 | 5.16962E0 |
| 1.21622E-4 | 2.32343E-5 | 5.23460E0 |
| 2.05398E-4 | 3.90187E-5 | 5.26411E0 |
| 2.60081E-4 | 4.93403E-5 | 5.27117E0 |
| 3.94621E-4 | 7.54282E-5 | 5.23175E0 |
| 5.20198E-4 | 1.00562E-4 | 5.17292E0 |
| 6.05105E-4 | 1.16881E-4 | 5.17709E0 |
| 7.35250E-4 | 1.41248E-4 | 5.20540E0 |
| 9.00384E-4 | 1.81953E-4 | 4.94844E0 |
| 9.69428E-5 | 1.87863E-5 | 5.16030E0 |
| 1.22453E-4 | 2.36007E-5 | 5.18854E0 |
| 1.96955E-4 | 3.78494E-5 | 5.20366E0 |
| 2.87781E-4 | 5.52811E-5 | 5.20577E0 |
| 3.56384E-4 | 6.84626E-5 | 5.20552E0 |
| 4.31451E-4 | 8.28949E-5 | 5.20480E0 |
| 5.47302E-4 | 1.05160E-4 | 5.20447E0 |
| 5.96319E-4 | 1.14615E-4 | 5.20278E0 |
| 5.32192E-4 | 1.02333E-4 | 5.20059E0 |
| 8.17152E-4 | 1.56980E-4 | 5.20546E0 |

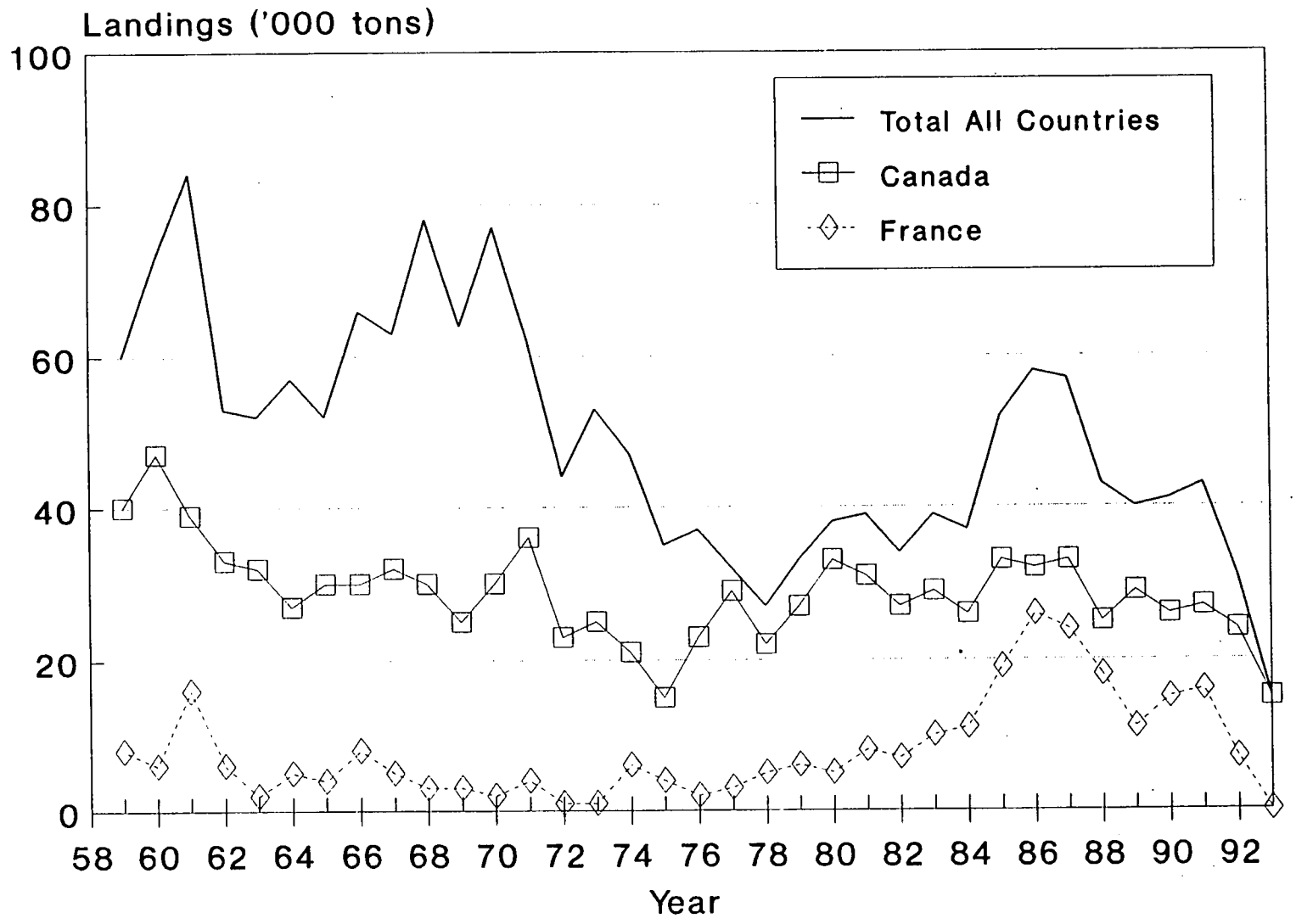


Figure 1. Cod landings from Subdivision 3Ps for the period 1959-93.

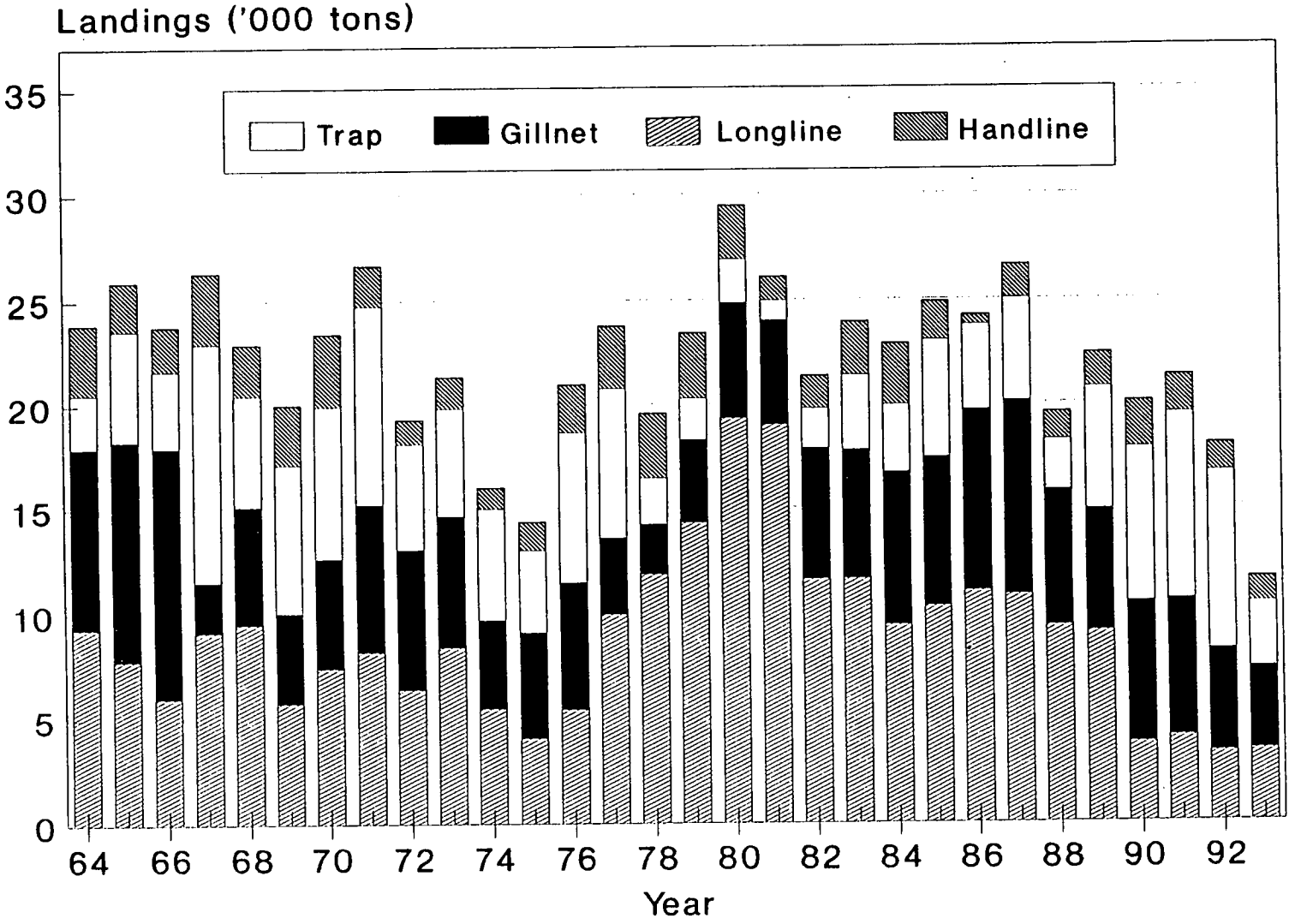


Figure 2. Fixed gear cod landings by Canada in Subdivision 3Ps. 1964-1993.

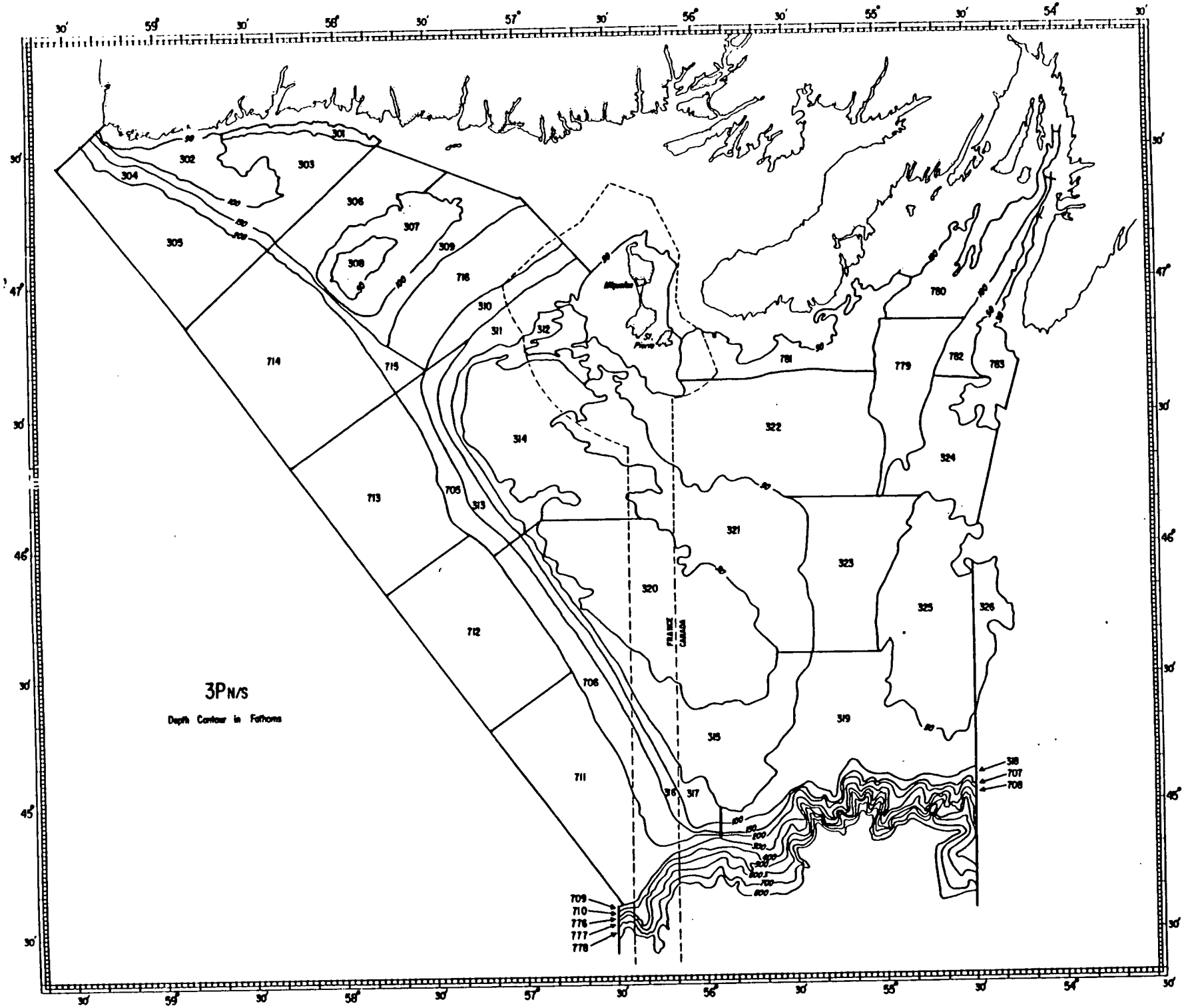


Figure 3. Stratification scheme used for random-stratified surveys in NAFO Subdivision 3Ps.

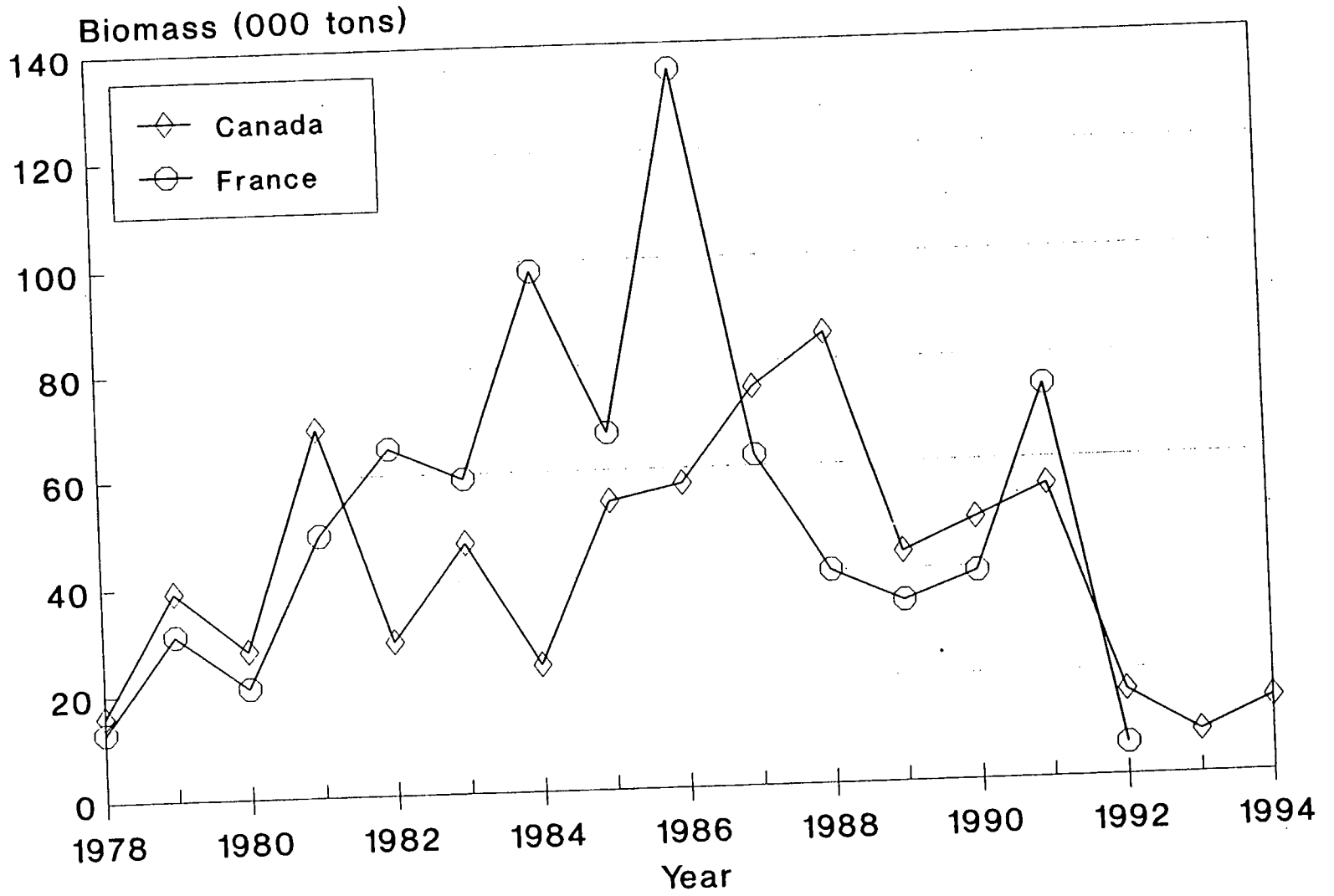


Fig 4. Biomass of cod in Subdiv. 3Ps
estimated from Canadian and French RV.

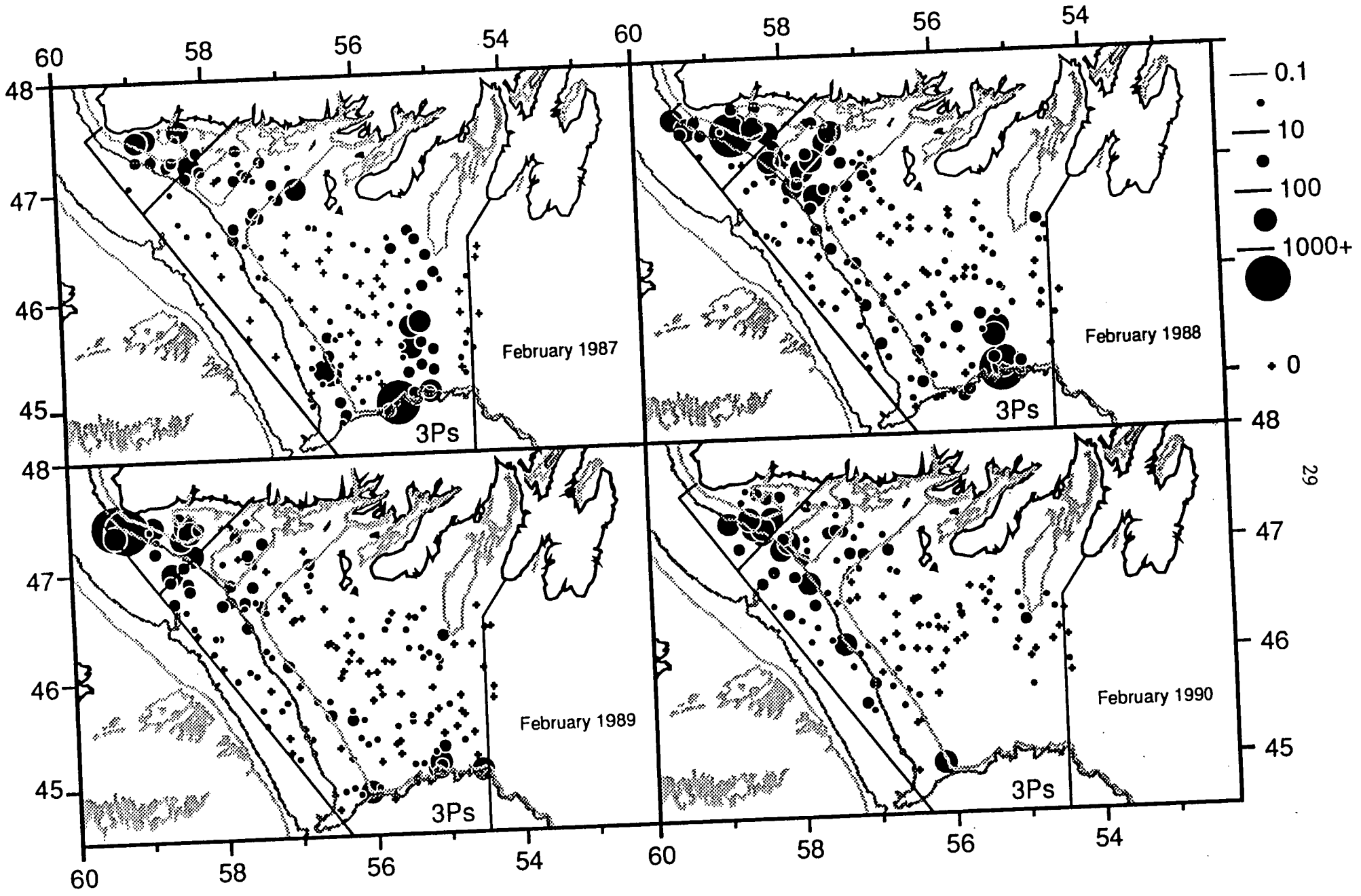


Figure 5. Cod distribution (numbers per tow) from the Canadian winter-spring surveys in Subdiv. 3Ps for the 1987-93 period.

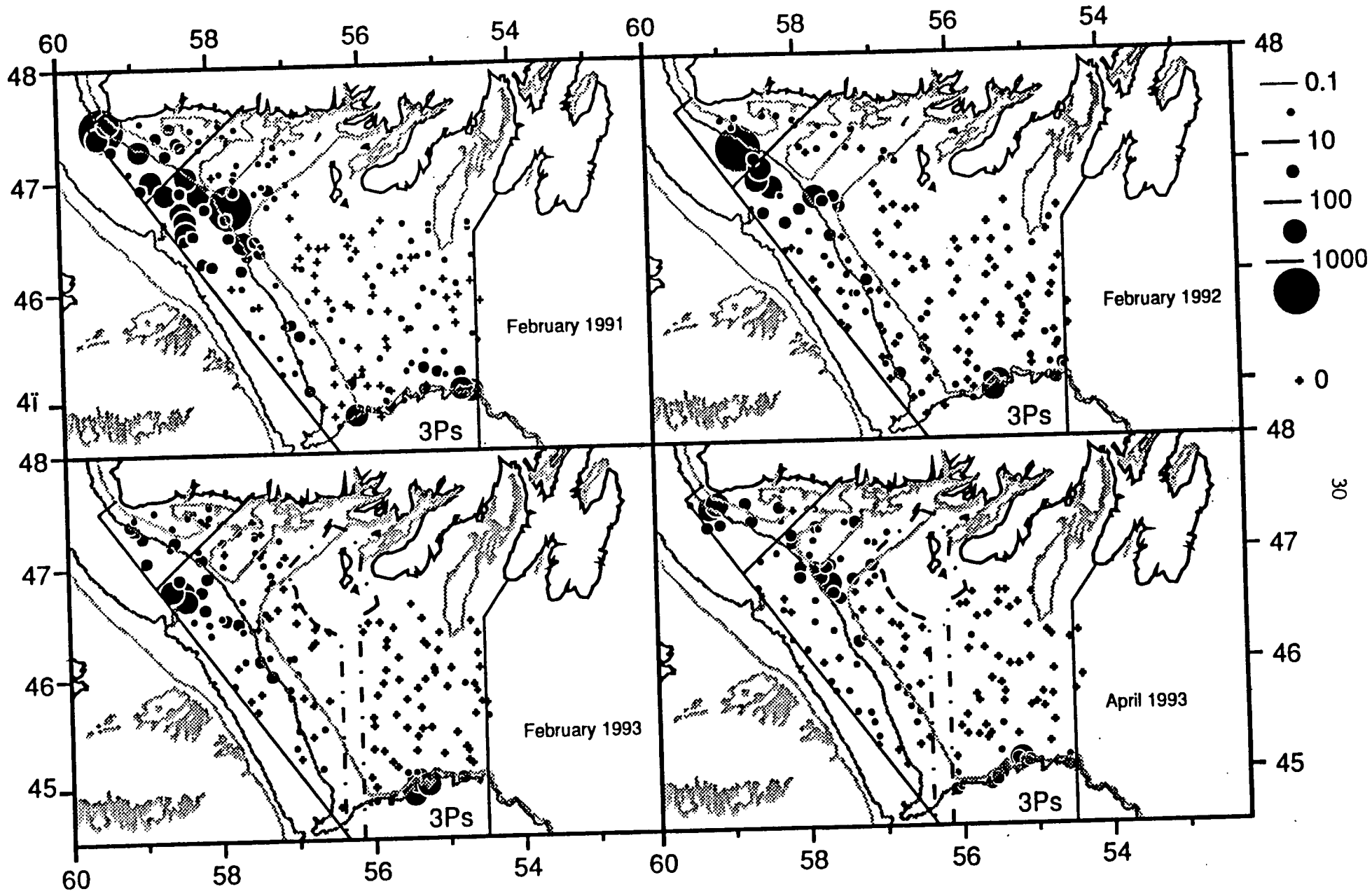


Figure 5. (cont'd)

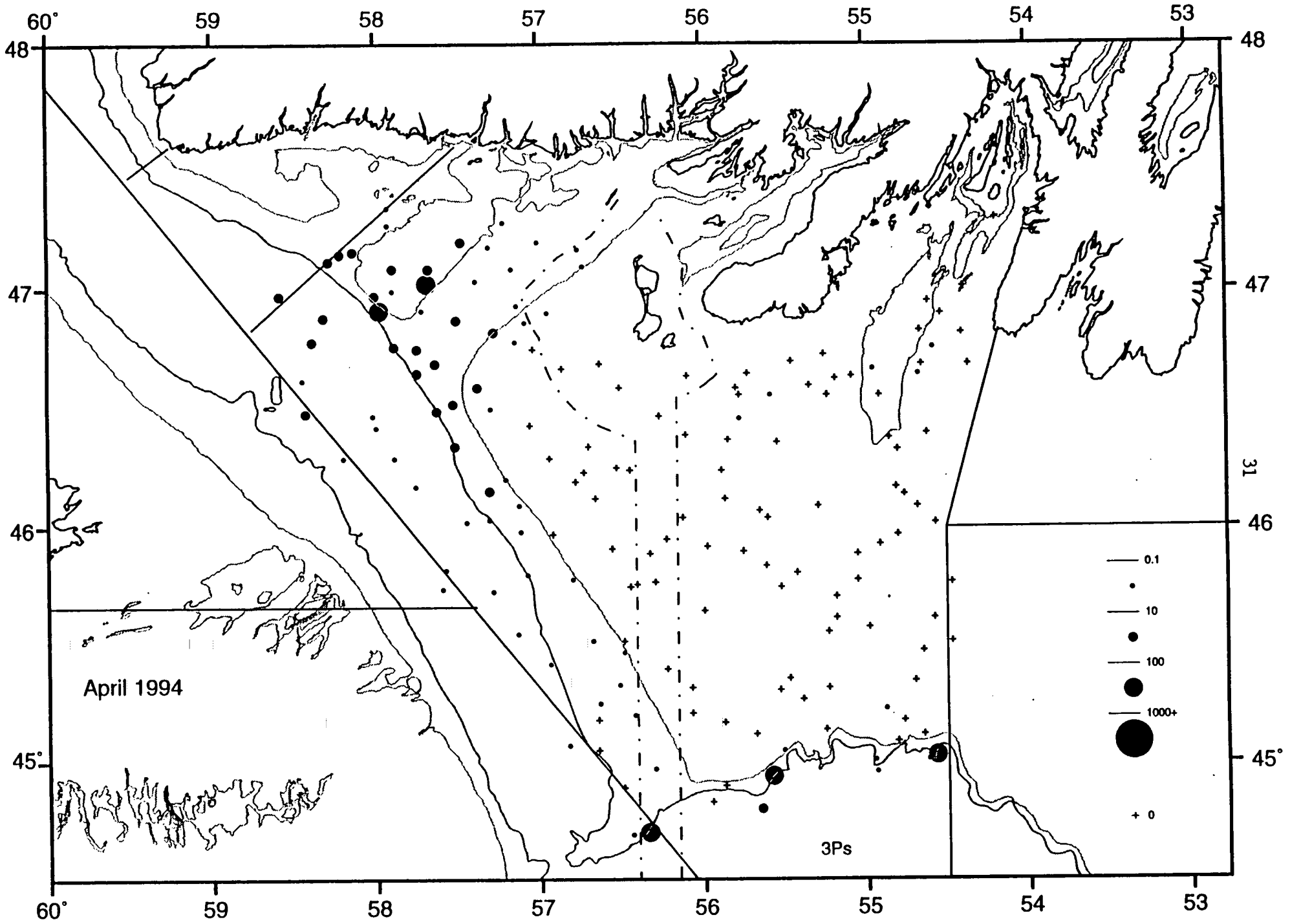


Figure 6 . Cod catches numbers per tow fron Canadian Research Vessel Survey April 1994.

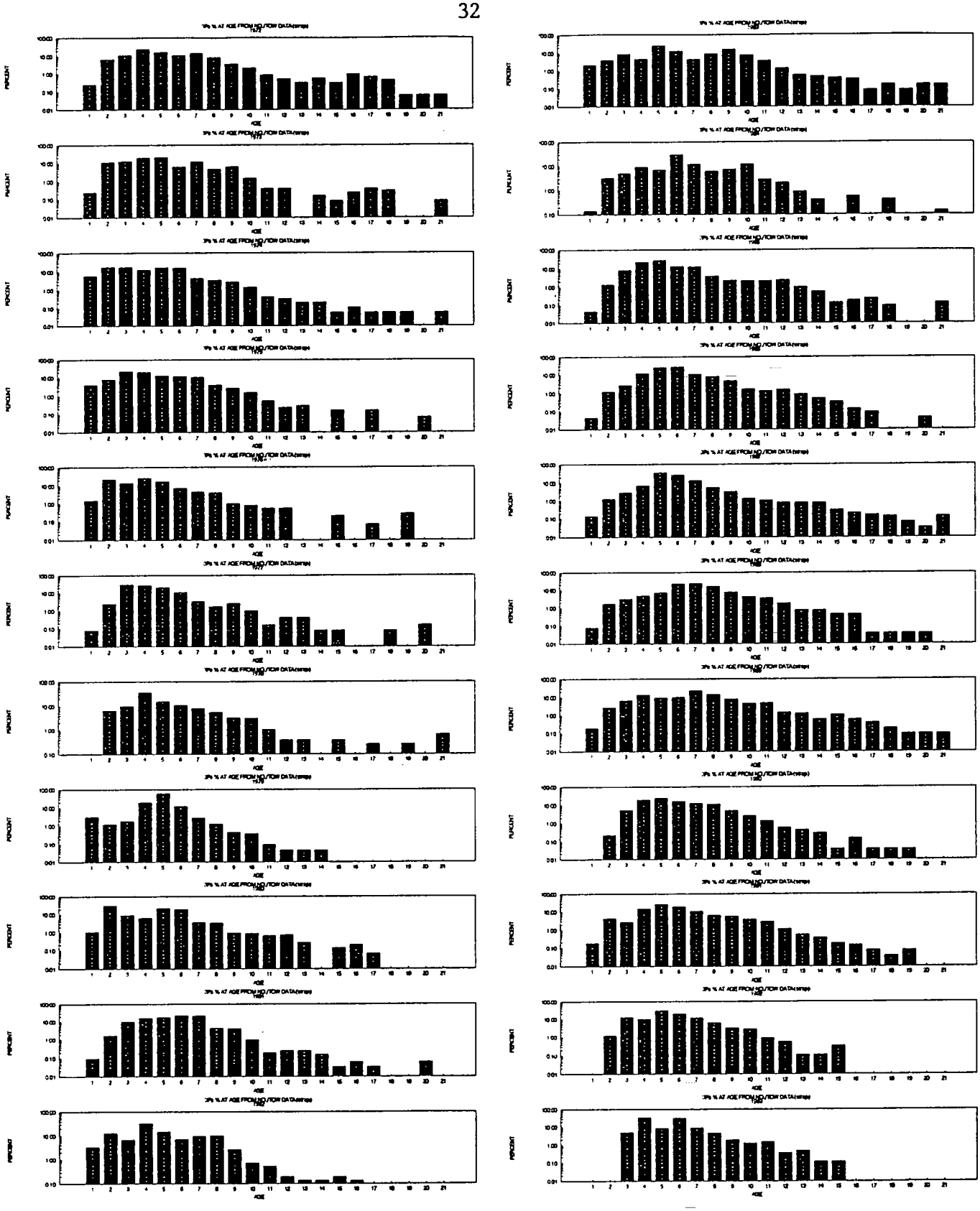

Figure 7. Proportional age distribution from Canadian RV survey data (1972 - 1993). ( Log scale ).

Figure 8 Total mortality (Z) estimates from Canadian RV mean number per tow estimates for 3 age groups (ln percent at age regression) from 1972 to 1993.