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An assessment of the cod stock in NAFO Divisions 2J+3KL.

Évaluation du stock de morue dans les divisions 2J+3KL de l'OPANO

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Abstract

The status of the 2J+3KL cod stock is updated based on an additional year of research bottom-trawl surveys, sentinel surveys, a prerecruit survey, acoustic surveys in specific areas, returns from tagging studies, a questionnaire completed by fishing communities, and catches and catch rates from the index fishery. Considerable uncertainty exists about the structure of this stock and consequently in this assessment the stock status was assessed under two hypotheses: a) the cod currently inshore belong to an inshore subpopulation that is functionally separate from the offshore; and b) inshore and offshore fish together constitute a single functional population. Under the hypothesis of a separate inshore population, it is not clear whether the spawning stock has been sustained by recent levels of recruitment at the current levels of natural and fishing mortality. Catch rates from the sentinel survey, commercial logbooks and autumn research bottom-trawl surveys in the inshore show a decreasing trend in exploitable biomass since 1998. However, estimates of exploitable stock size based on tagging studies have been relatively constant. Under the single functional population hypothesis, there is no doubt that the 2J+3KL cod spawner biomass remains at an extremely low level compared to historical size, and there is no evidence of a recovery. Any fishery on the remnant in the inshore will delay recovery of the stock. Predation by harp seals is estimated to be 37,000 t and may be preventing the recovery of the cod stock.

Résumé

L'état du stock de morue dans les divisions 2J+3KL est mis à jour à la suite d'une année supplémentaire de relevés au chalut de fond, de relevés par pêche sentinelle, de relevés des pré-recrues, de relevés acoustiques dans certaines zones, de données issues d'étiquettes retournées, des réponses à un questionnaire rempli par les pêcheurs, ainsi que des prises et des taux de prises de la pêche indicatrice. De nombreuses incertitudes subsistent quant à la structure de ce stock et par conséquent, l'a présente évaluation de l'état du stock se fonde sur deux hypothèses : a) la morue actuellement en zone côtière appartient à une sous-population côtière qui est fonctionnellement distincte de la population des eaux hauturières et b) les poissons des eaux hauturières et les poissons des eaux côtières constituent une seule sous-population. Quand on se base sur l'hypothèse d'une population côtière distincte, on ne sait pas très bien si le stock reproducteur a été maintenu aux niveaux actuels de mortalité naturelle et de mortalité due à la pêche grâce aux récents niveaux de recrutement. Les taux de prise issus du relevé par pêche sentinelle, des registres des bateaux de pêche commerciale et des relevés au chalut de fond faits en automne dans les eaux côtières indiquent une tendance à la baisse de la biomasse exploitable depuis 1998. Cependant, les estimations de la taille du stock exploitable fondées sur les études d'étiquetage ont été relativement constantes. Si l'on adopte l'hypothèse de la sous-population unique, il ne fait aucun doute que la biomasse de géniteurs dans les divisions 2J+3KL demeure à un niveau extrêmement faible par rapport à sa taille historique et qu'il n'y a aucun signe de rétablissement du stock. Toute pêche sur le reste de la zone côtière retardera le rétablissement du stock. La prédation par les phoques du Groenland est évaluée à 37 000 t et empêche peut-être ce stock de se rétablir.

1 Introduction

Historically, many of the cod in NAFO Divisions 2J+3KL (the "northern cod") migrated between overwintering areas in deep water near the shelf break and feeding areas in shallow waters both on the plateau of Grand Bank and along the coasts of Labrador and eastern Newfoundland (Fig. 1a). Some cod remained inshore throughout the winter in deep water both within the bays and off the headlands. For several centuries various nations pursued the cod while they were in the shallow areas, first with hook and line and later with nets which evolved by the late 1800s into the highly effective Newfoundland cod trap. The deep waters, both inshore and offshore, remained refugia until the 1950s, when longliners designed to exploit populations of cod in deep coastal waters were introduced to eastern Newfoundland and distant water fleets from Europe started to employ bottom-trawlers to fish the deeper water of the outer banks, first mainly in summer/autumn but later in the winter and early spring when the cod were highly aggregated. Landings increased dramatically in the 1960s as large numbers of bottom-trawlers targeted the overwintering aggregations on the edge of the Labrador Shelf and the Northeast Newfoundland Shelf. At the same time, the numbers of large cod in deep nearshore waters are thought to have declined quickly as the longliner fleet switched to synthetic gillnets. Additional details on the history of the northern cod fishery, including changes in technology and temporal variability in the spatial distribution of fishing effort, may be found in Templeman (1966), Lear and Parsons (1993), Hutchings and Myers (1995) and Neis *et al*. (1999).

The number and individual size of the fish declined through the 1960s and 1970s and the stock reached a very low biomass by the mid-1970s (Baird *et al*. 1991). Following Canada's extension of jurisdiction to 200 miles in 1977, the stock began to recover as a consequence of smaller catches, entry of the strong 1973-1975 year-classes and an increase in the growth rate of individual fish. Fishing effort by an expanding Canadian trawler fleet increased dramatically following extension of jurisdiction and this fleet took a large portion of the total allowable catch, which almost doubled between 1978 and 1984. It became clear in retrospect that the stock size was overestimated during this period. Fishing mortality was about twice as high as the $F_{0.1}$ target level. In addition, the 1976-1977 year-classes were weak and individual growth rate declined. The 1978-1982 year-classes were moderate to strong but the 1983-1985 year-classes were weak. The spawner biomass did not increase after about 1982 and the 3+ population size peaked in 1984-1985.

Reasons for the overestimation of stock size include changes in the method by which the sequential population analysis (SPA) was calibrated and the "retrospective" problem, a phenomenon whereby adding additional data on each year-class results in downward revisions of population size. In addition, the 1986 survey was positively biased. It was recognized in 1988 that the 1986 value had contributed to severe overestimation of stock size (Baird *et al*. 1991; Lear and Parsons 1993; Bishop and Shelton 1997). The catch predicted for an $F_{0.1}$ fishing mortality in 1989 was much lower than the TAC's and catches of preceding years, and the fixed fishing mortality approach was suspended in favour of an approach that reduced quotas more gradually in hopes of avoiding undue hardship to the fishing industry. Fishing mortality was allowed to escalate. Simulations indicate that the change in the approach to setting the quota turned what might have been a severe stock decline under a fixed fishing mortality rate into a collapse (Shelton 1998).

By the early 1990s much hope was placed on the 1986 and 1987 year-classes, which appeared to be strong in the research vessel surveys and initially contributed strongly to commercial catches. However, in concert with older year-classes, these two year-classes appeared to decline very rapidly. Fishing mortality was very high but reported landings including documented discards were insufficient to account for the abrupt decline observed in the research vessel indices in 1990-1991. The stock was closed to Canadian fishing in July 1992. The research vessel index showed a further large decline in autumn 1992. It was thought that there might have been a substantial increase in natural mortality, especially during the first half of 1991 (Lear and Parsons 1993; Atkinson and Bennett 1994). Research vessel indices continued to decline in the absence of a Canadian fishery and reached a very low level by 1994.

Controversy continues regarding the time course and causation of the collapse. Some analyses found no support for a sudden increase in natural mortality in 1990-1991 (Myers and Cadigan 1995) and attributed the decline to fishing mortality alone (Hutchings and Myers 1994; Hutchings 1996; Myers *et al*. 1996a,b; Myers *et al*. 1997a,b). However, in the late 1980s and early 1990s the stock underwent several changes that may not have been related to fishing. For example, the distribution during the autumn was increasingly concentrated toward the outer edge of the banks (Lilly 1994; Taggart *et al*. 1994), the distribution during the winter was increasingly toward the south and to deeper water (Baird *et al*. 1992b; Kulka *et al*. 1995), the inshore fishery started late (Davis 1992) and fish experienced a pronounced decline in growth, condition and age at maturity, especially in the north (Taggart *et al*. 1994). In addition, declines in abundance and changes in distribution were experienced by many other groundfish, both commercial and non-commercial (Atkinson 1994; Gomes *et al*. 1995). Changes in the lightly exploited American plaice in Divisions 2J and 3K (Bowering *et al*. 1997) parallel many of the changes in cod. Capelin, the dominant pelagic species in the area and the major prey of cod, almost disappeared from Division 2J, increased in abundance in areas where they were previously uncommon (Flemish Cap and eastern Scotian Shelf), became inaccessible to acoustic surveys conducted at traditional times, arrived late in the inshore for spawning, and experienced low growth rates (Lilly 1994; Frank *et al*. 1996; Nakashima 1996; Carscadden *et al*. 1997; Carscadden and Nakashima 1997). Arctic cod, a cold water species, appeared to increase in abundance and expand its distribution (Lilly *et al*. 1994; Lilly and Simpson 2000). Changes were observed in salmon (Narayanan *et al*. 1995) and several other pelagic species, especially migrants from the south (Montevecchi and Myers 1996). These changes in cod and many other species may have been related to the prolonged period of low water temperatures starting in the early 1980s and to a particularly cold period in the early 1990s (Narayanan *et al*. 1995; Drinkwater 1996; Colbourne *et al*. 1997), but causal links between changes in water temperature and changes in fish biology remain to be established in many cases, especially for the cod (e.g. Lilly 1994). Although much of the published literature concludes that fishing was the major and even the sole cause of the collapse of the 2J+3KL cod during the late 1980s and early 1990s, the possible impacts of factors such as water temperature, the abundance and availability of prey (especially capelin) and predation by seals require additional study.

A thorough review of all analyses relating to the decline of cod in 2J+3KL from the mid-1980s to the early 1990s is beyond the scope of this paper. However, one specific aspect may be mentioned as illustrative of the degree of uncertainty. Various analyses have been presented in support of the hypothesis that the cod shifted southward (Kulka *et al*. 1995; Wroblewski *et al*. 1995b), possibly in response to a decline in water temperature (deYoung and Rose 1993; Rose *et al*. 1994; Atkinson *et al*. 1997; Rose *et al*. 2000) or a southward shift in the distribution of capelin (Rose *et al*. 2000), and that this shift increased the vulnerability of the cod to both Canadian and non-Canadian fleets (Rose *et al*. 1994; Atkinson, *et al*. 1997; Rose and Kulka 1999). Other analyses find no support for the southward shift hypothesis (Hutchings and Myers 1994; Hutchings 1996; Myers *et al*. 1996a). There can be little progress in determining what caused the deaths of the fish until there is better understanding of where and when the deaths occurred.

Uncertainty about the time course of the decline lies at the heart of the inability to reconcile catch data and the autumn research vessel index within a sequential population analysis (SPA). One may class the various possibilities for the discrepancy into three groups. First, the stock decline may have been more gradual than indicated by the surveys. Under this scenario, the survey index had positive year effects for several years in the late 1980s and early 1990s. These effects may have been associated with the increased degree of aggregation toward the shelf edge at the time of the surveys. Hutchings (1996), for example, has conducted a modelling exercise that he suggests demonstrates how aggregations could cause overestimation in a random stratified survey. If, however, the autumn survey index accurately reflected the changes in cod abundance, then the decline occurred rapidly and a large number of fish remain unaccounted for in the catches. This leads to the second and third sets of hypotheses. The second is that catches in the late 1980s and early 1990s were grossly underestimated. This could include under-reporting of landings and the dumping of fish (including discarding of small fish) in Canadian fisheries (Hutchings 1996; Myers *et al*. 1997a; Hutchings and Ferguson 2000) and underestimation of the catch by distant water fleets on the Nose of the Bank. The third group of hypotheses involves an increase in natural mortality, caused for example by seal predation or a decrease in condition.

Shelton and Lilly (2000) conducted diagnostic studies to determine the magnitude of the departure from standard SPA assumptions required to allow the SPA to fit the data. They found that the departures were too large to be explained with independent data currently available. They concluded that unreported deaths caused by the offshore fishery may be most plausible as the main contributing factor to lack of model fit but that factors such as increased natural mortality, and possibly changes in survey catchability, also played a role.

The inshore region has gained a greatly increased degree of prominence in the assessment of 2J+3KL cod since the mid-1990s. By the autumn of 1994 there appeared to be very few cod left within the boundaries of the 2J+3KL stock complex. In spring 1995, a research vessel unexpectedly found a dense aggregation of cod in Smith Sound, Trinity Bay, and during summer/autumn of 1995 participants in the new sentinel survey program experienced good catch rates of commercial size cod over much of the area from central 3K to southern 3L. These reports of cod in the inshore called into question the adequacy of the offshore survey as an index of total stock abundance. Information on the general biology (e.g. distribution, spawning, feeding, growth, condition) of cod in the inshore may be found in Lilly *et al*. (1998a) and Lilly *et al*. (1999), and in the many sources cited therein. Our knowledge of the biology of cod in the inshore has increased rapidly through interviews with fishermen (e.g. Neis *et al*. 1999; Jarvis and Stead 2001) and an intensification of study, including a tagging program, sentinel surveys, a logbook program for commercial vessels under 35 feet in length, acoustic surveys in specific areas, and an extension of the autumn survey into new strata in the inshore.

Attention should be drawn to one specific portion of the inshore. Gilbert Bay in southern Labrador has been shown to have a small resident population of cod (Green and Wroblewski 2000) that are genetically distinct from other cod in the 2J3KL area (Ruzzante *et al*. 2000). Gilbert Bay has been identified as an Area of Interest, which is a step along the way to becoming a Marine Protected Area. Because of its small size, limited distribution and genetic distinctiveness, the Gilbert Bay population was not included in the present assessment of 2J+3KL cod.

A narrative of the assessment process for 2J+3KL cod from extension of Canadian jurisdiction in 1977 to the moratorium in 1992 has been compiled by Bishop and Shelton (1997). Their report provides details of the annual assessments, including the data and methods used to determine stock status and the results of the assessments. The latter include TAC projections in terms of the standard requested reference points. The origin and evolution of the important databases such as catch at age, catch rate indices, and research survey data are discussed. Topics related to the assessments, such as the various committees and commissions that were struck to provide advice on scientific aspects of the assessments, and important issues such as the “retrospective problem”, are also given attention. Documentation supporting assessments since 1992 may be found in Bishop *et al*. (1993; 1994; 1995a,b), Shelton *et al*. (1996), Murphy *et al*. (1997) and Lilly *et al*. (1998b; 1999, 2000b). Reports of the Canadian assessment meetings during 1993-1996, 1999 and 2001 may be found in Sinclair (1993), Shelton and Atkinson (1994), Shelton (1996), Evans (1996), Rivard (1999) and Morgan (2001). NAFO deliberations are documented in NAFO Scientific Council Reports.

The 2001 assessment updated the status of the 2J+3KL cod stock to the end of 2000 based on an additional year of research bottom-trawl surveys, sentinel surveys, a prerecruit survey, acoustic surveys in specific areas, returns from tagging studies, a questionnaire completed by fishing communities, and catches and catch rates from the index fishery. A summary of the assessment is provided in the Stock Status Report (DFO 2001). Technical details are provided in the present document and in several additional documents referenced in the text.

2 The fishery

2.1 Fishery quota and management plan for 2000

In May 2000, the Fisheries Resource Conservation Council recommended that only sentinel fisheries be prosecuted in 2J, that only sentinel and index fisheries be prosecuted in 3KL, and that the total catch for coastal 2J3KL not exceed 7,000 t (FRCC 2000). The Minister of Fisheries and Oceans announced on June 14 that an index fishery will be conducted in the inshore portion of 2J3KL and that sentinel surveys will continue. A TAC of 7,000 t was established for the 2000-2001 fishery, with 6,600 t for the index fishery, 300 t for the sentinel survey and 100 t for by-catch. A recreational / food fishery was also announced.

2.1.1 Index fishery

Management measures for the index fishery were similar to the 1999 commercial fishery. The fishery was conducted on an IQ basis, with each licenced fisher permitted to harvest 8,400 lbs round weight (7,000 lbs head-on gutted weight). Fishers were restricted to fishing only in the NAFO Division of their homeport, with the additional limitation that fishers in Division 3L were restricted to fishing to the north or south of Grates Point (between Trinity Bay and Conception Bay), again based on the location of their homeport. (There were some special provisions for fishers living close to the dividing line.) Smith Sound in Trinity Bay was limited to fishers with homeports in the Sound. All fishing was restricted to within the 12 nm limit. Fishers were permitted to direct for cod with one gear type combination; either longlines and handlines or gillnets and handlines, but not both combinations during the same week. Fishers were permitted to use a maximum of six 50-fathom gillnets (5 ½ - 6 ½ inch mesh) or longlines with a maximum of 2,000 hooks. A small number of fishers were permitted to use cod traps to obtain fish for growout. All landings were subject to an industry-funded 100% Dockside Monitoring Program.

Two fishing seasons were announced: June 26 – July 29 and September 11 – October 28. The second period was subsequently extended to November 18 and then again to November 30.

2.1.2 Sentinel surveys

Sentinel surveys were conducted for the sixth year. Protocols are described in Maddock Parsons *et al*. (2001).

2.1.3 Recreational / food fishery

A recreational / food fishery was held during three weekends: August 25-27, September 2-4 and September 23-24. (The initial announcement specified only the first two weekends. The third was added because of poor weather.) Fishing was by hook-and-line (hand-held or angling). Jiggers were not permitted. The individual catch limit was 10 groundfish per day.

The estimated level of participation was 56,000 person-days. The estimated total catch was 302,000 fish weighing 499 t (Fisheries Management Branch, DFO, Newfoundland Region, unpublished data). In comparison, 57,000 person-days caught 98,000 fish weighing 220 t during the 8-day 1999 fishery and 57,000 person-days caught 340,000 fish weighing 696 t during the 3-day 1998 fishery.

2.2 Catch and catch at age

2.2.1 Nominal catch

Landings from this stock increased during the late 1950s and early 1960s and peaked at just over 800,000 t in 1968 (Table 1; Fig. 2). Landings then declined rapidly to a minimum of 139,000 t in 1978, increased to a plateau of approximately 250,000 t in the mid- to late 1980s and then declined very quickly in the early 1990s. The portion of the landings coming from each of the Divisions changed over time. During the 1960s, when the fishery was primarily by non-Canadian fleets (Fig. 3), landings were taken mainly from Divisions 2J and 3L (Fig. 4). Division 3K became prominent in the mid-1970s. Landings from Division 2J were relatively small in the mid-1980s. Division 3L dominated from the mid-1980s until the moratorium in 1992.

The fixed gear landings (Table 2; Fig. 5) increased from just 41,000 t in 1975 to a peak of 113,000 t in 1982, declined to 74,000 t in 1986, and increased again to a peak of 117,000 t in 1990, just 2 years before declaration of the moratorium. There was a substantial decline to 61,000 t in 1991. The commercial fishery was closed in July 1992 and only 12,000 t were landed that year. Some of the increase in the late 1980s was due to a resurgence of gillnet landings in southern Division 2J and trap landings in Division 3L, but much was due to an expansion of the gillnet fishery to the Virgin Rocks and other offshore areas in Division 3L (see Table 3 of Shelton *et al*. 1996).

Landings have been small since 1992. In 1993 a recreational fishery together with by-catches accounted for 11,000 t. In 1994 a limited (10 d) food fishery during August and September, together with by-catch, accounted for about 1,300 t. In 1995 there was no recreational or food fishery but a sentinel survey was introduced to provide catch-effort information from fixed gear fished in a manner similar to a commercial fishery. Reported landings were only 330 t. In 1996 the sentinel survey continued and a food fishery was allowed on two consecutive 3-day weekends. These two fisheries together with by-catch landed approximately 1,700 t. In 1997 there was no food fishery. Sentinel surveys accounted for about 70% of the total landings of 500 t.

In 1998 there was a quota of 4,000 t, divided among by-catch (275 t), sentinel surveys (375 t), and an index fishery, which was itself divided into an inshore component (3000 t) and an offshore component (350 t). [The concept of an **index fishery** was introduced by the Fisheries Resource Conservation Council (FRCC 1998). An index fishery is not a commercial fishery, but rather a small directed fishery conducted by commercial fishermen "to provide additional information to supplement sentinel programs and to add confidence

… in cod population estimates". It was stated that the program should be designed such that "this program supplements (and not duplicates) the sentinel survey data". The magnitude of an index fishery, if the only objective were to provide information for scientific analysis of the size of the resource, has not been debated. The magnitude of an index fishery (in the context of 2J+3KL cod) as defined by the FRCC may be inferred from their use of the term "index" for TAC's of 4,000 t (FRCC 1998) and 7,000 t (FRCC 2000) and the term "commercial" for a TAC of between 6,000 and 9,000 t (FRCC 1999).] The reported landings in 1998 were 398 t from by-catch, 388 t from sentinel surveys, 3,019 t from the inshore index fishery, and essentially zero from the offshore index fishery. In addition, there was a 3-day food fishery that is estimated to have taken 696 t.

In 1999 there was a quota of 9,000 t in the inshore portion of 2J3KL. The quota available for a commercial fishery was set at 8,600 t after allowances of 300 t for the sentinel survey and 100 t for by-catch. Reported landings were about 8,050 t from the commercial fishery and 200 t from the sentinel survey. An additional 220 t were estimated to have been taken by the food/recreational fishery.

In 2000 / 2001 a quota of 7,000 t was established for an index fishery and sentinel surveys in the inshore for vessels under 65 feet (see Section 2.1). Reported landings were approximately 4,700 t from the index fishery and 200 t from the sentinel surveys, which together with the estimate of 500 t for the food / recreational fishery totalled approximately 5,400 t.

The index fishery in 2000 was conducted on the basis of individual quotas. Participants were licenced to fish only in the Division of their home port, with an additional restriction within 3L to either north or south of Grates Point, so landings within each Division (or area within 3L) reflected both the relative availability of fish and the number of licences in the area. The percentage of the landings by Division increased from 2J (< 1% by weight) to 3K (27%) to 3L (73%). The percentage taken in 3K was considerably reduced from the 43% in 1999.

The landings in 2000 from all sources (commercial fishery including by-catch, sentinel survey and food / recreational fishery) are presented by gear, unit area and month in Table 3. Gillnets contributed 76% by weight, linetrawls 4% and handlines 18%. There was also a small catch from traps and a very small by-catch in the yellowtail fishery by large otter trawlers on Grand Bank (3L). Most (75%) of the catch came from the area between central Notre Dame Bay and Grates Point; 22% in 3Ki (Twillingate – Fogo), 27% in 3La (Bonavista Bay) and 26% in 3Lb (Trinity Bay). As in 1999, the months of highest catch were July (28%) and September (38%).

It is known that in recent years there have been removals in excess of sentinel surveys and legal fisheries. The magnitude of these removals cannot be estimated but is thought to be substantial.

2.2.2 By-catch and discards

The Canadian observer program, jointly funded by DFO and industry, provides varying levels of coverage of fishing activity by the various fleet sectors off Newfoundland. The primary purpose of the program is enforcement and control, but useful data for science are also generated. These data include length frequencies, otolith samples, and estimates of catch, effort, by-catch and discarding. Data for 2000 were evaluated to gauge the possible impact of by-catch and discards on the recovery of the northern cod stock. The percentage of the sets covered were about 1% for vessels less than 35ft, 8% for vessels 35-65ft, 18% for vessels 65-100ft, and 73% for vessels greater than 100ft (including 100% coverage on vessels directing on yellowtail). In the 2J3KL area there were 1,633 sets observed. Of these sets, 3 were directed at black back flounder, 10 at capelin, 102 at cod, 9 at crab, 213 at Greenland halibut, 4 at herring, 32 at lumpfish, 951 at shrimp and 309 at yellowtail. The weight of cod kept or discarded in the non-cod directed observed sets totalled 28 t. No attempt is made in the current assessment to estimate the by-catch and discards in the unobserved sets for the non-cod directed fisheries using the rates in the observed sets. The amount of cod discarded in the cod directed sets totalled only 156 kg for an observed kept catch of 11,725 kg, giving a discard rate of 0.0133. Taking into account the total recorded landings of 5,365 t for 2000/2001, the amount of cod discarded in the cod-directed fishing in the past season is thus estimated to be 71 t. An implicit assumption made in this calculation is that observed and unobserved sets have equal discard rates.

Although bias is a major issue, analysis should be carried out on the observer data to attempt to estimate overall by-catch and discard rates for each fishery, which can then be extrapolated, using an appropriate model, to estimate total by-catch and discards. Clearly this should be carried out on a directed species/gear basis and it may be useful to consider temporal and spatial effects in the data, and to account for discarding by length. To do the appropriate analysis, two data files will have to be interrogated together – the observer data and the commercial catch-effort database. This will be set as a priority for the next assessment.

2.2.3 Sampling of catch in 2000

The sentinel survey was sampled intensively. Most gear / unit area cells in the index fishery were well sampled during July and September, but there were some shortfalls, the most noticeable being the absence of sampling at any time in 3Lj (eastern Avalon Peninsula). There was no sampling of the food/recreational fishery.

The number of fish measured in 2000 is given by gear, unit area and month in Table 4. The number of fish aged is given by gear, unit area and quarter in Table 5.

2.2.4 Catch numbers and weights at age

The age composition and mean length-at-age of the landings were initially calculated by gear, unit area and quarter as described in Gavaris and Gavaris (1983). The following relationship was applied in deriving average weight-at-age:

$$\log(\text{weight}) = 3.0879*\log(\text{length}) - 5.2106.$$

In terms of numbers of fish, the landings in 2000 were dominated by gillnet (65%), followed by handline (24%), linetrawl (7%), trap (4%) and otter trawl (<1%) (Table 6). The dominance of gillnet was less than in 1999, when that gear accounted for 81% of the landings.

The total catch-at-age in 2000 comprised a range of ages, with ages 3 to 10 each contributing at least 5% by number and ages 5 and 6 most prominent (Table 6; Fig 6). Only 2% (by number) of the total catch in 2000 was older than age 10 (the 1990 year-class). The total catch at age in 2000 strongly reflects the selectivity of the gillnets, which tend to select ages 6 and 7 but caught roughly equal numbers of ages 5 to 8 in 2000. Hook and line gears caught cod of a wide range in age, with ages 3-5 most prominent in linetrawls and ages 4-5 most prominent in handlines. The trap catch was dominated by age 4 and the otter trawl by-catch by ages 3-4. The small size of cod in the otter trawl by-catch presumably results from the use of restrictor grates in the yellowtail fishery.

The numbers at age for fish in the reported landings from 1962 to 2000 are presented in Table 7. The 1989 year-class was the most important contributor to the catch in 1993-1994. The 1990 year-class was the most important contributor in 1995-1997 and was still an important contributor in 2000. The 1992 year-class was the most important contributor in 1998-1999, but was less prominent in 2000.

The mean weights-at-age calculated from mean lengths-at-age in the landings have varied over time (Table 8; Fig. 7). There was an increase in the late 1970s and early 1980s, followed by a decline through the 1980s to low levels in the early 1990s. There has been substantial improvement in the latter half of the 1990s, and for some age-groups (e.g. ages 4-7) the weights-at-age calculated for 2000 were at or near the highest levels in the time-series. Interpretation of changes in the weights-at-age is difficult because of changes in the relative contributions of the various gear components and changes in the location and timing of catches from each gear component. For example, much of the landings prior to the moratorium came from otter trawling offshore early in the year, whereas since the moratorium most of the catch has come from fixed gear inshore in the second half of the year. The high proportion of landings coming from gillnets in 2000 will tend to increase the calculated mean weight-at-age of those age-classes entering the selection range of the gear. This may apply in particular to ages 5 and 6 in 2000. There may also be an underestimate of weight-at-age for those age-classes leaving the selection range of gillnets.

There are clearly problems with the 1993 weights-at-age that remain to be resolved.

The biomass at age for fish in the reported landings from 1962 to 2000 is presented in Table 9.

2.2.5 Weights-at-age at the beginning of the year

Weights-at-age at mid-year and the beginning of the year were required for explorations of whole stock analyses employing sequential population analysis (SPA). Although these SPA explorations were not at this time considered helpful in assessing present status of the stock and are not reported, it is thought that the weights-at-age employed in these explorations should be documented as a record of what had been used and to assist additional explorations.

A satisfactory time-series of stock weights-at-age is not available. Estimates have in the past been obtained by adjusting to the beginning of the year those mean weights-at-age calculated from sampling during the commercial fishery (see, for example, Rivard 1982, p. 14). A problem with such data is that the commercial fishery may be conducted with a variety of gears, each with its peculiar selection pattern, and the temporal pattern of fishing may not centre on the time when the fish attains the mid-point of its annual length increment. In addition, both the relative contribution of each gear to the total catch and the temporal and spatial pattern of fishing may vary among years. Prior to preparation of the 1998 assessment of 2J+3KL cod it was thought that weights-at-age derived from sampling during research bottom-trawl surveys might provide a more representative measure of weight-at-age at the beginning of the year. Based on a comparison of data from research surveys and the commercial fishery in Subdivision 3Ps (Lilly 1998b), it was decided that data from the research vessel survey were too variable at older ages and that it would be prudent to continue to use estimates from commercial fishery data until more representative data were available. The use of survey data for the 2J+3KL stock in recent years is further constrained by poor or nil representation for some of the older age groups caught in the inshore fisheries from the mid-1990s to the present. This is most apparent in Divisions 2J and 3K. Even with the above concerns, it may be desirable to use information from the bottom-trawl surveys to provide estimates for the younger ages, since commercial gears tend to select the larger individuals at these ages, but to date the modeling of seasonal growth required to adjust the autumn survey data to mid-year and January 1 estimates has not been attempted. It was decided that the commercial weights-at-age would continue to be used to estimate January 1 weights-at-age.

As noted by Lilly (1998a), there are several aspects of the commercial weight-at-age data (Table 8; Fig. 7) that require particular attention. (1) Constant values have been assumed in some of the early years. Weights at ages 2-20 are constant from 1962 to 1971 and weights at ages 19 and 20 are constant from 1972 to 1977. The value for age 20 jumps from 7.19 kg in the first period to 17.46 in the second. (2) Some values seem unusually high or low compared with adjacent values. The most notable instances are values for ages 8 and 9 in 1993, which seem much too high, and the value for age 12 in 1995, which is too low. It is assumed that these outliers arise from sampling error, often associated with small sample sizes, although there may be other reasons not yet discovered.

There are some missing values for age 2 and ages 10-20, especially since 1991. Values for age 2 are required for reconstruction of the population biomass and have been set at 0.26 kg, which is the average of non-missing values in the period 1974-1997. Values are required for some of the other missing ages as well, and for consistency have been supplied for all instances of missing values in the matrix. Where possible a missing value was assumed to equal the average of the values in the nearest two non-missing years preceding and two non-missing years following. Where values were not available for following years, values were assumed to be equal to the average of the nearest three preceding non-missing years. The exception to this was age 20 in 1990-1997, which was set equal to the value of the nearest four preceding years because the value for 1988 seemed low compared to the others. The high values at ages 8 and 9 in 1993 and the low value for age 12 in 1995 were replaced with values calculated with the above protocol. The resulting matrix is presented in Table 10.

Weights-at-age at the beginning of the year were calculated from the commercial weights-at-age using formulae in Rivard (1982, p. 14). For ages 3-20, weight-at-age at the beginning of year t ($\hat{W}_{i,t}$) was approximated by

$$\hat{W}_{i,t} = e^{(\ln W_{i-0.5,t-0.5} + \ln W_{i+0.5,t+0.5})/2}$$

For age 2, the $\hat{W}_{2,t}$ were approximated by the relationship

$$\hat{W}_{2,t} = e^{(2\ln W_{i+0.5,t+0.5} - \ln \hat{W}_{i+1,t+1})}$$

The resultant matrix is presented in Table 11.

3 Industry perspective

A perspective on several aspects of the 2000 sentinel survey and commercial index fishery is available from the responses to a questionnaire sent by the Fish, Food and Allied Workers Union (FFAW) to the Fish Harvester Committees representing the 55 sites where a sentinel survey was conducted by the FFAW in 2000 (Jarvis and Stead 2001).

In response to whether commercial catch rates in 2000 were low, average or high compared with historical results, 67% said low, 23% said average and 10% said high. All responses but one from southern Labrador to White Bay were “low”. “Low” responses also came from some areas on the Baie Verte Peninsula, two areas in eastern Notre Dame Bay, and several areas in the region from inner Trinity Bay to the southern Avalon Peninsula. “High” responses came from two sites in inner Bonavista Bay, two on the western side of Trinity Bay and one on the southern Avalon Peninsula.

In response to whether commercial catch rates were lower, the same or higher than during the 1999 commercial fishery, 67% said lower, 27% said they were the same, and 6% said higher. The "lower" responses came from most sites from southern Labrador to eastern 3K and all sites from inner Trinity Bay to the southeastern Avalon Peninsula.

In response to whether "signs" of small (up to 18 inches) fish were worse, the same or better than in 1999, 7% said worse, 25% said the same and 68% said better. In response to whether the overall condition of cod caught during 2000 was poor, average or good, 2% said poor, 25% said average and 73% said good. In 1999, 90% had said good.

The Fish Harvester Committees felt that warm water, inclement weather and restrictions imposed by the 2000 Conservation Harvesting Plan negatively affected catch rates in the index fishery.

4 Resource Status

4.1 Stock structure

Numerous studies have indicated the likelihood of substock structure within the northern cod complex (see Lear 1986 for an overview). For example, there was a north-south cline in size-at-age and spawning time, there was a change in vertebral counts at approximately the north slope of Grand Bank, and cod tagged at specific locations in the offshore in winter tended to migrate to specific but broad areas of the inshore for feeding and then returned to approximately the area of tagging in subsequent winters. It was also known that cod overwintered in various locations inshore and that some spawning occurred inshore.

The stock collapsed during the late 1980s and early 1990s, and by 1994 there seemed to be very few cod anywhere in the stock area. Beginning in 1995 the perception of stock size and distribution changed when a large aggregation of cod was located in Smith Sound (Trinity Bay). The sentinel surveys, which started that year, achieved good catch rates in much of the area from White Bay in central 3K southward to the boundary with 3Ps.

Recent interest has focussed on whether those cod currently inshore are distinct from cod currently offshore. As summarized in the assessment documents for 1999 and 2000 (Lilly *et al*. 1999, 2000b), several sources of information are consistent with the hypothesis that there are distinct inshore or bay stocks along the east coast of Newfoundland. The information includes the presence of cod inshore in the winter, the historic existence of spring fisheries in the inner reaches of Bonavista and Trinity bays before cod arrived at the headlands from the offshore, the occurrence of spawning within the bays, and the paucity of returns offshore from cod tagged inshore in the winter.

Tagging studies, conducted during the post-moratorium period while the overall stock size has been extremely low (Brattey *et al*. 2001), indicate that the inshore of 3KL is currently inhabited by at least two groups of cod: (1) a northern resident coastal group that inhabits an area from western Trinity Bay northward to western Notre Dame Bay and (2) a migrant group from inshore and offshore areas of 3Ps that moves into southern 3L and less commonly into northern 3L and 3K during late spring and summer and returns to 3Ps during the autumn. Only a small number of tagged cod from 3Ps were caught north of Trinity Bay. The tagging also indicates considerable movement of cod among Trinity, Bonavista and Notre Dame Bays. It is not known if there is currently movement between the inshore and the offshore in 2J3KL. No tags have been applied to cod in the offshore in recent years because no aggregations sufficiently large to warrant tagging have been located. In addition, there have been no reported offshore recaptures of cod tagged inshore, although it must be noted that there is no directed offshore cod fishery and the by-catch of cod from fisheries directed at other species is thought to be small relative to the cod-directed inshore catch.

There are two conflicting interpretations of genetic studies. One is that cod in the inshore and offshore are genetically distinct from one another; the other is that there is no differentiation among groups of 2J+3KL cod. These differences originate in part in methodology. The results of studies employing microsatellite loci are interpreted to support the existence of considerable sub-stock structure between the inshore and the offshore and within both the inshore and the offshore (Bentzen *et al*. 1996; Ruzzante *et al*. 1996, 1997, 1998, 1999, 2000; Taggart *et al*. 1998; Beacham *et al*. 1999, 2000). In contrast, the results of studies with mitochondrial DNA provide no evidence of substock structure within 2J3KL (Pepin and Carr 1993; Carr *et al*. 1995). The conflicting interpretations of stock structure are not just a consequence of the use of different methodologies. Carr and Crutcher (1998) state that "re-evaluation of (the) microsatellite data supports the conclusion of extremely limited genetic differentiation among populations in the Northwest Atlantic". Those who support the interpretation of considerable substock structure contend that the mitochondrial DNA approach lacks the ability to detect the structure that is there.

Neither interpretation of the genetic data would preclude the possibility that functional subpopulations exist without significant genetic differentiation or the possibility that inshore populations could colonize the offshore areas.

In light of the uncertainty about stock structure, in this assessment the stock status is assessed under two hypotheses regarding stock structure: a) the inshore constitutes a separate inshore subpopulation that is functionally separate from the offshore; and b) inshore and offshore fish together constitute a single functional population.

4.2 Population indices

4.2.1 Bottom-trawl surveys

4.2.1.1 Survey design

Research vessel surveys have been conducted by Canada during the autumn in Divisions 2J, 3K and 3L since 1977, 1978 and 1981 respectively. No survey was conducted in Division 3L in 1984, but the results of a summer (August-September) survey in 1984 have been used for some analyses. The 1995 autumn survey continued into late January 1996.

Spring surveys have been conducted by Canada in Division 3L during the years 1971-1982 and 1985-present.

The autumn surveys in Divisions 2J and 3K were conducted by RV *Gadus Atlantica* until 1994. In 1995-2000 they were conducted mainly by RV *Teleost*, although RV *Wilfred Templeman* surveyed part of Division 3K. Surveys in Division 3L were conducted by RV *A.T. Cameron* (1971-1982) and RV *Wilfred Templeman* or its sister ship RV *Alfred Needler* (1985-2000 for spring and 1983-2000 for autumn). In recent years, RV *Teleost* occupied some of the 3L stations, particularly those in deep water.

In the autumn 1995 survey both ships used for the first time the Campelen 1800 shrimp trawl with rockhopper footgear, replacing the Engel 145 Hi-rise trawl that had been used since the start of the surveys in 2J and 3K and since the change to the RV *Wilfred Templeman* in Division 3L. In addition, the Campelen trawl was towed at 3.0 knots for 15 min instead of 3.5 knots for 30 min. The selectivities of the two nets were found through comparative fishing experiments in 1995 and 1996 to be markedly different, with the Campelen being far more effective at catching small cod (Warren 1997; Warren *et al*. 1997). There were limited data for the comparison of larger cod. Conversion of Engel catches to Campelen equivalent catches is reported by Stansbury (1996, 1997).

The survey stratification scheme, illustrated in Fig. 8-10, is based on depth intervals intersected by lines of latitude and longitude (Doubleday 1981; Bishop 1994). The strata used in 1996 were similar to those in previous years except that the survey was extended to 1500 m and 25 new strata were added to the inshore in Divisions 3K and 3L to obtain an estimate of the cod landward of the standard survey area. The survey in 1997 was similar to that in 1996, except that some of the new inshore strata were modified and one stratum was added. The survey in 1998 was as in 1997. The survey in 1999 was as in 1997 and 1998 except that the new inshore strata were not fished. The survey in 2000 was again similar to the previous 5 years in the offshore, and the inshore strata in 3K and 3L were fished once again. A few strata in both 3K and 3L were either not fished or received only 1 set in 2000 because of vessel problems.

Prior to 1988, set allocation was proportional to stratum area, with the provision that each stratum be allocated at least 2 sets. In 1989 and 1990 an “adaptive design” was introduced in an attempt to minimize variance. It was found that this method introduced a bias and the additional sets fished during the second phase of these surveys have been excluded from analyses. In 1991-1994, additional sets were allocated in advance to certain strata based on past observed stratum variance (Gagnon 1991). In 1995-2000, set allocation was based once again on stratum area alone (with the provision that there be at least 2 sets in each stratum).

4.2.1.2 ***Autumn bottom-trawl surveys***

4.2.1.2.1 Autumn abundance and biomass

Abundance and biomass have been estimated by areal expansion of the stratified arithmetic mean catch per tow (Smith and Somerton 1981). To account for incomplete coverage of some strata in some years, estimates of biomass and abundance for non-sampled strata were obtained using a multiplicative model.

Estimates of abundance and biomass for the autumn surveys in 1978-1994 (Divisions 2J and 3K) and 1981-1994 (Division 3L) may be found in Tables 12-19 of Shelton *et al*. (1996). The data from 1983 to 1994 have been converted to Campelen equivalents and are presented in this paper along with the actual Campelen data from 1995-2000. Data for Division 2J are in Tables 12-15 and data for Division 3K are in Tables 16-19. Note that data for 1993-2000 are presented separately from earlier years for Divisions 2J and 3K because of the change in stratification scheme introduced in 1993 (Bishop 1994). Estimates for surveys in Division 3L in 1983-1987 are in Tables 16-18 of Lilly *et al*. (1999). Estimates for strata <= 200 fathoms in Division 3L in 1988-2000 are in Tables 20-21 of the present paper. Estimates for strata > 200 fathoms in Division 3L in 1990-2000 are in Table 22.

Because there have been changes over time in the depths fished, annual variability in the abundance and biomass of cod has been monitored for those strata that have been fished most consistently since the start of the surveys. These "index" strata are those in the depth range 100-500 m in Divisions 2J and 3K and 55-366 m (30-200 fathoms) in Division 3L. The inshore strata fished in 1996-1998 and 2000 are not included in the index. Because an index has also been calculated for the inshore strata, the former "index" will now be referred to in this paper as the "offshore index".

Changes in abundance and biomass in the offshore index strata are shown by Division for the years 1983-2000 in Fig. 11. The patterns in abundance and biomass differ in detail, reflecting changes in the relative abundance of small and large fish. Of note are the positive anomaly in 2J and 3K in 1986, the very large increase in 3K in 1989 and the rapid decline during the early 1990s. Abundance and biomass have remained at extremely low levels in all Divisions since 1993.

Abundance and biomass estimates for the new inshore strata in 1996-1998 and 2000 (Table 23) are less than estimated for the offshore but are relatively high given the much smaller area of the inshore strata. The total abundance and biomass of all strata fished in 1983-1998 are provided by Division and year in Table 24.

The abundance and biomass for offshore index strata, deep offshore strata and inshore strata are provided in Table 25 by Division and year for the 6 years since introduction of the Campelen trawl. Abundance in offshore index strata declined from 1995 to 1997 and increased from 1998 to 2000, with the largest increase in 1998-1999. Biomass in offshore index strata increased from 1995 to 1997, remained unchanged in 1998, nearly doubled in

1999 and increased a little in 2000. The biomass in offshore index strata in 2000 was about 30,000 t, which is about 2.5% of the average biomass of 1,200,000 t (in Campelen equivalents) in the period 1983-1988 (excluding the high value in 1986).

4.2.1.2.2 Autumn mean catch at age per tow

Offshore index strata

The divisional mean number caught at age per tow in offshore index strata during autumn surveys from 1979 (1981 in Division 3L) to 1994, and the mean number per tow for Divisions 2J, 3K and 3L combined, may be found in Tables 3-6 of Bishop *et al*. (1995b). The data from 1983 to 1994 have been converted to Campelen equivalents and are presented along with the actual Campelen data from 1995-2000 in Table 26 for Divisions 2J, 3K and 3L separately and for all three Divisions combined. Mean catch per tow has continued to be very low for each age in each Division during the past few years when compared with many years in the 1980s and early 1990s. An increase in the abundance index from 1998 to 1999 occurred in 3K and 3L but not in 2J. The index was up in all Divisions in 2000 compared with 1999, but was still far below levels seen prior to 1993.

The overall 2J3KL catch at age 1 in 2000 was similar to that in 1995, indicating that the 1999 year-class may be comparable to the 1994 year-class, which has been recognized as the strongest in the offshore since the early 1990s. The 1994 year-class was well represented in 2J and 3K, but not in 3L, whereas the 1999 year-class was weaker in 2J, of comparable strength in 3K, and stronger in 3L.

The weakness of recent year-classes is emphasized when mean catch at age per tow is plotted for the 1976-1999 year-classes at ages 1-3 (Fig. 12). For age 1, year-class strength declined from 1994 to 1996 and has since increased. The 1994 and 1999 year-classes at age 1 were relatively large compared with actual catches of earlier year-classes, but look very weak compared to previous year classes following conversion to Campelen equivalent numbers. At age 3 all year-classes from 1992 to 1997 look weak even when compared with unconverted catches of some of the year-classes from the early and late 1980s.

An index of spawner biomass in divisions 2J3KL combined in 1983-2000 was calculated from the mean catch per tow at age, the proportion mature at age (Section 4.3.2), and the commercial Jan. 1 weights-at-age (Section 2.2.5). (The latter two were moved back one age and one year to correspond to the timing of the autumn survey.) The index declined quickly after 1989 to reach a minimum in 1995 (Fig. 13). There was a slight increase during the late 1990s and no trend during the past few years. The index in 2000 stood at about 1.6% of the average index in the period 1983-1988 (excluding the high value in 1986).

Inshore strata

Inshore strata in 3K and 3L were fished in 1996-1998 and 2000. The mean catch at age per tow was calculated for 3K and 3L separately (Table 27) and for 3KL combined (Table 28). Each 3KL catch at age index is the mean of the divisional means, weighted by the divisional survey areas (where the area of inshore strata is 3,235 sq n miles in 3K and 3,107 sq n miles in 3L).

The inshore catch at age data are displayed in three ways in Fig. 14; as an index of abundance for ages 1-4 and 5+, as an index of biomass for ages 1-4 and 5+, and as an index of spawner biomass. The biomass index is the abundance index with commercial Jan. 1 weights-at-age applied, and the spawner biomass index is the biomass index with the proportions mature at age applied. The Jan. 1 weights-at-age and proportions mature at age were moved back one age and one year to correspond to the timing of the autumn survey. It was stated in the Stock Status Report (DFO 2001) that “the inshore biomass of fish age 1-4 has been increasing since 1997 but the biomass of older fish has been decreasing since 1996.” As illustrated in Fig. 14, the above statement is appropriate for abundance, not biomass. Inshore biomass of fish age 1-4 declined from 1996 to 1998 and increased in 2000. The same pattern was seen in older fish, except that the decline from 1996 to 1998 was proportionally greater and the increase in 2000 was proportionally less.

4.2.1.2.3 Autumn distribution (all ages combined)

The distribution of cod at the time of the autumn surveys has been illustrated in numbers per standard tow (Shelton *et al*. 1996; Murphy *et al*. 1997) and in weight (kg) per standard tow (Lilly 1994, 1995). The catch from each tow in the period 1983-1994 has been recalculated to Campelen equivalents, and plots of these recalculated catches for 1985-1994 are shown together with the actual catches in 1995-1998 in Lilly *et al*. (1999). The catches in 1987-1988 are presented in Fig. 15 of the present paper as an example of the relatively large catches that were obtained during the 1980s.

For the period 1981-1988 catches were widespread over the survey area. The first indication of the big changes to come occurred in 1988, when almost no fish were caught in the area of Harrison Bank in northwestern Division 2J. Commencing in 1989 the fish in Divisions 2J and 3K became increasingly concentrated toward the edge of the bank. By 1991, concentrations on Hamilton Bank and the plateau of Grand Bank disappeared, leaving fish in inner Hawke Saddle and in the saddles between Belle Isle Bank and Funk Island Bank and between Funk Island Bank and Grand Bank. In 1992, only the concentration between Funk Island Bank and Grand Bank remained. This concentration was smaller in 1993 and disappeared in 1994.

Catches in 1995-2000 are presented in Fig. 16 a-c. (Note the change in scale between Fig. 15 and Fig. 16.) During this period catches tended to be very small. On the southern Labrador Shelf and the Northeast Newfoundland Shelf the larger catches were broadly spread, with a tendency toward occurring off the banks. In Division 3L, catches tended to be small in 1995-1998, but somewhat larger and more broadly distributed in 1999 and 2000.

4.2.1.2.4 Autumn distribution (juveniles)

Previous work on the distribution of juvenile cod in Divisions 2J3KL has revealed that individuals of ages 0 and 1 were found mainly in shallow waters near the coast off southern Labrador and northeastern Newfoundland and on the northern Grand Bank, that individuals of ages 3 and 4 were mainly in those offshore areas occupied by older cod, and that individuals of age 2 were intermediate in distribution (Lilly 1992; Dalley and Anderson 1997; Anderson and Gregory 2000). Catches from autumn surveys in 1995-1998 revealed a similar pattern, with the notable exception that the 1994 year-class, which was the strongest year-class appearing in the surveys during the early to mid-1990s, was already well onto the shelf by age 1 (Lilly *et al*. 2000a). More recent year-classes have been extremely weak in Division 2J, but have been somewhat more abundant adjacent to the coast in Divisions 3K and 3L.

The distributions of cod of ages 0 to 5 in autumn 1999 were illustrated in Fig. 16 of Lilly *et al*. (2000b). The occurrence of cod of ages 0 and 1 off the northern tip of Newfoundland and in southwestern Division 3L has been a consistent feature of such plots. The occurrence of cod of ages 1-3 in the southern Funk Island Deep has been seen consistently since 1995, as has the appearance of cod of ages 2 or 3 to the east of Funk Island Bank. The relatively large catches on the Nose of the Bank were mainly of ages 2 and 3. Distribution at age in autumn 2000 was not available at the time of the assessment meeting.

4.2.1.3 Spring 3L bottom-trawl surveys

4.2.1.3.1 Spring 3L abundance and biomass

Abundance and biomass of cod in Division 3L in the spring have been estimated by areal expansion of the stratified arithmetic mean catch per tow. Estimates for the surveys from 1978 to 1995 may be found in Tables 20-21 of Shelton *et al*. (1996). The data from 1985 to 1995 have been converted to Campelen equivalents and are presented along with the actual Campelen data from 1996-1998 in Lilly *et al*. (2000b). The data from 1988 to 2000 for the index strata (depths <= 366 m or 200 fathoms) are provided in Tables 29-30 of the present document. The indices declined very rapidly from 1990 to 1994 and have remained very low in subsequent surveys (Fig. 17). Despite a small increase since the mid-1990s, the biomass index for 2000 was only 1.5% of the average in the period 1986-1989.

Fishing in waters deeper than 200 fathoms started on a regular basis in 1991 (Table 31). In some years, most notably 1992, a substantial biomass was estimated to lie in these deeper strata. There may have been a large biomass in the deeper water in 1991 as well, because several sources of information indicate that cod were unusually deep in the early 1990s and stratum 735 (201-300 f), which was estimated to contain 50,000 t in 1992, was not fished in 1991 because of ice cover. The percentage of the total estimated biomass found in depths greater than 200 f was as high as 92% in 1994, but was only 2% in 1999.

4.2.1.3.2 Spring 3L mean catch at age per tow

The mean number caught at age per tow in index strata during 3L spring surveys from 1985 to 2000 are presented in Table 32. The values from 1985 to 1995 are Campelen equivalents and those from 1996 onward are based on actual Campelen catches. Mean catch per tow declined precipitously in the early 1990s. There were increases in both 1999 and 2000, but values continue to be well below levels obtained prior to 1993.

Part of the increase in total catch per tow in 1999 and 2000 was due to the strength of the 1998 and 1999 year-classes, both of which were stronger at age 1 than the preceding 3 year-classes. In addition, catch per tow increased from 1999 to 2000 for each of the 1996 to 1998 year-classes, indicating either sampling variability or immigration into the 3L survey area. On the other hand, catch per tow of fish older than age 6 declined from 1999 to 2000.

4.2.1.3.3 Spring distribution

The distribution of cod during spring surveys in Division 3L is shown together with distribution in Divisions 3NO for the years 1984-1995 in Fig. 18. Because the catches became very small by the mid-1990s, the catches for 1992-1999 (Fig. 19) are displayed with a finer scale.

During the second half of the 1980s the spring distribution in Division 3L was similar to that observed during the autumn, in that the highest densities were generally on the plateau of the bank and along the northern and northeastern slopes of the bank. However, there were in some years moderately large catches in the area between the northern slope and the plateau, a situation much less evident in the autumn. The spring of 1990 was unusual, in that few cod were taken on the plateau but very large catches were taken along the full length of the northeastern slope. Much of the northeastern slope could not be surveyed in 1991 because of ice cover, but catches seemed to be smaller. Catches continued to decline until 1995 when very few cod were caught. Catch rates increased with the introduction of the Campelen trawl in 1996, but have remained far below the levels in the 1980s. Starting in 1996 the cod in 3NO appeared to be further onto the bank at the time of the surveys than they were in the early 1990s. In 1999 there was a hint, for the first time in many years, of a continuous distribution of cod from the southwestern part of 3O across the 3L/3NO boundary into the area of the Virgin Rocks. In 2000 cod were caught from the southernmost part of the Northeast Newfoundland Shelf in northern 3L along the northeastern slope of Grand Bank and on the Nose of the Bank (Fig. 20). Small catches were also taken on the plateau of the bank and in the Avalon Channel.

4.2.1.4 Southern Northeast Newfoundland Shelf and Nose of Grand Bank

There are indications from several sources of a recent increase in cod density on the southern Northeast Newfoundland Shelf and along the northeastern slope of Grand Bank onto the Nose of Grand Bank. For example, several acoustic studies since May 1999 have reported aggregations of cod in this area (see Section 4.2.2.1). In addition, NAFO inspection reports of commercial vessels targeting Greenland halibut in deep water on the Nose of Grand Bank during April 2000 record the presence of small catches of cod, the first time this was noted since the early 1990s.

Plots of the distribution of cod during spring and autumn bottom-trawl surveys in southeastern 3K and eastern 3L in 1995-2000 (Fig. 21 a-c) reveal spotty catches throughout the period, and an increase starting at least as early as autumn 1999.

4.2.2 Acoustic surveys and observations

4.2.2.1 Offshore

Acoustic studies were conducted in Hawke Channel in 2J in June 1994-1996 and 1998-2000. The biomass decreased by half from 1994 to 1995, decreased further in 1996 (Anderson and Rose 2000), and has since remained rather stable at this lower level (G. Rose, Memorial University of Newfoundland, St. John's, pers. comm.).

As discussed in Section 4.2.1.4, there are indications from several sources of a recent increase in cod density on the southern end of the Northeast Newfoundland Shelf, particularly toward the shelf break. During an acoustic study of capelin in May 2000, small cod marks were common throughout the deep water to the north of Grand Bank and marks of larger cod were seen near the bays and in one larger concentration on the shelf break between 49º 00' N and 49º 15' N (F. Mowbray, DFO, St. John's, pers. comm.). Cod densities as indicated from acoustic records were greater than those observed in May 1999. A cod-directed acoustic study by G. Rose (Memorial University of Newfoundland, St. John's, pers. comm.) in June 2000 located at least one concentration of cod in this general area, and a study in January 2001located relatively high cod densities in deeper waters seaward of the location where cod were found the previous June.

4.2.2.2 Inshore (Smith Sound)

Acoustic studies have been conducted in Smith Sound in western Trinity Bay at various times since spring 1995. The quantity of cod detected in the Sound at any specific time will depend not only on population size but also on where the cod are in their annual cycle of movements. Fish overwinter in deep water in the Sound and some of them spawn there in the spring. Most of them move into shallow water and northward along the coast from late spring to early autumn. They then return to the Sound in late autumn or early winter.

Estimates of the biomass of cod within Smith Sound have varied considerably. Acoustic surveys by Rose (2000) provided biomass estimates of 13,000 t in May 1995, 14,000 t in June 1998, 15,000 t in January 1999 and 1,000 t in June 1999. Two acoustic surveys in January 2000 provided an average biomass of about 22,000 t. Other winter/spring biomass estimates for Smith Sound have been as low as 150 t in April 1996 and as high as 21,000 t in April 1997 (Brattey and Porter 1997; Porter *et al*. 1998; Wheeler 2000). The quantity of cod detected in Smith Sound during autumn surveys was low in 1996 and 1997 but substantially higher in 1999 (Anderson *et al*. 1998; Wheeler 2000). Much of the variability among these estimates can be attributed to the seasonal migration described above, but it is also possible that some of the fish move into and out of the Sound on a short-term basis during the winter/spring, and that there is annual variability in the timing and extent of the seasonal migration. Some of the variability is also attributable to differences in acoustic gear and the method of data analysis.

If one focuses on recent acoustic surveys in January, the average index of biomass has increased rapidly from about 15,000 t in 1999 to about 22,000 t in 2000 (Rose 2000) and to about 31,000 t in 2001 (G. Rose, Memorial University of Newfoundland, St. John's, pers. comm.). Sampling by bottom-trawl showed that the 1995, 1996 and 1997 year-classes formed a substantial portion of the fish in Smith Sound over the past few years and that the 1990 and 1992 year-classes continue to be present in relatively large numbers.

It is not clear at the time of writing whether the 110% increase in the biomass estimates from 1999 to 2001 is due entirely to population growth. There may also have been some immigration or some among-year variability in the proportion of the population available to the surveys.

The presence of older fish in Smith Sound may be an indication of better survival rates in this area than in those areas covered by the research bottom-trawl surveys.

4.2.3 Beach seine surveys

A broadscale beach seine survey of demersal 0-group and 1-group cod was conducted in divisions 3KL during 1992-1997 (Methven *et al*. 1998). Results of surveys on a much smaller spatial scale in Newman Sound (Bonavista Bay, 3K) in 1995-1996 and 1998 were consistent with the broadscale survey (Gregory *et al*. 1999, 2000). The Newman Sound studies continued in 1999 and 2000. A combination of the two series indicated that the 1997-1999 year-classes should rank comparatively high relative to other year-classes in the mid- to late 1990s, especially the 1995 and 1996 year-classes (Gregory *et al*. 2000). The 2000 year-class was weak at age 0 (R.S. Gregory, DFO, St. John's, NF, pers. comm.). The Newman Sound data were entered into the recruitment model for the first time during the present assessment.

4.2.4 Sentinel surveys

Sentinel surveys for cod were conducted by fishing enterprises operating from many communities (Fig. 1d) in Divisions 2J, 3K and 3L at various times during summer and autumn 1995-2000. The primary goal of these surveys was to obtain information on catch rates on traditional inshore fishing grounds during the moratorium. The surveys have been conducted primarily with gillnets. Linetrawls have been used extensively in only a few areas. Handlines and cod traps have been used much less.

The sentinel surveys were also intended to provide samples that would yield information on various aspects of the biology of cod in the inshore, including age compositions, size-at-age, condition, maturity and feeding. Various analyses are available for data collected in

1995-1997 (Lilly 1997; Lilly *et al*. 1998a), but these have not been updated. However, age compositions for the full time period are now available in the form of standardized catch rates at age (see Section 4.2.4.2).

4.2.4.1 Sentinel site-by-site descriptions

Maddock Parsons *et al*. (2000) provided weekly average catch rates by sentinel survey site, gear and year (1995-1999). There is considerable among-site variability in the timing of the fishing and in the seasonal and annual patterns in fishing success.

Maddock Parsons *et al*. (2001) presented weekly average catch rates and annual relative length frequencies (number of fish at length divided by amount of gear) by NAFO division, gear and year. With few exceptions, average catch rates were lower in 2000 than in 1999 in all gears fished. Catches in 2J have remained very low since 1995 with only the 3¼ inch gillnets showing catches comparable to those in other areas. In 3K, catches from gillnet, linetrawl and handline declined in 2000. In 3L, linetrawl catches in 2000 were similar to those in 1999, but catch rates in 5½ inch gillnets were down. Catch rates in small mesh (3¼ inch) gillnets were up in 2000 compared to 1999.

4.2.4.2 Sentinel standardized CPUE

An age-disaggregated index of standardized relative abundance for cod in the inshore of 2J3KL was calculated from data gathered from sentinel fishing with gillnets and linetrawls (Stansbury *et al*. 2000). The catch from 2J3KL was divided into cells defined by gear type (gillnet 5½ inch, gillnet 3¼ inch and linetrawl), NAFO Division (2J, 3K, 3L), statistical unit area (e.g. 3Ki, 3Lh), year (1995-2000) and quarter. Age-length keys were generated for each cell using fish sampled from both fixed and experimental survey methods. There were no fixed sites using 3¼ inch gillnets. Length frequencies and age-length keys are combined within cells. Numbers of fish at length were assigned ages using an age-length key. Because there were little or no discards in the sentinel fishery and the fish harvesters measured the length of all of the fish for linetrawl and gillnet sets, obtaining catch numbers-at-age was relatively straight forward (see Stansbury *et al*. (2000) for details).

The catch per unit effort (CPUE) at age data were standardised to remove site and seasonal effects. For gillnets, only sets fished during July to November with a soak time between 18 and 24 hours were included in the analysis. For linetrawl, sets fished during August to November with a soak time less than or equal to 12 hours were selected. Sets with effort and no catch for some or all ages were considered valid entries in the model. Ages in the model ranged from 3 to 10 for 5½ inch gillnet, 2 to 10 for 3¼ inch gillnet and 3 to 9 for linetrawl. Fish older than age 10 were not included because of their rarity. Application of the various criteria listed above resulted in the elimination of as much as 40% of the data.

A generalized linear model (McCullagh and Nelder 1989) was applied to the catch and effort data for each gear and survey method. The response distribution was specified as Poisson and the link function was chosen to be log. That is, the Poisson mean parameter μ_i is related to the linear predictor by

$$\log(\mu_i) = X_i'\beta$$

where X_i is a vector of explanatory factors for catch observation *i* (i.e. month, site, age and year) and β is a vector of coefficients to be estimated from the data.

Thus catch is assumed to have a Poisson probability distribution with the mean μ_i related to the factors month nested within site and age nested within year by

$$\log(\mu_{jklm}) = \log(E) + \beta_{jk} + \beta_{lm}$$

where E is an offset parameter for fishing effort and j, k, l, m indicate the level for each of the four factors, for example June for the factor *month*, and where

$$month_i(j) = \begin{cases} 1 \text{ if month}=j \\ 0 \text{ if month}\neq j \end{cases}.$$

Site/month combinations where no fish were landed in all years where deleted from the analysis. The model was fit using the SAS procedure GENMOD. Amount of gear is expressed as number of nets for gillnet and number of hooks for line trawl. Estimates for age nested in year were adjusted for month nested in site effects and transformed to a linear scale to give the relative index at age for each year.

Additional information regarding the models (proportion of available data that was actually included, model output and residual plots) are not presented this year, but they are similar to the findings of the 1995-1999 analyses, which are described in detail by Stansbury *et al.* (2000).

Gillnet catch rates increased from 1995 to 1998 but declined from 1998 to 1999 and decreased further in 2000 (Fig. 22). Linetrawl catch rates showed relatively little change from 1995 to 1996, increased in 1997, and declined again in 1998, 1999 and 2000.

Catch rates at age (Fig. 23) decreased in 2000, especially at ages 5 to 7. The catch rate at age 4 by 3¼ inch gillnets in the last 3 years has been less than half compared to the level in 1996 and 1997. Inspection of catch rates at age from all 6 years revealed that the 1990 and 1992 year-classes were relatively strong and that all subsequent year-classes are weaker. The pattern in age-aggregated gillnet catch rates is consistent with the 1990 and 1992 year-classes entering and then passing through the fishery and being replaced by the weaker year-classes. It is also possible that the decline from 1998 to 2000 could be attributed in part to decreased availability of fish to the gear, such as might occur if the fish were distributed over a greater range of depths.

4.2.5 Commercial fishery CPUE

Catch rates were calculated from catch and effort data recorded in logbooks maintained by the <35 foot sector participants in the index fisheries in 1998 and 2000 and the commercial fishery in 1999. Only catch rates from gillnet fisheries were examined in detail because the effort with other gears was relatively small and less representative in space. Median gillnet catch rates were calculated by statistical section (Fig. 1c) for each of the three years (Fig. 24). The spatial pattern since fishing re-commenced in 1998 has been similar among years. Catch rates were very low north of White Bay, increasing from White Bay to eastern Notre Dame Bay, generally highest from northern Bonavista Bay to western Trinity Bay, lower from eastern Trinity Bay to the eastern Avalon Peninsula and increasing again on the southern Avalon Peninsula. Over the three-year period (1998-2000) catch rates remained relatively stable in Bonavista and Trinity bays but declined in southern 3K and especially on the eastern and southern Avalon Peninsula.

The catch and effort data were standardized by using a generalized linear model to remove spatial (unit area, Fig. 1b) and seasonal (month) effects to produce annual estimates of average catch rates for 3K and 3L combined. The data were aggregated (summed) by week and site within month and unit area for both the catch and the amount of gear used (i.e. number of nets). The model approach used was very similar to that applied to the sentinel data.

Gillnet catch rates declined from 1998 to 1999 to 2000 (Fig. 25). Data were insufficient to fit the same model for linetrawl.

4.3 Population Biology

4.3.1 Autumn size-at-age and condition

4.3.1.1 Size-at-age

The lengths-at-age and weights-at-age of cod sampled during the autumn surveys confirm the general pattern of a decline in the 1980s and early 1990s as observed in commercial weights-at-age (Fig. 7). The research survey data (Tables 33, 34; Figs. 26, 27) illustrate that the changes varied with Division; there was a strong decline in Division 2J, a lesser decline in Division 3K, and little or no decline in Division 3L. These Divisional differences are more apparent in Fig. 28, which focuses on changes in mean lengths and weights of cod of ages 4 and 6. Superimposed on the long-term decline are periods of relatively quicker or slower growth associated with changes in water temperature (Shelton *et al.*1999). The trend toward low mean lengths-at-age and weights-at-age in the early 1990s appears to have been reversed during the latter half of the 1990s. However, size-at-age declined again at some ages, particularly in 3L, from 1999 to 2000. Sample sizes at ages greater than age 4 have been very small since about 1992-1994 (Lilly 1998a), so the accuracy of these estimates is likely to be poor.

4.3.1.2 Condition

Condition can be expressed in various formulations. In this paper it is presented as W/L^3, where W is either the gutted weight of the fish or the liver weight, and L is the length. Arithmetic means by Division, year and age are presented for gutted condition (Table 35; Fig. 29) and liver index (Table 36: Fig. 30).

In Division 2J, both gutted condition and liver index declined in the early 1990s. During the second half of the 1990s gutted condition returned to approximately normal, whereas the liver index improved but did not fully recover. There is evidence of a decline in condition, particularly in the liver index, in 2000.

In Division 3K, gutted condition declined during the early 1990s and improved during the latter half of the 1990s. Liver index changed little during the 1990s. As in Division 2J, there is evidence of a decline in condition, particularly in the liver index, in 2000.

In Division 3L, gutted condition has remained relatively unchanged over time whereas liver index increased considerably in the early 1990s and has since declined to an intermediate level.

The cause of the decline in condition in 2J and 3K in 2000 has not yet been sought. Historic trends in condition indices are complex and poorly understood (Lilly 1996, 1997).

4.3.2 Maturity at age

The observed proportions mature at age for female cod in divisions 2J3KL combined from 1982 to 2001 based on sampling conducted during autumn bottom-trawl surveys in 1981 to 2000 are shown in Table 37. Also provided are parameters for a probit model fitted with a logit-link function, as well as estimated age at 50% maturity (A50) and upper and lower 95% confidence intervals. A time series of estimated proportions mature at age for females is provided in Table 38 and illustrated for ages 4-6 in Fig. 31. The proportion mature at age increased among young females during the early 1990s and has fluctuated since. For example, the proportion of age 6 cod that are mature increased from about 40% in the 1980s to 70% or more in recent years.

The model estimates for A50 for females (Fig. 32) were a little above age 6 through most of the 1980s, declined from the late 1980s until the mid-1990s to about age 5, and varied considerably during the past few years.

Age at 50% maturity has also been calculated for females by year-class (Fig. 33). A decline in 50% maturity occurred between the year-classes of the mid-1980s and those of the late 1980s. Year-classes born in the 1990s tended to mature about one year earlier than those born prior to the mid-1980s.

Males generally mature about one year younger than females and show a similar trend over time.

4.4 Population Analysis

An attempt to combine catch data and various indices in a sequential population analysis for the whole stock was attempted but was unsuccessful because of the change in the proportion of the stock covered by the survey and the change in the survey gear. Therefore, there is currently no synthesis that can provide an estimate of the size of the 2J+3KL cod stock as a whole. However, a number of analyses of the available data were carried out under both stock hypotheses to determine stock status.

4.4.1 Inshore harvest rates and biomass

Estimates of the biomass of exploitable fish in the inshore were derived from tagging studies in conjunction with reported catches.

4.4.1.1 Harvest rates

A new series of tagging studies in inshore areas of 2J3KL and in 3Ps was initiated in 1997. Since then a total of 50,000 fish have been tagged. Of the 2553 fish tagged in 3K and 3L in the early part of year 2000, 6.3% have been recovered suggesting a harvest rate for the tagged population of at least this amount (Brattey *et al*. 2001). In practice however not all fish survive tagging, some tags fall off the fish particularly in the first year, and not all recaptured tagged fish are reported. Accounting for these effects leads to a higher estimate of harvest rate of 11.2%. However, harvest rates clearly vary between fish tagged in different areas; for example, in 1999 harvest rates were particularly high (43%) on fish tagged in 3K compared to northern 3L (13.2%) and southern 3L (23.6%). Results for 2000 give harvest rates of 10.3% for fish tagged in 3K, 10.7% in northern 3L (Trinity and Bonavista Bays), and 22% in southern 3L.

The above values are estimates of the rate at which tagged fish were harvested but the harvesting may occur in an area different from where the fish were tagged. For example more fish tagged in southern 3L were harvested in 3Ps than in 3L. This makes it difficult to use these rates to convert local catches to estimates of local fishable biomass.

It is possible to estimate local harvest rates (except for southern 3L) using more detailed models. Harvest rates from these models are broadly similar to those given above. Two different models were examined.

4.4.1.2 Model 1

A relatively simple model included a treatment of migration but did not incorporate some practical problems such as fish growth and gear selectivity (Pope and Brattey 2001). The exploitable biomass of cod in northern 3L and in 3K from 1998 to 2000 is estimated to have been of the order of 40,000 t. The majority of this estimated biomass (about 30,000 t) was in Bonavista Bay and Trinity Bay.

4.4.1.3 Model 2

A more detailed model considered gear selection, fish growth, and within season harvest but not migration. The model is similar to the one used in the 2000 northern cod assessment (Cadigan and Brattey, 2000); that is, exploitation was estimated separately for three regions in 3KL (3K, northern 3L, southern 3L; see Table 39). However, there were two modifications. The first modification involved how the fishery removals of tagged fish were accounted for, and the second modification involved how weekly exploitation rates were estimated.

In Cadigan and Brattey (2000) the size of the tagged population available to the fishery each week (M_t) was estimated using $M_t = \xi_t e^{-m(t-t_x)} M$, where M is the number of tagged fish released. In this model $e^{-m(t-t_x)}$ is the fraction of M that survived natural mortality between release week t_x and recapture week t, and ξ_t is the estimated cumulative fraction that survived fishing mortality. $\xi_t = \prod_{j=t_x}^{t-1} (1-\mu_j)$ was estimated using the tagging model estimates of weekly exploitation rates, μ_t ($t=t_x,...,t-1$), and these were based only on returns from the same region of release (i.e. 3K, etc). Cadigan and Brattey (2000) also adjusted M_t for tag loss, and the adjustment depended on the number of tags (single or double). The size of the tagged population available to the fishery was estimated for each tagging experiment, for each release length class, and for the four different types of tags that are returned. The different tag types and the specific models that are appropriate for these tag types are described in Cadigan and Brattey (1999, 2000).

The formulation of the model we use for the size of the tagged population each week (*t*) in the present analysis is

$$M_t = M_{t-1} e^{-m} - R_{t-1} / \lambda,$$

where R_{t-1} is the number of tagged fish captured and reported by the fishery at time *t-1*, and λ is the reporting rate. This model can be used recursively to express M_t in terms of the number of tagged fish released, *M*, similar to the approach in Cadigan and Brattey (2000). For simple models it is possible to show that exploitation rates estimated using this model are identical to those estimated using the methods in Cadigan and Brattey (2000). This model was run for each tagging experiment, for each release length class, and for the different tag types.

One advantage of the current formulation is computational, because the size of the tagged population available to the fishery is estimated directly from the data, whereas Cadigan and Brattey (2000) estimated M_t and μ_t simultaneously. Another advantage is that the new model suggests an easy method to improve the analysis, which is to remove the tagged catch at time *t-1* from all regions, and not just those fish that were caught in the same area of release. This is a better approach for estimating the size of the tagged population available to the fishery; however, there are still problems with this approach in that the migration of part of the tagged population outside the region of release is still not fully accounted for. Only those fish that are caught outside of the release region are removed from the size of the tagged population. This is an improvement over Cadigan and Brattey (2000) who did not adjust the size of the tagged population for any fishing mortality that occurred outside of the release region; however, further adjustments are still necessary to produce absolute estimates of exploitation rates and stock size. The current approach still only provides a lower bound on exploitation rates.

The second modification was to use some smoothing when estimating the fully recruited exploitation rates each week and for each gear type. The kernel smoothing method was used to estimate exploitation rates. The smoothing neighbourhood gave 95% weight to ± 2 weeks. The smoothing was done separately for each gear type.

Another change was that temporal variability in reporting rates was investigated. The results suggested that reporting rates are not significantly different in each region except northern 3L, where reporting rates in 2000 appear low relative to 1999. The reporting rate estimates are presented in Table 39. Note that the reporting rate estimates for regions outside of 3KL are required to adjust and remove tag catches outside of 3KL.

Tag loss was assumed to be the same in all regions. This is reasonable because the mechanisms contributing to tag loss do not seem location dependent. The Kirkwood model for tag loss was used (see Cadigan and Brattey 2000). The estimated tag retention rate is plotted in Fig. 34. The vertical line marks the time it takes for 5% of tagged fish to loose their tag, which is 18 weeks.

The model was run twice. The first run used annual estimates of reporting rates for all regions. The second run used annual estimates of reporting rates for the northern part of 3L, and constant estimates across years for the other regions. There was little reason to prefer either run so, since the second run was more similar to the formulation used in the last assessment of this stock, it was decided that this would be the analysis to report.

The model output is similar in format to that presented in Cadigan and Brattey (2000). To save space we do not report on all of the model results. The gear selectivity estimates were similar to those in Cadigan and Brattey (2000). Estimates of the fully recruited (over lengths) exploitation rates for each gear type are presented in Fig. 35, 36. The units are in %. The estimates are combined with estimates of the length selectivity for the various gears to estimate weekly exploitation rates at length. The estimates are combined with information on the length composition of the commercial landings to produce estimates of weekly total biomass at length, which can be summed over lengths to produce estimates of weekly biomass and weekly total exploitation rates (catch weight divided by population biomass). The results are shown in Figure 37. The weeks are numbered from the beginning of the year. Note that estimates are shown only for those weeks in which at least 25 tonnes of cod were landed in each region. Total exploitation was taken to be total catch weight for fish of lengths 40 cm and greater, divided by average weekly estimated population biomass for the same range of lengths. The average is based on weeks with at least 50 tonnes of fish landed by the commercial fishery. Year 2000 average weekly biomass in 3K is 42,000 tonnes and in northern 3L is 35,000 tonnes. The estimates of total exploitation in 2000 were 3.4% and 8% for 3K and northern 3L.

Note: Subsequent to the stock assessment, it was noted that 535 tags (of a single tag type but accumulated across various areas and years) had not been included in the analysis. When these data were added, the estimate of exploitation rate for 3K increased to 3.8% and the upper limit estimated for exploitable biomass decreased to 37,000 t. For northern 3L, the exploitation rate increased to 10% and the upper limit estimated for exploitable biomass decreased to 27,000 t. The effect of these additional tags on the estimates from the simple migration model (Model 1) have not been determined.

4.4.1.4 Summary of model estimates of biomass

The results of the two models are broadly similar for northern 3L. The estimate from Model 1 is about 30,000 t and the upper limit estimated from Model 2 is 35,000 t. However, there is a considerable difference for 3K, where the estimate from Model 1 is 10,000 t and the upper limit estimated from Model 2 is 42,000 t. The extent to which this difference in estimates for 3K might be attributable to the absence of tagging in 3K in 2000 prior to the beginning of the fishery is not known. As noted above, no concentrations of fish suitable for tagging were located in 3K prior to the fishery.

It was not possible to estimate a biomass for southern 3L fish because tagging results indicated that many of the fish currently caught in the southern 3L area are seasonal migrants from 3Ps.

4.4.2 Autumn total mortality (Z)

Total mortality rates at age in each year, $Z_{a,y}$ were estimated from catch rate at age per tow during the autumn research bottom-trawl surveys in 2J3KL (combined) by applying the following equation:

$$Z_{a,y} = \ln(RV_{a,y} / RV_{a+1,y+1})$$

where ages (a) = 1 to 14 and years (y) = 1983 to 1999.

The estimates for ages 1-14 are illustrated in Fig. 38, and those for ages 4 and 6 are isolated for additional clarity in Fig. 39. In general, the estimates increased up until 1992, coinciding with the beginning of the moratorium. The rates then declined until 1995, and since then have remained at levels similar to those observed in the late-1980s when there was a substantial fishery. The decline in the survey index estimates for cohorts after they reach age 2 is indicative of high levels of mortality, given what is known about the selectivity of the gear and the distribution of young fish. The reason for mortality levels in excess of the commonly assumed natural mortality rate of 0.2 is not understood.

The presence of older fish in the bottom-trawl tows conducted in conjunction with the acoustic studies in Smith Sound and in the catches of the sentinel surveys and the index fishery may indicate that mortality in some areas of the inshore has been less than in the offshore.

4.4.3 Recruitment index

The recruitment index introduced in 2000 (Shelton and Stansbury 2000) was updated with data collected in 2000 and the addition of a new index. The following studies were used to derive the index in 2000: experimental squid traps; experimental fixed-station bottom-trawling (FS BT) with a Campelen trawl, both inshore and offshore; beach seining from White Bay to St. Mary's Bay (Fleming survey); pelagic 0-group monitoring with an IYGPT trawl, both inshore and offshore; sentinel survey linetrawl (LT); sentinel survey 5.5 inch gillnet (GN 5.5); sentinel survey 3.25 inch gillnet (GN 3.25); and stratified-random bottom-trawl (SR BT) monitoring with a Campelen trawl, both inshore and offshore. The index added for the first time was derived from the beach seining in Newman Sound, Bonavista Bay (BB) (see Section 4.2.3). For each source of information, catch rates were available for one or more ages of juvenile cod in the age range 0-3 (as appropriate for the gear and area). The years during which each series was operational and the ages of cod caught and considered during this analysis are provided in the following text table.

Data source	Cod ages	Years
Squid trap	0-3	1991-1994
FS BT inshore	0-3	1992-1995
FS BT offshore	0-3	1992-1995
Beach seine Fleming	0-2	1992-1997
Beach seine BB	0-1	1995-96, 1998-2000
IYGPT inshore	0	1994-1999
IYGPT offshore	0	1994-1999
Sentinel LT	3	1995-2000
Sentinel GN 5.5	3	1995-2000
Sentinel GN 3.25	2-3	1996-2000
SR BT inshore	1-3	1996-98, 2000
SR BT offshore	0-3	1995-2000

The total number of surveys considered in the analysis was 12 and the number of survey/age indices was 30. The squid trap data are from experimental studies during the Northern Cod Science Program (E. Dalley and E. Dawe, DFO, SOE Branch, Newfoundland Region, pers. comm.); the fixed station bottom-trawl data, both inshore and offshore, are from Dalley and Anderson (1997); the broad-scale beach seine data (Fleming survey) are from Methven *et al*. (1998); the beach seine data from Newman Sound are from Gregory *et al*. (2001); the IYGPT trawl data are from Dalley *et al*. (2000); the sentinel data are from Stansbury *et al*. (2000) and updated in Section 4.2.4.2 of the present paper; and the stratified-random bottom-trawl data, both offshore and inshore, are from Section 4.2.1.2.2 of the present paper.

An iterative reweighting multiplicative model was fitted to the survey at age indices to remove survey and age effects and thereby reveal the signal of year-class strength:

$$I_{say} = q_{s,a} N_{o,y} ,$$

where I_{say} is the index for survey s at age a in year y, q is the catchability parameter for the survey index at age, and N_0 is the year-class effect. The weighting factor is the reciprocal of the variance for each survey age index. To prevent one index from capturing all the weight, indices were ranked by their variances and the top 1/3 of the indices were assigned the variance of lowest index in the top third. All other index weightings were $1/\text{variance}_{sa}$. The weighting values were also standardized for each iteration to sum to 10. The values of 1/3 for a cut off and the sum of the weights equal to 10 are arbitrary. The recruitment data from inshore and offshore were treated together because the inshore appears to be an important nursery area for cod spawning in both the inshore and the offshore (Lilly *et al*. 2000a). These data were combined to produce a single index of relative year-class strength (Fig. 40).

The 1998 to 2000 year-classes are higher than earlier year-classes in the time series. Their present strength is known only imprecisely and their ultimate strength is yet to be determined.

It should be noted that strength of all of these year-classes is much lower than the strength of those that occurred during the 1980s. Moreover, the ability of the index to predict recruitment to the fishable population remains uncertain, particularly because it does not pick up the 1992 year-class, which was relatively strong in sentinel and commercial catches.

4.4.4 Spawner biomass levels and recruitment

Under the precautionary approach it is desirable to establish spawner biomass reference levels that trigger specific management actions to ensure sustainability and to conserve the population. One of these levels is a lower limit to spawner biomass (B_{lim}) below which there is considerable concern about the viability of the stock. Spawner biomass reference levels have yet to be established for 2J+3KL cod. In this section a preliminary reference level is described under the hypothesis of a single functional population comprising both the inshore and the offshore.

The unaccounted for decline in the 1986 and 1987 year-classes has precluded an acceptable sequential population analysis of northern cod since the 1992 assessment (Baird *et al*. 1992a; Shelton and Lilly 2000). That assessment carried out the last population projection and $F_{0.1}$ TAC calculation, despite rising concern regarding the residual pattern caused by the disappearance of the 1986 and 1987 year-classes (Bishop and Shelton 1997). The estimates of spawner biomass and recruitment from the 1992 assessment provide useful insights for considering spawner biomass reference levels for 2J+3KL cod.

Although there was a substantial decline in spawner biomass (males and females aged 7+) in this stock from over 1.5 million tons in 1962 to a level of less than 200,000 t by the time of extension of jurisdiction in 1977 (Fig 41), several strong year-classes arose during the 1980s at spawner biomass levels above 200,000 t. These year classes led to a partial recovery of the spawner biomass. There has been no good recruitment at spawning stock biomass levels below 200,000 t and only a few reasonably strong year-classes at spawner biomass levels below 400,000 t (Fig. 42). Although it is difficult to define a B_{lim} at this stage, it would clearly be desirable to have the spawning stock above 200,000 t in the shortest possible time and ultimately above 400,000 t. It is generally accepted that an approach of no directed fishing is consistent with the precautionary approach for a stock that is below B_{lim}. Any fishery on the remnant in the inshore will delay recovery of the stock.

5 Other considerations

5.1 Temperature and other physical oceanography

In general, the below normal oceanographic trends in temperature and salinity, established in the late 1980s, reached a peak in 1991 (Colbourne 2000). This cold trend continued into 1993 but started to moderate during 1994 and 1995. During 1996-1999, ocean temperatures continued above normal over most areas.

There is some evidence that, in general, relatively warm temperatures are favourable for stocks toward the northern end of a species' range (e.g. Planque and Frédou 1999). However, there were no new analyses to determine whether the recent increase in temperature has affected recruitment, growth, mortality or distribution of 2J+3KL cod.

5.2 Predators

A wide variety of predators are known to consume cod, mainly during the cod's juvenile stages (Pálsson 1994; Bundy *et al*. 2000). Cannibalism is well documented for 2J+3KL cod and is thought to be an important source of mortality in other cod stocks (Bogstad *et al*. 1994). However, the predator that has attracted the most interest and concern in recent years is the harp seal.

5.2.1 Quantity of cod consumed by harp seals

The quantity of cod consumed by harp seals during the period 1965-2000 was calculated using estimates of harp seal population numbers, energy requirements of individual seals, the average duration of seal occurrence within 2J3KL, the relative distribution of seals between inshore and offshore, and stomach contents of seals sampled in the inshore and offshore in winter and summer (Stenson and Perry 2001). An average diet was calculated for each of the four combinations of area (inshore and offshore) and season (winter and summer) using all stomach content data collected in 2J3KL during the years 1982 and 1986-1998. Stomachs collected since 1998 have not yet been analyzed. Uncertainty in the estimates of numbers at age, diets, residency time in 2J3KL and the proportion of seals in nearshore areas, were used to evaluate the possible range in consumption estimates. The only factor effecting annual changes in the estimates of prey consumption is the estimate of seal population numbers. Recent estimates of harp seal population size show that the population reached about 5 million in 1996 and has been fairly stable since.

Based on the average diets, it is calculated that harp seals consumed 37,000 t of cod in 2000 (with a 95% confidence interval of 14,000 – 62,000 t). The estimate for 1998 is also about 37,000 t. This is less than previous estimates of consumption for that year (50,000 t estimated in 1999 and 108,000 t estimated in 1998). Reasons for the change in the estimate from 1998 to 1999 were described in Lilly *et al*. (1999). The single change that contributed most to the additional decrease in the current analysis was the removal of some offshore samples that were obtained in the vicinity of research vessels conducting surveys for cod. Examination of these samples indicated that these seals might have been feeding on discards from the vessel or cod in the survey net. In addition, the equations used to estimate the lengths of Atlantic cod, squid, American plaice, and other flatfish from hard parts were revised. The new equations were based on additional data and/or equations developed using local data that are more appropriate for the area. The previous estimate incorporated a 10% 'correction factor' for unidentified prey to account for biases associated with using hard parts to identify prey. Because the degree of potential bias associated with the consumption of soft-bodied prey, the digestion of small otoliths, and belly feeding could not be estimated, this correction factor was removed.

Diet data from the inshore show that the per capita consumption of cod by harp seals has not declined with the collapse of the cod stock. In 1998 there was an increase in per capita consumption in the inshore, especially in the winter. This increase occurred in various areas from White Bay to Trinity Bay.

5.2.2 Observations of harp seals consuming cod bellies

In recent winters there have been many reports of harp seals in inshore waters, often very close to land, taking bites from the bellies of large cod, thereby removing the liver and stomach and leaving the rest of the body untouched (Lilly *et al*. 1999; p. 42). During the winters of 1997-1998 and 1998-1999 there were numerous instances of such observations, particularly in eastern Notre Dame Bay and southwestern Bonavista Bay (Lilly *et al*. 1999; p. 14-15). Additional observations were reported during the winter of 1999-2000, most notably in southwestern Bonavista Bay in early April 2000. Incidents reported during the winter of 2000-2001 have been less dramatic than those in previous years. Most reports have come from Bonavista Bay and the Smith Sound area of Trinity Bay. There are no estimates of the numbers of cod killed by "belly-feeding", so this form of predation has not been incorporated into the estimates of consumption.

5.2.3 Numbers at age eaten by harp seals

The revised estimates of the quantity of cod consumed by harp seals were used to estimate numbers of cod (at age) consumed by the seals in 1986-1998 using methods similar to those described by Stansbury *et al*. (1998). Stomach contents of seals sampled in 1999 and 2000 are not yet available for analysis.

Length frequencies were derived from the new otolith length – fork length regression found in Stenson and Perry (2001). Data were originally separated into quarterly time periods for each year for inshore and offshore. In the current analysis, the inshore and offshore were combined because of the paucity of data from the offshore. In addition, the quarters were combined into the first half and the second half of the year because of low sampling intensity in some quarters.

The length frequencies reconstructed from otoliths in the stomach samples were compiled into half-yearly length frequencies for each year (Fig. 43). Although otoliths from the seal stomachs have been aged, the data are not extensive enough to be used to break down the annual length frequencies by half year. For this reason age sampling from the spring 3L research surveys using the Campelen trawl in 1996-1998 were combined to give a key for the first half of the year (Table 40) and sampling from the autumn surveys in 2J, 3K and 3L using the Campelen in 1995-1997 were combined for the second half of the year (Table 41). These keys were applied to the seal length frequencies on a half-yearly basis for each year to give the numbers at age.

Mean weights at length were calculated from the standard weight-length regression and used in conjunction with the length frequencies and the estimates of biomass consumed to calculate numbers of cod consumed. The estimates of mean weights of cod consumed and the number of cod consumed are illustrated by half-year and year in Fig. 44. Proportions at age were calculated by applying the semi-annual age-length keys to the semi-annual length frequencies in each year.

Estimates of the number of cod at age consumed by harp seals during 1986-1998 are provided by half-year and year in Table 42 and illustrated by year in Fig. 45. There is considerable variability in the estimates. For instance, the number of age 0 cod consumed in the second half of the year varies by up to 3 orders of magnitude during the period 1987-1993. In general, the matrix of consumption at age in the second half would appear to be influenced more strongly by year effects than year-class effects. In addition, the pattern in consumption at age is sometimes very dissimilar between the first and the second halves of the year. For example, in 1998 the consumption of age 1 cod is estimated at 1,116 thousand in the first half and 6 thousand in the second half.

Despite these apparent inconsistencies in the estimates, there are some generalities that can be emphasized. From 1986 to 1996, cod age 0 and 1 were the predominant age groups found in harp seal stomachs. In 1997 and 1998 older fish (ages 3-5) were the dominant age groups and fish as old as age 7 were found more frequently than in previous years. With this shift to older, larger cod in recent years the estimates of total number of fish consumed have decreased while the estimates of total biomass consumed have been relatively constant.

5.2.4 Uncertainties regarding the estimation of cod consumption by seals

Information regarding the population size, distribution and feeding behaviour of seals increases each year and leads to changes in estimates of the number, size and age of cod and other species consumed by the seals. Changes in perception can be large, as illustrated by the considerable reduction over the past few years in the estimates of the quantity of cod consumed by seals. Much of the uncertainty associated with the consumption of cod arises because cod is a minor prey of the harp seal. This increases the possibility of sampling error leading to large among-year differences in the number of seals having cod otoliths in their stomachs and in the size composition of those otoliths that are found. The population of harp seals is large, so slight changes in the proportion of cod in the diet samples can lead to large changes in the quantity of cod which the seals are estimated to consume.

The estimates of cod consumption may be biased upwards because diet reconstruction relies on the presence and identification of hard parts (such as cod otoliths) in the stomachs of those seals that are sampled. Diet contributions from soft bodied animals or fish with small otoliths may be missed or under-represented.

On the other hand, the estimates of cod consumption may be biased downwards because incidences of belly-feeding may be undetected and therefore not incorporated into the diet reconstructions. It is also recognized that the weight of cod killed by belly-feeding is much higher than the weight of cod consumed. The feeding on bellies also causes the size composition of the cod killed to move toward larger sizes compared with a size composition based solely on otoliths. At this time there is little information on the proportion of the seal population engaging in this form of predation, the number of days on which it happens and how many cod each of these seals kills per day.

5.2.5 The impact of seals on population dynamics of cod

In the absence of a sequential population analysis for the cod stock (see Section 4.4), the importance of seal predation to cod population dynamics was not explored further.

However, the estimates of removals of cod by harp seals, based on reconstructed diets, are high (37,000 t in 2000) and do not incorporate the mortality caused by seals feeding on cod bellies alone. It appears that the number of cod eaten by seals annually has been high since at least 1986. It is assumed that the mortality imposed on the cod stock increased toward the mid-1990s as the removals by seals remained high and the cod population declined.

It is possibile that predation by seals is preventing the recovery of the cod stock. See Shelton and Healey (1999) for a discussion of the possibility that the lack of recovery is due to a decline in per capita reproductive success, perhaps as a result of increased predation on prerecruit fish by seals. It is also important to recognize that some of the cod eaten by seals are mature fish that have survived the juvenile years when natural mortality is high. That is, some of the predation by seals affects the cod spawning population directly.

It is speculated that belly-feeding may be an important source of mortality for local cod aggregations, especially in the area from White Bay to Bonavista Bay. The occurrence of harp seals is reported to be increasing in Trinity Bay, notably in Smith Sound.

The hooded seal is also known to prey on cod, and estimates of their consumption of cod (34,000 t in 1996; Hammill and Stenson 2000) should be updated and incorporated into an analysis of the removals of cod by all predators, including cod itself. The potential impact of this predation on the population dynamics of cod should be explored through modelling.

5.3 Prey

Capelin has historically been the dominant pelagic species in the area and the major prey of cod. In the early 1990s capelin almost disappeared from Division 2J, increased in abundance in areas where they were previously uncommon (Flemish Cap and eastern Scotian Shelf), became inaccessible to acoustic surveys conducted at traditional times, arrived late in the inshore for spawning, and experienced low growth rates (Lilly 1994; Frank *et al*. 1996; Nakashima 1996; Carscadden *et al*. 1997; Carscadden and Nakashima 1997). In the past 2-3 years there are indications that some aspects of capelin biology, notably their offshore distributions, appear to be changing to more closely resemble patterns observed in the 1980s (Lilly and Simpson 2000; DFO 2000).

The trend in biomass of capelin has been uncertain since the late 1980s (DFO 2000). Recent acoustic studies have detected some aggregations of capelin in the inshore but few offshore compared to the 1980s (O'Driscoll *et al*. 2000; DFO 2000). (There are no reports to date of the distribution or biomass of capelin in 2000.)

There is concern that there may not be sufficient capelin in the offshore, particularly in the north, to support good condition in cod. Other prey items exist in the offshore, but capelin was historically the most important prey in the diet of 2J+3KL cod and changes in capelin biomass, as determined from acoustic surveys, explain some of the interannual variability in growth and condition of cod (Krohn *et al*. 1997). Parallels with other ecosystems also provide cause for concern. Declines in capelin biomass have been associated with reductions in growth rate of cod in waters around Iceland (Steinarsson and Stefánsson 1996) and in the Barents Sea (Mehl and Sunnanå 1991; Jørgensen 1992) and with a reduction in somatic condition and lipid reserves of cod in the Barents sea (Jørgensen 1992; Marshall *et al*. 1999).

5.4 Ecosystem approach

There has been very little progress in the adoption of an ecosystem approach in the context of biological interactions among capelin, cod and seals. It is likely that many of the questions regarding the recovery of northern cod and the sustainability of future fisheries can be answered only by developing a more complex realization of the ecosystem than that used in the 1980s and early 1990s. Vital data for developing an ecosystem approach include abundance of predators and prey and diet composition of predators. The current paucity of data on the abundance of capelin (and other planktivores, such as Arctic cod) and the diets of harp seals (and hooded seals, cod and other important predators) compromises any useful ecosystem modelling related to cod in the foreseeable future.

6 Outlook

The text for the outlook for the 2J+3KL cod stock is taken directly from the Stock Status Report (DFO 2001).

6.1 Outlook for the stock under two hypotheses regarding stock structure

The stock is assessed under two hypotheses regarding stock structure: a) the inshore constitutes a separate inshore subpopulation that is functionally separate from the offshore; and b) inshore and offshore fish together constitute a single functional population.

6.1.1 Separate inshore subpopulation hypothesis

The acoustic data for Smith Sound show an increase in the biomass index from about 15,000 t in 1999 to about 31,000 t in 2001 while the research bottom-trawl index for inshore strata in 3K and 3L suggests that the inshore biomass of fish age 1-4 has been increasing since 1997 but the biomass of older fish has been decreasing since 1996. Catch rates from the sentinel survey and from the commercial logbooks show decreasing trends from 1998. The fishing community questionnaire indicates that overall the catch rates in 2000 were low compared with the historical average. In the fall surveys, few fish older than age 5 have been found in inshore 3K and 3L and the age composition is consistent with a high overall mortality rate. The age structure (presence of older fish) in Smith Sound and the inshore commercial catch may indicate that the mortality in some areas of the nearshore is lower.

Tagging data indicate that the 1999 fishery resulted in a 43% harvest rate for fish tagged in 3K compared to northern 3L (13.2%) and southern 3L (23.6%). Tag returns indicate harvest rates in 2000 of about 10% for fish tagged in 3K and northern 3L and 22% for fish tagged in southern 3L. Based on reported catches, the corresponding exploitable biomass estimates from a simple migration model were roughly 40,000 t in 3K and northern 3L combined over the period 1998-2000. A more detailed model without migration gives a biomass of no more than 77,000 t in 3KL in 2000.

The recruitment model, based on both inshore and offshore data, estimates that the 1998 to 2000 year-classes are stronger than earlier year-classes in the 1990s. It is considered that these levels are extremely low compared to recruitment to the whole 2J+3KL stock in the 1980s. The inshore is thought to be a preferred nursery area for young cod (ages 0 and 1) irrespective of whether they originate from spawning in the inshore or the offshore. Year-classes after 1996 are slightly stronger and may lead to increases in the abundance of commercial size fish and the spawning biomass in the inshore in the future if mortality rates are low.

The overall decreasing trend in indices of the abundance of commercial size and spawning age fish suggest that, at current levels of mortality, stock size has not been sustained by recent levels of recruitment. The particularly weak 1996 year-class is likely to exacerbate this situation. However, declining levels of biomass are not apparent in tagging results.

There is no information on what levels of biomass could be supported in the inshore, or on what would constitute an undesirably low spawner biomass under a precautionary approach. If the inshore biomass is considered to be above any such low level, then a harvest rate of 10% could be considered consistent with a precautionary approach under the hypothesis of a functionally separate inshore subpopulation. Indices of exploitable biomass from commercial and sentinel catch rates and the fall bottom-trawl survey in inshore strata appear to be inconsistent with estimates from tagging in their information about trends. Therefore, we cannot say whether recent levels of exploitation have been sustainable. The fact that only about 70% of the TAC was taken in the 2000 index fishery may be further cause for concern.

6.1.2 Single functional population hypothesis

Overall, there is no doubt that the 2J+3KL cod spawner biomass remains at an extremely low level and there is no evidence of a recovery. The offshore research bottom-trawl survey results show extremely low abundance levels, although the remaining fish are widespread. Mortality rate of fish in the offshore is estimated to be as high as levels in the 1980s when a substantial commercial fishery existed. Slightly elevated abundances of fish have been detected in 1999-2000 in acoustic surveys and bottom trawl surveys on the shelf near the boundary between southern 3K and northern 3L. This overlaps the areas in which the Greenland halibut and shrimp directed fisheries are being carried out. Although reported by-catches on observed vessels are low (less than 40 t in 2000), there is concern that by-catch mortality could delay or impede the recovery of the stock.

Although there was a substantial decline in spawner biomass in this stock over the 1960s to a level of less than 200,000 t by the time of extension of jurisdiction in 1977, several strong year-classes arose during the 1980s at a spawner biomass level of about 400,000 t. There has been no good recruitment at spawning stock biomass levels below 200,000 t. Although it is difficult to define a B_{lim} at this stage, it would clearly be desirable to have the spawning stock above 200,000 t. It is generally accepted that an approach of no directed fishing is consistent with the precautionary approach for a stock that is below B_{lim}. Any fishery on the remnant in the inshore will delay recovery of the stock.

6.1.3 Impact of harp seals

The estimates of removals of cod by harp seals, based on reconstructed diets, are high (37,000 t in 2000) and do not incorporate the mortality caused by seals feeding on cod bellies alone. It appears that predation by seals has been an important source of mortality of cod since the start of the moratorium. There is also the possibility that predation by seals is preventing the recovery of the cod stock, not simply because considerable numbers of cod are being consumed but also because some of those cod eaten are mature fish.

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Table 1. Landings (t) of cod from NAFO Divisions 2J3KL for the period 1959-2000.

	2J				3K				3L				2J3KL			
	Offshore mobile gear		Fixed gear		Offshore mobile gear		Fixed gear		Offshore mobile gear		Fixed gear					
Year	Canada	Other	Canada	Total	Canada	Other	Canada	Total	Canada	Other	Canada	Total	Total Canada	Total Other	Total	TAC
1959	0	46372	17533	63905	0	97678	56264	153942	4515	51515	85695	141725	164007	195565	359572	
1960	1	164123	15418	179542	53	74999	47676	122728	7355	63985	94192	165532	164695	303107	467802	
1961	1	243144	17545	260690	0	64023	31159	95182	4675	73899	70659	149233	124039	381066	505105	
1962	0	226841	23424	250265	0	47015	42816	89831	4383	90276	72271	166930	142894	364132	507026	
1963	1	197868	23767	221636	0	79331	47486	126817	4446	83015	73295	160756	148995	360214	509209	
1964	13	197359	14787	212159	0	121423	40735	162158	10158	142370	75806	228334	141499	461152	602651	
1965	0	246650	25117	271767	21	50097	26467	76585	7353	130387	58943	196683	117901	427134	545035	
1966	39	226244	22645	248928	13	58907	32208	91128	8253	120206	55990	184449	119148	405357	524505	
1967	28	217255	27721	245004	114	78687	24905	103706	13478	200343	49233	263054	115479	496285	611764	
1968	4650	355108	12937	372695	1849	119778	40768	162395	15784	211808	47332	274924	123320	686694	810014	
1969	30	405231	4328	409589	56	80949	24923	105928	18255	151945	67973	238173	115565	638125	753690	
1970	0	212961	1963	214924	92	78274	21512	99878	14471	137840	53113	205424	91151	429075	520226	
1971	0	154700	3313	158013	31	61506	21111	82648	11976	148766	38115	198857	74546	364972	439518	
1972	0	149435	1725	151160	7	133369	14054	147430	4380	109052	46273	159705	66439	391856	458295	
1973	1123	52985	3619	57727	108	159653	13190	172951	1258	97734	24839	123831	44137	310372	354509	666000
1974	0	119463	1804	121267	19	149189	10747	159955	880	67918	22630	91428	36080	336570	372650	657000
1975	410	78578	3000	81988	189	112678	15518	128385	670	53770	22695	77135	42482	245026	287508	554000
1976	94	30691	3851	34636	771	79540	20879	101190	2187	40998	35209	78394	62991	151229	214220	300000
1977	525	39584	3523	43632	1051	26776	28818	56645	5362	26799	40282	72443	79561	93159	172720	160000
1978	4682	17546	6638	28866	7027	6373	29623	43023	9213	12263	45194	66670	102377	36182	138559	135000
1979	9194	6537	8445	24176	21572	16890	27025	65487	14184	12693	50359	77236	130779	36120	166899	180000
1980	13592	7437	17210	38239	21920	6830	37015	65765	15523	13963	42298	71784	147558	28230	175788	180000
1981	22125	4760	14251	41136	23112	3847	23002	49961	21754	15070	42827	79651	147071	23677	170748	200000
1982	58384	8923	14429	81736	8881	4074	42141	55096	27181	9271	56490	92942	207506	22268	229774	230000
1983	37276	4158	10748	52182	31621	2815	40683	75119	39123	10920	55001	105044	214452	17893	232345	260000
1984	9231	2782	13150	25163	48114	11059	35143	94316	47668	15973	49351	112992	202657	29814	232471	266000
1985	1466	78	10211	11755	68880	12945	30368	112193	36863	31176	39306	107345	187094	44199	231293	266000
1986	5734	7859	12916	26509	62086	5781	28384	96251	57805	53946	32202	143953	199127	67586	266713	266000
1987	39344	3999	16022	59365	39686	6160	27442	73288	44612	25916	36743	107271	203849	36075	239924	256000
1988	41468	9	17112	58589	40260	50	33820	74130	57805	26748	51405	135958	241870	26807	268677	266000
1989	33626	1003	23304	57933	37350	1179	20711	59240	40958	36621	59238	136817	215187	38803	253990	235000
1990	17883	183	14505	32571	26920	504	27516	54940	31187	25488	75266	131941	193277	26175	219452	199262
1991	621	82	2214	2917	30112	311	13332	43755	30264	49660 [2]	45416 [3]	125340	121959	50053	172012	190000
1992	0	0	18	18	584	273	884	1741	13627	14610 [4]	10960 [5]	39197	26073	14883	40956	0
1993	0	0	13	13	0	0	541	541	2	2425 [6]	8411 [7]	10838	8967	2425	11392	0
1994 [1]	0	0	9	9	0	0	368	368	0	50	936	986	1313	50	1363 [8]	0
1995 [1]	0	0	0	0	0	0	94	94	0	0	237	237	331	0	331 [9]	0
1996 [1]	0	0	3	3	0	0	739	739	1	0	655	656	1398	0	1398 [10]	0
1997 [1]	0	0	3	3	0	0	159	159	4	0	339	343	505	0	505	0
1998 [1]	0	0	16	16	0	0	1993	1993	1	0	2490	2491	4501	0	4501	4000
1999 [1]	0	0	36	36	0	0	3644	3644	0	0	4792	4792	8472	0	8472	9000
2000 [1]	0	0	5	5	0	0	1459	1459	13	0	3888	3901	5365		5365	7000

Table 2. Fixed gear landings (t) by Division and gear type in Divisions 2J, 3K and 3L in 1975-1999. Landings from statistical areas other than Newfoundland are not included.

	2J					3K					3L					2J3KL
Year	Trap	GN	LL	HL	Total	Trap	GN	LL	HL	Total	Trap	GN	LL	HL	Total	Total
1975	642	2304	0	54	3000	4662	8645	565	1646	15518	10390	7552	1641	3112	22695	41213
1976	1022	2787	6	36	3851	7056	10666	718	2439	20879	18404	9066	2904	4835	35209	59939
1977	1285	2076	37	125	3523	11501	11611	1294	4412	28818	20988	8852	3591	6851	40282	72623
1978	2872	3376	55	335	6638	11329	11445	3647	3202	29623	23218	9023	5114	7839	45194	81455
1979	1333	5663	175	1274	8445	3532	11474	8414	3605	27025	20785	13488	7022	9064	50359	85829
1980	4679	11414	204	913	17210	12732	13549	8059	2675	37015	12871	11231	9394	8802	42298	96523
1981	3893	10105	72	181	14251	3952	10679	6360	2011	23002	10177	13579	11425	7646	42827	80080
1982	4464	9121	114	730	14429	16415	17571	6101	2054	42141	24248	20295	5704	6243	56490	113060
1983	3870	4854	842	1182	10748	10490	18305	2560	9328	40683	25690	16446	3834	9031	55001	106432
1984	5618	6116	379	1037	13150	9957	14362	2499	8325	35143	23103	14985	3824	7439	49351	97644
1985	4973	2992	252	1994	10211	13310	8082	2352	6624	30368	21594	8760	3245	5707	39306	79885
1986	4373	7804	109	630	12916	14555	7626	1555	4648	28384	15669	9865	2492	4176	32202	73502
1987	5158	9228	218	1418	16022	11278	10223	1590	4351	27442	11370	17419	3338	4616	36743	80207
1988	5907	9183	272	1750	17112	16261	11898	935	4726	33820	22148	18576	4004	6677	51405	102337
1989	6713	14846	290	1455	23304	8189	7921	700	3901	20711	23964	22231	4676	8367	59238	103253
1990	3616	9364	653	872	14505	11201	7726	3838	4751	27516	32158	28936	4545	9627	75266	117287
1991	1016	271	93	834	2214	7696	1384	1851	2401	13332	26524	11696 [2]	1247	5949	45416 [2]	60962
1992	0	0	2	16	18	27	103	9	745	884	1173	1131	16	8640 [3]	10960 [3]	11862
1993	0	0	1	12	13	3	37	9	492	541	11	93	80	8227 [3]	8411 [3]	8965
1994 [1]	0	0	0	9	9	0	8	0	359	367	6	38	22	870	936	1312
1995 [1]	<1	<1	0	0	0	13	52	28	2	95	12	176	33	16	237	332
1996 [1]	0	0	0	3	3	25	132	17	565	740	18	219	15	404	656	1500 [4]
1997 [1]	0	3	0	0	3	22	101	34	1	159	33	257	29	21	339	501
1998 [1]	0	3	5	8	16 0	24	1081	245	644	1994	31	1377	284	798	2490	4501
1999	0	21	3	12	36	4	3030	106	503	3644	4	4310	60	419	4792	8472
2000	0	4	0	1	5	15	1126	43	275	1459	63	2954	189	684	3891	5354

[1] Provisional catches.

[2] Catch is 4000 (t) less than Canadian statistics as this quantity is considered 3NO gillnet catch misreported in 3L.

[3] Estimate for recreational fishery has been reported as 3L Handline.

[4] Comprised of sentinel survey catch of 294 t, a food fishery catch of 1155 t and by-catch 142 t.
An amount of 103 t must still be allocated by gear type and division from the sentinel catches.

Table 3. Catch (t) in 2000 from all sources (index fishery including by-catch, sentinel survey and food/recreational fishery), by gear, unit area and month.

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	oct	Nov	Dec	Total
Gillnet													
2JA													0.0
2JD							0.5						0.5
2JI											1.1		1.1
2JM							0.3	0.6	1.0	0.1			2.0
2JN									0.1				0.1
3KA							2.2	1.3	6.0	0.7	0.3		10.5
3KB								0.1	0.0				0.1
3KC		0.1						0.2	0.0				0.2
3KD						0.1	8.7	3.4	11.8	4.7	0.9		29.5
3KE								0.3	0.2				0.4
3KF								2.4	3.8				6.2
3KG								1.9	0.4				2.4
3KH						0.6	17.9	7.2	43.7	25.5	32.6		127.5
3KI		0.0	0.0	0.1	0.0	18.7	383.8	32.6	240.3	95.0	178.3	0.2	949.0
3LA						9.1	367.4	29.0	388.9	238.4	110.1	0.4	1143.3
3LB	1.4	1.1				40.2	282.6	30.9	561.7	144.7	22.6		1085.2
3LC							3.3	2.6	1.8				7.6
3LD								1.9	1.0				2.9
3LF						4.2	164.4	7.5	112.5	18.9	8.5		316.0
3LG											1.3		1.3
3LJ		0.3			0.0	1.1	90.4	5.9	111.7	54.6	3.6		267.7
3LQ					1.3	9.3	81.1	7.2	17.9	13.1	0.2		130.2
Total	1.4	1.4	0.0	0.1	1.3	83.2	1402.7	134.9	1502.9	595.8	359.7	0.6	4084.0
Linetrawl													
2JM													0.0
3KA									1.0	0.2			1.1
3KD								0.0	1.8	0.7			2.4
3KE													0.0
3KH								0.2	5.6	5.5	0.9		12.2
3KI		0.1	0.0				0.0	0.3	14.0	9.1	3.2		26.7
3LA						0.9	2.7	1.0	57.1	5.9	0.9		68.4
3LB						0.0	0.4		28.2	3.2	0.9		32.7
3LF									6.6	8.5	0.7		15.8
3LJ		0.0					16.3	0.2	16.0	1.4	0.8		34.7
3LQ							15.3		3.2	17.9	0.3		36.7
Total		0.1	0.0	0.0	0.0	0.9	34.7	1.7	133.3	52.4	7.8		230.9

(cont'd)

Table 3 (cont'd). Catch (t) in 2000 from all sources (index fishery including by-catch, sentinel survey and food/recreational fishery), by gear, unit area and month.

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	oct	Nov	Dec	Total
Handline													
2JA													0.0
2JM							0.0	0.0	0.3	0.7			1.1
3KA								1.7	1.2	1.7	1.5		6.1
3KD								3.7	4.0	2.5	0.2		10.4
3KH							0.7	8.8	25.6	23.2	3.2		61.4
3KI						0.2	23.0	44.1	93.0	34.3	4.5		199.1
3LA							0.7	89.3	100.2	20.1	12.7		223.0
3LB							0.3	110.9	108.6	11.3	4.9		236.0
3LD										0.1			0.1
3LF							0.1	8.6	25.7	27.4	2.7		64.5
3LJ							3.6	28.4	40.8	43.8	14.4		130.9
3LQ							5.6	12.9	7.9	1.3	0.2		27.9
Total	0.0	0.0	0.0	0.0	0.0	0.2	34.0	308.4	407.2	166.3	44.2	0.0	960.4
Trap													
3KD								2.3	9.3				11.7
3KH								0.0	1.2				1.3
3KI								2.2	0.1				2.3
3LA								4.7	3.1				7.8
3LB					3.5	26.7	16.0	0.2	4.0				50.5
3LJ								0.7	3.9				4.6
3LQ													0.0
Total	0.0	0.0	0.0	0.0	3.5	26.7	16.0	10.2	21.7	0.0	0.0	0.0	78.1
OT/ST													
2JB			0.0										0.0
2JC		0.0	0.0										0.0
2JF		0.0	0.0				0.0						0.0
2JI				0.0									0.0
2JN			0.0	0.1	0.0								0.1
3KB					0.0								0.0
3LD				0.0									0.0
3LR					0.1			1.6	9.9	0.8			12.4
3LS								0.4					0.4
Total		0.0	0.0	0.1	0.1	0.0	0.0	2.0	9.9	0.8	0.0	0.0	12.9
Total	1.4			0.1	4.8	111.1	1487.4	455.2	2065.1	814.5	411.7	0.6	5366.3

Table 4. Number of fish measured in 2000 from sentinel surveys and the commercial fishery, by gear, unit area and month.

	Month												
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Gillnet													
2JA													0
2JD													0
2JI													0
2JM							69	501	1,212	191			1,973
2JN													0
3KA							140	283	105				528
3KB													0
3KC													0
3KD						50	370	1,656	379	202			2,657
3KE													0
3KF													0
3KG													0
3KH						41	399	1,941	713	232	104		3,430
3KI					4	1,402	2,996	6,365	2,190	214	300	140	13,611
3LA						1,853	4,774	7,889	2,460		1,328		18,304
3LB	218	173				2,414	4,714	5,598	2,156	1,218			16,491
3LC								2,501					2,501
3LD								186					186
3LF						435	1,721	266	269	13			2,704
3LG													0
3LJ													0
3LQ					525	3,258	4,168	2,122	99	211	77		10,460
Total	218	173	0	0	529	9,453	19,351	29,308	9,583	2,281	1,809	140	72,845
Linetrawl													
2JM													0
3KA													0
3KD								6	47				53
3KE													0
3KH								181	144	90	2		417
3KI								144	260		87		491
3LA								767	601	183			1,551
3LB							145		168				313
3LF										351			351
3LJ													0
3LQ									21		158		179
Total		0	0	0	0	0	145	1,098	1,241	624	247		3,355

(cont'd)

Table 4 (cont'd). Number of fish measured in 2000 from sentinel surveys and the commercial fishery, by gear, unit area and month.

	Month												
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Handline													
2JA													0
2JM								39					39
3KA													0
3KD													0
3KH								124		36			160
3KI						116			550				666
3LA							360		184	593	265		1,402
3LB							149		21				170
3LD													0
3LF										388			388
3LJ													0
3LQ													0
Total	0	0	0	0	0	116	509	163	755	1,017	265	0	2,825
Trap													
3KD								941	777				1,718
3KH							23	1,631					1,654
3KI							2,283	101					2,384
3LA							1,639						1,639
3LB					1,218		1,273						2,491
3LJ													0
3LQ													0
Total	0	0	0	0	1,218	0	5,218	2,673	777	0	0	0	9,886
OT/ST													
2JB			6										6
2JC		5	41										46
2JF		21	46										67
2JI				31									31
2JN			43	1,608									1,651
3KB													0
3LD				78									78
3LR													0
3LS													0
Total		26	136	1,717	0	0	0	0	0	0	0	0	1,879
All gears	218			0	1,747	9,569	25,223	33,242	12,356	3,922	2,321	140	90,790

Table 5. Number of fish aged from sampling of the sentinel surveys and the index fishery, by gear, unit area and quarter. Quarter 1 is January-February, Quarter 2 is March-May, Quarter 3 is June – August and Quarter 4 is September – December.

Unit area	Quarter 1	2	3	4	total
Gillnet					
2JM			105	123	228
3KA			19		19
3KD			228	77	305
3KH			30	100	130
3KI			87	103	190
3LA			235	237	472
3LB	46		227	160	433
3LD			88		88
3LF			145	10	155
3LJ					0
3LQ		28	177	22	227
					2247
Linetrawl					
2JM					0
3KA					0
3KD				20	20
3KH				60	60
3KI				20	20
3LA				131	131
3LB			22	68	90
3LD					0
3LF					0
3LJ					0
3LQ					0
					321
Handline					
2JM					0
3KA					0
3KD					0
3KH				36	36
3KI			27	170	197
3LA			124	220	344
3LB			42	15	57
3LD					0
3LF				116	116
3LJ					0
3LQ					0
					750
Trap					
2JM					0
3KA					0
3KD			58	46	104
3KH			109		109
3KI			142		142
3LA			53		53
3LB		81	65		146
3LD					0
3LF					0
3LJ					0
3LQ					0
					554
All gears					3872

Table 6. Estimated average weight (kg), length (cm) and number (plus standard error and coefficient of variation) of the 2000 catch at age, for all gears combined and for individual gears.

	WEIGHT	LENGTH	NUMBER		
AGE	(kg.)	(cm.)	(000'S)	STD ERR.	CV
All gears combined					
1			0.0		
2	0.26	31.28	5.2		
3	0.66	42.03	140.7	5.05	0.00
4	0.97	47.37	257.5	6.46	0.03
5	1.71	57.12	418.6	8.65	0.02
6	2.14	61.56	436.7	9.64	0.02
7	2.79	66.98	327.7	10.30	0.03
8	3.39	71.16	293.6	10.00	0.03
9	3.95	74.72	151.3	8.30	0.05
10	4.54	78.23	135.7	7.63	0.06
11	4.88	79.85	33.3	4.67	0.14
12	6.03	84.93	5.1	1.50	0.29
13	5.63	83.85	3.2	1.34	0.42
14	4.80	78.88	1.1	0.68	
15	9.42	100.00	0.1	0.07	0.91
16			0.0	0.00	
17	11.28	106.00	0.0		
Gillnet					
1			0.0		
2	0.25	30.92	4.1		
3	0.61	40.84	21.6	2.11	0.00
4	1.19	50.63	38.3	2.92	0.08
5	1.88	59.03	231.1	7.46	0.03
6	2.20	62.15	327.4	9.14	0.03
7	2.80	67.08	275.3	10.12	0.04
8	3.38	71.08	252.0	9.87	0.04
9	3.97	74.85	129.3	8.23	0.06
10	4.55	78.28	117.3	7.57	0.06
11	4.92	80.02	29.3	4.66	0.16
12	6.04	84.97	4.5	1.49	0.33
13	5.38	82.91	2.8	1.34	0.48
14	4.71	78.44	0.9	0.67	
15	9.42	100.00	0.1	0.07	1.06
16			0.0	0.00	
17	11.28	106.00	0.0		
Linetrawl					
1			0.0		
2	0.29	32.27	0.9		
3	0.64	41.60	38.3	2.29	0.00
4	0.93	46.80	37.6	2.39	0.06
5	1.54	55.24	30.3	1.37	0.05
6	2.00	60.10	17.8	0.69	0.04
7	2.73	66.35	8.0	0.39	0.05
8	3.53	72.16	6.2	0.33	0.05
9	3.96	74.64	3.7	0.24	0.07
10	4.58	78.64	2.7	0.20	0.07
11	4.92	80.40	0.6	0.08	0.13
12	5.31	81.63	0.1	0.04	0.31
13	6.02	85.92	0.0	0.02	0.42
14	7.47	92.46	0.0	0.01	
15	9.42	100.00	0.0	0.00	0.95
16					
17					

(cont'd)

Table 6 (cont'd). Estimated average weight (kg), length (cm) and number (plus standard error and coefficient of variation) of the 2000 catch at age, for all gears combined and for individual gears.

AGE	WEIGHT (kg.)	LENGTH (cm.)	NUMBER (000'S)	STD ERR.	CV
Handline					
1			0.0		
2	0.34	34.00	0.0		
3	0.71	42.99	57.5	3.24	0.00
4	0.97	47.55	134.1	4.51	0.03
5	1.52	54.98	140.6	3.89	0.03
6	1.99	59.95	85.1	2.90	0.03
7	2.76	66.66	42.2	1.83	0.04
8	3.44	71.55	34.1	1.55	0.05
9	3.82	73.87	17.7	1.06	0.06
10	4.46	77.82	15.0	0.99	0.07
11	4.52	78.23	3.3	0.41	0.12
12	6.07	85.36	0.5	0.12	0.27
13	7.46	90.82	0.4	0.09	0.24
14	5.02	79.98	0.1	0.10	
15	9.42	100.00	0.0	0.01	1.00
16					
17					
Trap					
1			0.0		
2			0.0		
3	0.62	41.24	11.4	2.11	0.00
4	0.79	44.49	41.4	2.48	0.06
5	1.28	52.09	14.1	1.34	0.09
6	1.66	56.55	5.5	0.67	0.12
7	2.38	63.61	1.9	0.30	0.15
8	3.46	71.75	1.0	0.13	0.14
9	3.86	74.32	0.5	0.11	0.21
10	4.29	76.38	0.6	0.10	0.15
11	5.30	82.25	0.0	0.02	0.50
12	5.70	85.00	0.0		0.00
13	5.32	82.86	0.0	0.01	0.80
14					
15					
16					
17					
Otter trawl (3L)					
1			0.0		
2	0.34	34.00	0.2		
3	0.72	43.14	7.7	0.91	0.00
4	0.99	48.05	3.9	0.99	0.26
5	1.22	51.37	1.8	0.54	0.31
6	1.91	58.85	0.2	0.04	0.22
7	2.63	65.36	0.1	0.02	0.30
8	4.25	76.80	0.1	0.02	0.21
9	5.29	82.53	0.0	0.01	0.40
10	3.97	75.35	0.0	0.01	0.49
11	4.90	79.50	0.0	0.00	0.68
12	6.97	90.71	0.0	0.00	1.08
13	5.70	85.00	0.0		0.00
14					
15					
16					
17					

Table 7. Catch numbers (thousands) at age for cod in 2J3KL in 1962-2000.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	301	1446	2872	85	819	790	288	59	6819	33	236	0	473
3	8666	5746	19338	5177	14057	15262	6142	4330	18104	12876	6737	3963	3231
4	26194	27577	27603	28709	65992	77873	94291	39626	60102	71557	79809	40785	13201
5	64337	60234	57757	46800	93687	100339	205805	100858	82357	95384	116562	94844	34927
6	58163	118112	60681	66946	62812	96759	150541	163228	101249	98111	76196	59503	74403
7	47314	58996	100147	64360	59312	54996	83808	107509	85696	57865	55984	35464	60539
8	27521	29349	50865	68176	30423	38691	39443	52661	29218	25055	29553	27351	35687
9	20142	15520	20892	33819	23844	17146	23171	19651	10857	11732	11750	14153	18854
10	18036	11612	12264	14913	8762	16084	10984	12370	3825	4470	6393	7566	10492
11	10444	8248	8698	6945	4528	5949	5591	6389	2000	2223	2987	3815	5818
12	9468	4204	6352	3729	2280	3367	5249	4479	1200	1287	1660	2153	2934
13	7778	3942	4989	3948	1825	2108	1939	3004	507	1140	1388	1173	1078
14	5785	2933	4036	3730	1186	1529	1334	1557	224	720	725	450	652
15	4669	2928	2703	2722	967	685	818	622	214	355	748	278	249
16	3888	1737	1456	1859	806	424	610	567	244	474	606	309	338
17	3955	1263	1918	575	416	193	127	319	124	124	452	85	162
18	2161	1352	1154	971	279	107	89	100	32	128	136	27	113
19	232	328	501	183	486	72	83	46	10	148	195	38	45
20	403	182	312	226	178	211	26	99	34	78	36	8	20
Total	319457	355709	384538	353873	372659	432585	630339	517474	402816	383760	392153	291965	263216

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	420	15	108	0	0	92	0	0	18	3	0	1	42
3	3968	13767	7128	1323	1152	2554	2185	1702	2585	782	650	831	2329
4	14101	33727	65510	17556	12361	12025	7172	31286	13616	14871	14824	15219	9217
5	25370	28049	40462	39206	37493	28814	13191	19003	42602	31760	36614	44168	32340
6	34426	20898	12107	20319	29202	30016	24800	14397	19028	38624	33922	45869	49061
7	39105	16811	5397	7711	10982	18017	22014	25435	12044	12503	28006	26025	28469
8	36485	16022	3396	3078	3460	4830	11848	16930	14701	7246	7050	14722	19505
9	13421	10931	2730	1530	1300	1217	3175	11936	8934	8910	3836	3104	5818
10	7514	4637	1381	1083	757	520	779	1923	6341	4227	5162	2000	1346
11	2315	1462	532	437	560	232	309	338	1018	2536	2905	1977	676
12	1179	631	296	219	183	229	195	156	248	451	1681	1101	873
13	808	292	149	105	116	56	125	90	90	146	254	574	391
14	372	251	75	62	51	65	48	153	41	48	107	116	200
15	165	100	42	40	43	37	14	40	29	41	39	29	37
16	82	50	21	21	38	13	28	12	11	30	20	18	22
17	5	40	20	7	7	10	20	13	9	7	17	11	3
18	8	64	14	8	7	14	5	4	6	7	1	9	1
19	22	30	2	2	4	4	5	0	2	4	3	2	4
20	1	20	6	7	9	10	5	0	3	3	5	2	0
Total	179767	147797	139376	92714	97725	98755	85918	123418	121326	122199	135096	155778	150334

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	25	8	58	35	0	0	0	0	1	0	3	7	5
3	2779	1696	7693	3111	430	940	105	7	40	8	96	70	141
4	14651	17639	40557	31654	3860	4993	379	30	237	23	229	238	258
5	20184	21150	36410	53805	14535	3343	575	71	297	54	395	638	419
6	47917	25212	22695	29553	12211	1940	177	55	341	56	689	795	437
7	45725	38708	16390	9064	4526	700	74	20	129	84	384	1157	328
8	18608	28499	17940	6164	1372	147	22	11	23	21	237	370	294
9	9026	8696	9156	4745	376	21	2	3	5	3	74	253	151
10	4337	3640	2865	1696	199	0	0	0	3	2	10	52	136
11	774	1695	1084	641	104	0	0	0	0	0	5	13	33
12	422	572	478	250	18	0	0	0	0	0	2	3	5
13	366	244	103	88	9	0	0	0	0	0	1	0	3
14	223	180	98	39	4	0	0	0	0	0	0	0	1
15	100	94	36	21	0	0	0	0	0	0	0	0	0
16	32	43	25	9	0	0	0	0	0	0	0	0	0
17	5	4	8	3	0	0	0	0	0	0	0	0	0
18	10	9	7	2	0	0	0	0	0	0	0	0	0
19	5	0	1	2	0	0	0	0	0	0	0	0	0
20	5	1	0	0	0	0	0	0	0	0	0	0	0
Total	165194	148090	155604	140882	37644	12084	1334	197	1076	252	2125	3596	2210

Table 8. Catch weights-at-age (kg) for cod caught in 2J3KL in 1962-2000.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14		0.11
3	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.44	0.32	0.35
4	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.53	0.47	0.68
5	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.64	0.71	0.91
6	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.08	0.96	1.11
7	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.52	1.30	1.27
8	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.13	1.80	1.56
9	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.86	2.20	2.05
10	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.29	2.82	2.75
11	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.95	3.19	3.13
12	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.12	3.79	3.41
13	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	5.00	4.53	4.92
14	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	9.32	6.93	4.40
15	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	9.40	7.22	6.33
16	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	6.89	7.05	5.50
17	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	14.67	9.45	7.57
18	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	12.04	11.16	11.07
19	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	7.62	7.62	7.62
20	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	17.46	17.46	17.46

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	0.26	0.25	0.09			0.41	0.00		0.31	0.34		0.21	0.32
3	0.45	0.45	0.45	0.40	0.46	0.53	0.55	0.53	0.62	0.59	0.48	0.51	0.43
4	0.63	0.61	0.60	0.72	0.74	0.77	0.78	0.84	0.87	0.88	0.73	0.72	0.66
5	0.96	0.93	0.97	1.04	1.13	1.16	1.17	1.20	1.32	1.20	1.10	1.04	1.03
6	1.18	1.32	1.66	1.58	1.67	1.71	1.64	1.77	1.75	1.79	1.43	1.54	1.32
7	1.39	1.75	2.33	2.46	2.46	2.38	2.23	2.10	2.28	2.28	2.06	1.85	1.87
8	1.74	2.07	2.82	3.26	3.57	3.56	2.86	2.66	2.61	2.71	2.66	2.35	1.93
9	2.21	2.24	3.46	4.05	4.41	5.01	3.81	3.09	3.18	2.96	3.23	2.94	2.80
10	2.61	2.99	3.88	4.46	5.25	5.49	5.32	4.18	3.50	3.65	3.32	3.47	3.51
11	3.34	3.67	4.78	5.02	5.80	6.72	6.29	6.16	4.79	4.28	4.06	3.80	4.80
12	3.66	4.56	6.13	6.72	7.03	7.87	7.06	7.19	7.76	6.19	4.55	4.54	4.64
13	4.78	6.18	7.31	8.10	8.96	8.38	7.32	8.00	9.07	8.39	7.03	5.34	5.74
14	5.20	8.19	8.40	7.42	8.54	10.03	10.01	8.36	9.14	10.26	9.67	7.12	6.13
15	5.20	9.77	8.81	8.20	9.46	11.31	8.99	7.86	10.62	11.44	11.37	11.77	8.53
16	5.46	11.23	11.75	11.26	10.70	13.87	11.54	7.91	10.57	11.61	11.27	11.24	13.51
17	8.51	12.44	10.63	11.61	13.12	10.68	10.48	9.58	13.13	17.47	12.68	14.15	9.10
18	9.24	11.16	12.27	8.92	13.49	16.09	11.15	12.95	15.97	12.94	12.42	16.14	21.77
19	7.62	7.62	7.62	10.57	15.51	12.04	9.82	0.00	9.73	15.21	14.38	12.30	17.66
20	17.46	17.46	17.46	16.00	14.77	11.37	12.59	0.00	15.88	12.81	19.49	15.72	0.00

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	0.29	0.26	0.29	0.17				0.21	0.40	0.32	0.29	0.32	0.26
3	0.49	0.48	0.42	0.36	0.29	0.57	0.40	0.49	0.72	0.51	0.63	0.59	0.66
4	0.73	0.74	0.69	0.61	0.58	0.71	0.68	0.79	0.99	0.84	0.94	1.05	0.97
5	1.08	1.03	1.06	0.97	0.81	0.97	0.98	1.51	1.30	1.49	1.51	1.62	1.71
6	1.38	1.44	1.50	1.41	1.19	1.25	1.41	1.95	1.90	2.01	2.14	2.12	2.14
7	1.67	1.83	1.94	1.88	1.73	1.59	1.85	2.24	2.38	2.44	2.48	2.51	2.79
8	2.21	2.07	2.22	2.27	2.05	8.40	2.05	2.47	2.77	2.87	3.02	2.96	3.39
9	2.51	2.64	2.44	2.63	2.66	9.23	3.05	2.53	3.30	3.78	3.35	3.66	3.95
10	3.04	3.02	3.06	3.14	2.24			2.93	3.19	4.30	4.18	4.70	4.54
11	4.37	3.96	3.58	3.80	2.68			4.51	5.44	4.23	4.01	5.17	4.88
12	5.49	5.41	4.68	4.96	4.95			2.01	4.35	6.33	3.87	5.57	6.03
13	6.55	7.50	6.23	5.49	5.34				7.63	6.22	6.42	6.23	5.63
14	8.60	9.24	8.51	7.61	7.02				4.46			7.66	4.80
15	9.76	10.05	9.78	11.58									9.42
16	9.73	9.34	12.58	11.01									
17	12.58	15.74	15.45	12.82									11.28
18	16.01	18.66	13.58	13.00									
19	16.60		17.26	13.10									
20	11.03	17.64											

Table 9. Catch biomass (t) at age for cod caught in 2J3KL in 1962-1999.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	42	202	402	12	115	111	40	8	955	5	33	0	52
3	2946	1954	6575	1760	4779	5189	2088	1472	6155	4378	2964	1268	1131
4	14407	15167	15182	15790	36296	42830	51860	21794	33056	39356	42299	19169	8977
5	56617	53006	50826	41184	82445	88298	181108	88755	72474	83938	74600	67339	31784
6	71540	145278	74638	82344	77259	119014	185165	200770	124536	120677	82292	57123	82587
7	78541	97933	166244	106838	98458	91293	139121	178465	142255	96056	85096	46103	76885
8	58345	62220	107834	144533	64497	82025	83619	111641	61942	53117	62948	49232	55672
9	53175	40973	55155	89282	62948	45265	61171	51879	28662	30972	33605	31137	38651
10	57354	36926	39000	47423	27863	51147	34929	39337	12164	14215	21033	21336	28853
11	39269	31012	32704	26113	17025	22368	21022	24023	7520	8358	11799	12170	18210
12	39292	17447	26361	15475	9462	13973	21783	18588	4980	5341	6839	8160	10005
13	47135	23889	30233	23925	11060	12774	11750	18204	3072	6908	6940	5314	5304
14	32049	16249	22359	20664	6570	8471	7390	8626	1241	3989	6757	3119	2869
15	28528	17890	16515	16631	5908	4185	4998	3800	1308	2169	7031	2007	1576
16	22667	10127	8488	10838	4699	2472	3556	3306	1423	2763	4175	2178	1859
17	25470	8134	12352	3703	2679	1243	818	2054	799	799	6631	803	1226
18	13117	8207	7005	5894	1694	649	540	607	194	777	1637	301	1251
19	1534	2168	3312	1210	3212	476	549	304	66	978	1486	290	343
20	2898	1309	2243	1625	1280	1517	187	712	244	561	629	140	349
total	644926	590090	677428	655244	518248	593302	811698	774346	503047	475357	458793	327188	367583

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	109	4	10	0	0	38	0	0	6	1	0	0	13
3	1786	6195	3208	529	530	1354	1202	902	1603	461	312	424	1001
4	8884	20573	39306	12640	9147	9259	5594	26280	11846	13086	10822	10958	6083
5	24355	26086	39248	40774	42367	33424	15433	22804	56235	38112	40275	45935	33310
6	40623	27585	20098	32104	48767	51327	40672	25483	33299	69137	48508	70638	64761
7	54356	29419	12575	18969	27016	42880	49091	53414	27460	28507	57692	48146	53237
8	63484	33166	9577	10034	12352	17195	33885	45034	38370	19637	18753	34597	37645
9	29660	24485	9446	6197	5733	6097	12097	36882	28410	26374	12390	9126	16290
10	19612	13865	5358	4830	3974	2855	4144	8038	22194	15429	17138	6940	4724
11	7732	5366	2543	2194	3248	1559	1944	2082	4876	10854	11794	7513	3245
12	4315	2877	1814	1472	1286	1802	1377	1122	1924	2792	7649	4999	4051
13	3862	1805	1089	851	1039	469	915	720	816	1225	1786	3065	2244
14	1934	2056	630	460	436	652	480	1279	375	492	1035	826	1226
15	858	977	370	328	407	418	126	314	308	469	443	341	316
16	448	562	247	236	407	180	323	95	116	348	225	202	297
17	43	498	213	81	92	107	210	125	118	122	216	156	27
18	74	714	172	71	94	225	56	52	96	91	12	145	22
19	168	229	15	21	62	48	49	0	19	61	43	25	71
20	17	349	105	112	133	114	63	0	48	38	97	31	0
total	262319	196809	146023	131904	157091	170005	167661	224625	228118	227236	229191	244066	228564

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	7	2	17	6	0	0	0	0	0	0	1	2	1
3	1362	814	3231	1120	125	536	42	3	29	4	60	41	93
4	10695	13053	27984	19309	2239	3545	258	24	234	19	214	249	249
5	21799	21785	38595	52191	11773	3243	564	107	385	81	596	1032	716
6	66125	36305	34043	41670	14531	2425	250	107	647	112	1477	1687	936
7	76361	70836	31797	17040	7830	1113	137	45	306	205	952	2908	915
8	41124	58993	39827	13992	2813	1235	45	27	63	61	714	1094	994
9	22655	22957	22341	12479	1000	194	6	8	18	11	248	927	598
10	13184	10993	8767	5325	446	0	0	0	11	8	40	246	616
11	3382	6712	3881	2436	279	0	0	0	1	2	22	65	162
12	2317	3095	2237	1240	89	0	0	0	0	1	7	15	31
13	2397	1830	642	483	48	0	0	0	0	0	6	2	18
14	1918	1663	834	297	28	0	0	0	0	0	0	1	5
15	976	945	352	243	0	0	0	0	0	0	0	0	1
16	311	402	315	99	0	0	0	0	0	0	0	0	0
17	63	63	124	38	0	0	0	0	0	0	0	0	1
18	160	168	95	26	0	0	0	0	0	0	0	0	0
19	83	0	17	26	0	0	0	0	0	0	0	0	0
20	55	18	0	0	0	0	0	0	0	0	0	0	0
total	264975	250632	215096	168021	41200	12290	1301	321	1694	504	4338	8269	5335

Table 10. Mean weights-at-age (kg) of cod caught in commercial fisheries (including recreational fisheries and sentinel surveys) in 1962-2000. Highlighted entries indicate cells that have been filled or modified as described in the text (cf Table 8).

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	**0.26**	0.11
3	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.44	0.32	0.35
4	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.53	0.47	0.68
5	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.64	0.71	0.91
6	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.08	0.96	1.11
7	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.52	1.30	1.27
8	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.13	1.80	1.56
9	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.86	2.20	2.05
10	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.29	2.82	2.75
11	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.95	3.19	3.13
12	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.12	3.79	3.41
13	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	5.00	4.53	4.92
14	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	9.32	6.93	4.40
15	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	9.40	7.22	6.33
16	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	6.89	7.05	5.50
17	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	14.67	9.45	7.57
18	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	12.04	11.16	11.07
19	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	7.62	7.62	7.62
20	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	17.46	17.46	17.46

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	0.26	0.25	0.09	**0.26**	**0.26**	0.41	**0.26**	**0.26**	0.31	0.34	**0.26**	0.21	0.32
3	0.45	0.45	0.45	0.40	0.46	0.53	0.55	0.53	0.62	0.59	0.48	0.51	0.43
4	0.63	0.61	0.60	0.72	0.74	0.77	0.78	0.84	0.87	0.88	0.73	0.72	0.66
5	0.96	0.93	0.97	1.04	1.13	1.16	1.17	1.20	1.32	1.20	1.10	1.04	1.03
6	1.18	1.32	1.66	1.58	1.67	1.71	1.64	1.77	1.75	1.79	1.43	1.54	1.32
7	1.39	1.75	2.33	2.46	2.46	2.38	2.23	2.10	2.28	2.28	2.06	1.85	1.87
8	1.74	2.07	2.82	3.26	3.57	3.56	2.86	2.66	2.61	2.71	2.66	2.35	1.93
9	2.21	2.24	3.46	4.05	4.41	5.01	3.81	3.09	3.18	2.96	3.23	2.94	2.80
10	2.61	2.99	3.88	4.46	5.25	5.49	5.32	4.18	3.50	3.65	3.32	3.47	3.51
11	3.34	3.67	4.78	5.02	5.80	6.72	6.29	6.16	4.79	4.28	4.06	3.80	4.80
12	3.66	4.56	6.13	6.72	7.03	7.87	7.06	7.19	7.76	6.19	4.55	4.54	4.64
13	4.78	6.18	7.31	8.10	8.96	8.38	7.32	8.00	9.07	8.39	7.03	5.34	5.74
14	5.20	8.19	8.40	7.42	8.54	10.03	10.01	8.36	9.14	10.26	9.67	7.12	6.13
15	5.20	9.77	8.81	8.20	9.46	11.31	8.99	7.86	10.62	11.44	11.37	11.77	8.53
16	5.46	11.23	11.75	11.26	10.70	13.87	11.54	7.91	10.57	11.61	11.27	11.24	13.51
17	8.51	12.44	10.63	11.61	13.12	10.68	10.48	9.58	13.13	17.47	12.68	14.15	9.10
18	9.24	11.16	12.27	8.92	13.49	16.09	11.15	12.95	15.97	12.94	12.42	16.14	21.77
19	7.62	7.62	7.62	10.57	15.51	12.04	9.82	**11.70**	9.73	15.21	14.38	12.30	17.66
20	17.46	17.46	17.46	16.00	14.77	11.37	12.59	**13.16**	15.88	12.81	19.49	15.72	**15.97**

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	0.29	0.26	0.29	0.17	0.26	0.26	0.26	0.21	0.40	0.32	0.29	0.32	0.26
3	0.49	0.48	0.42	0.36	0.29	0.57	0.40	0.49	0.72	0.51	0.63	0.59	0.66
4	0.73	0.74	0.69	0.61	0.58	0.71	0.68	0.79	0.99	0.84	0.94	1.05	0.97
5	1.08	1.03	1.06	0.97	0.81	0.97	0.98	1.51	1.30	1.49	1.51	1.62	1.71
6	1.38	1.44	1.50	1.41	1.19	1.25	1.41	1.95	1.90	2.01	2.14	2.12	2.14
7	1.67	1.83	1.94	1.88	1.73	1.59	1.85	2.24	2.38	2.44	2.48	2.51	2.79
8	2.21	2.07	2.22	2.27	2.05	**2.21**	2.05	2.47	2.77	2.87	3.02	2.96	3.39
9	2.51	2.64	2.44	2.63	2.66	**2.72**	3.05	2.53	3.30	3.78	3.35	3.66	3.95
10	3.04	3.02	3.06	3.14	2.24	**2.87**	**2.87**	2.93	3.19	4.30	4.18	4.70	4.54
11	4.37	3.96	3.58	3.80	2.68	**4.11**	**4.11**	4.51	5.44	4.23	4.01	5.17	4.88
12	5.49	5.41	4.68	4.96	4.95	**5.15**	**5.15**	**5.15**	4.35	6.33	3.87	5.57	6.03
13	6.55	7.50	6.23	5.49	5.34	6.17	6.17	6.17	7.63	6.22	6.42	6.23	5.63
14	8.60	9.24	8.51	7.61	7.02	**7.71**	**7.71**	**7.71**	4.46	**7.71**	**7.71**	7.66	4.80
15	9.76	10.05	9.78	11.58	**10.47**	**10.47**	**10.47**	**10.47**	**10.47**	**10.47**	**10.47**	**10.47**	9.42
16	9.73	9.34	12.58	11.01	**10.98**	**10.98**	**10.98**	**10.98**	**10.98**	**10.98**	**10.98**	**10.98**	**10.98**
17	12.58	15.74	15.45	12.82	**14.67**	**14.67**	**14.67**	**14.67**	**14.67**	**14.67**	**14.67**	**14.67**	11.28
18	16.01	18.66	13.58	13.00	**15.08**	**15.08**	**15.08**	**15.08**	**15.08**	**15.08**	**15.08**	**15.08**	**15.08**
19	16.60	**16.16**	17.26	13.10	**15.65**	**15.65**	**15.65**	**15.65**	**15.65**	**15.65**	**15.65**	**15.65**	**15.65**
20	11.03	17.64	**15.97**	**15.97**	**15.97**	**15.97**	**15.97**	**15.97**	**15.97**	**15.97**	**15.97**	**15.97**	**15.97**

Table 11. Beginning-of-year (January 1) weights-at-age estimated from actual and assumed commercial weights-at-age (Table 10) as described in the text. Highlighted entries indicate values copied from adjacent cells.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.09	0.23	0.05
3	**0.22**	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.25	0.21	0.30
4	**0.43**	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.42	0.45	0.47
5	**0.70**	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.59	0.61	0.65
6	**1.04**	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	0.97	0.78	0.89
7	**1.43**	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.37	1.18	1.10
8	**1.88**	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.65	1.42
9	**2.37**	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.46	2.16	1.92
10	**2.90**	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.95	2.84	2.46
11	**3.46**	3.46	3.46	3.46	3.46	3.46	3.46	3.46	3.46	3.46	3.54	3.24	2.97
12	**3.95**	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.94	3.87	3.30
13	**5.01**	5.01	5.01	5.01	5.01	5.01	5.01	5.01	5.01	5.01	4.56	4.32	4.32
14	**5.79**	5.79	5.79	5.79	5.79	5.79	5.79	5.79	5.79	5.79	7.52	5.89	4.46
15	**5.82**	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	7.22	8.20	6.62
16	**5.97**	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	6.49	8.14	6.30
17	**6.13**	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	9.25	8.07	7.31
18	**6.25**	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	8.81	12.80	10.23
19	**6.33**	6.33	6.33	6.33	6.33	6.33	6.33	6.33	6.33	6.33	6.80	9.58	9.22
20	**6.89**	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	10.74	11.53	11.53

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	0.20	0.19	0.04	0.20	0.19	0.35	0.19	0.1719	0.22	0.29	0.1896	0.15	0.26
3	0.22	0.34	0.34	0.19	0.35	0.37	0.47	0.37	0.40	0.43	0.40	0.37	0.30
4	0.47	0.52	0.52	0.57	0.54	0.60	0.64	0.68	0.68	0.74	0.66	0.59	0.58
5	0.81	0.77	0.77	0.79	0.90	0.93	0.95	0.97	1.05	1.02	0.98	0.87	0.86
6	1.04	1.13	1.24	1.24	1.32	1.39	1.38	1.44	1.45	1.54	1.31	1.30	1.17
7	1.24	1.44	1.75	2.02	1.97	1.99	1.95	1.86	2.01	2.00	1.92	1.63	1.70
8	1.49	1.70	2.22	2.76	2.96	2.96	2.61	2.44	2.34	2.49	2.46	2.20	1.89
9	1.86	1.97	2.68	3.38	3.79	4.23	3.68	2.97	2.91	2.78	2.96	2.80	2.57
10	2.31	2.57	2.95	3.93	4.61	4.92	5.16	3.99	3.29	3.41	3.13	3.35	3.21
11	3.03	3.09	3.78	4.41	5.09	5.94	5.88	5.72	4.47	3.87	3.85	3.55	4.08
12	3.38	3.90	4.74	5.67	5.94	6.76	6.89	6.72	6.91	5.45	4.41	4.29	4.20
13	4.04	4.76	5.77	7.05	7.76	7.68	7.59	7.52	8.08	8.07	6.60	4.93	5.10
14	5.06	6.26	7.20	7.36	8.32	9.48	9.16	7.82	8.55	9.65	9.01	7.07	5.72
15	4.78	7.13	8.49	8.30	8.38	9.83	9.50	8.87	9.42	10.23	10.80	10.67	7.79
16	5.88	7.64	10.71	9.96	9.37	11.45	11.42	8.43	9.11	11.10	11.35	11.30	12.61
17	6.84	8.24	10.93	11.68	12.15	10.69	12.06	10.51	10.19	13.59	12.13	12.63	10.11
18	8.36	9.75	12.35	9.74	12.51	14.53	10.91	11.65	12.37	13.03	14.73	14.31	17.55
19	9.18	8.39	9.22	11.39	11.76	12.74	12.57	11.42	11.23	15.59	13.64	12.36	16.88
20	11.53	11.53	11.53	11.04	12.49	13.28	12.31	11.37	13.63	11.16	17.22	15.04	14.02

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
2	0.23	0.20	0.26	0.13	0.17	0.21	0.19	0.11	0.35	0.25	0.20	0.23	0.17	**0.17**
3	0.40	0.37	0.33	0.32	0.22	0.38	0.32	0.36	0.39	0.45	0.45	0.41	0.46	0.42
4	0.56	0.60	0.58	0.51	0.46	0.45	0.62	0.56	0.70	0.78	0.69	0.81	0.75	0.80
5	0.84	0.87	0.89	0.82	0.70	0.75	0.83	1.01	1.01	1.21	1.12	1.23	1.34	1.29
6	1.19	1.25	1.24	1.22	1.07	1.01	1.17	1.38	1.69	1.61	1.79	1.79	1.86	1.91
7	1.48	1.59	1.67	1.68	1.56	1.38	1.52	1.78	2.16	2.15	2.23	2.32	2.43	2.45
8	2.03	1.86	2.02	2.10	1.96	3.81	1.81	2.14	2.49	2.61	2.71	2.71	2.92	3.07
9	2.20	2.42	2.25	2.42	2.46	4.35	5.06	2.28	2.85	3.23	3.10	3.33	3.42	3.66
10	2.92	2.75	2.84	2.77	2.43	2.76	5.15	2.99	2.84	3.77	3.98	3.97	4.08	4.23
11	3.92	3.47	3.29	3.41	2.90	3.03	3.44	3.60	3.99	3.67	4.15	4.65	4.79	4.71
12	5.13	4.86	4.30	4.21	4.34	3.71	4.60	2.87	4.43	5.87	4.05	4.73	5.58	5.42
13	5.51	6.42	5.81	5.07	5.15	5.53	5.63	5.63	3.91	5.20	6.37	4.91	5.60	5.82
14	7.03	7.78	7.99	6.89	6.21	6.42	6.90	6.90	5.24	7.67	6.93	7.01	5.47	5.20
15	7.73	9.30	9.51	9.93	8.93	8.57	8.99	8.99	8.99	6.83	8.99	8.99	8.49	6.72
16	9.11	9.55	11.24	10.38	11.27	10.72	10.72	10.72	10.72	10.72	10.72	10.72	10.72	10.17
17	13.04	12.38	12.01	12.70	12.71	12.69	12.69	12.69	12.69	12.69	12.69	12.69	11.13	11.13
18	12.07	15.32	14.62	14.17	13.90	14.87	14.87	14.87	14.87	14.87	14.87	14.87	14.87	13.04
19	19.01	16.08	17.95	13.34	14.27	15.36	15.36	15.36	15.36	15.36	15.36	15.36	15.36	15.36
20	13.96	17.11	16.06	16.60	14.46	15.81	15.81	15.81	15.81	15.81	15.81	15.81	15.81	15.81

Table 12. Estimates of cod abundance (thousands) from surveys in Division 2J in 1983-1992, in Campelen equivalent units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-118 1985	Gadus 131-132 1986	Gadus 145-146 1987	Gadus 159-160 1988	Gadus 174-176 1989	Gadus 190-191 1990	Gadus 208-209 1991	Gadus 224-226 1992
	Mean survey date		05-Nov-83	05-Nov-84	30-Oct-85	11-Nov-86	06-Nov-87	14-Nov-88	10-Nov-89	12-Nov-90	14-Nov-91	05-Nov-92
101-200	201	1427	87811	52543	82806	99720	25126	319	0	0	0	0
	205	1823	122517	182501	48964	44029	34532	38745	502	1223	0	0
	206	2582	55637	142654	68017	134937	17607	83620	48332	2874	3197	3339
	207	2246	145830	101693	171902	37826	38648	45550	9825	15492	0	1545
201-300	202	440	5387	8111	4086	31746	7838	1025	0	0	0	0
	209	1608	108766	14599	39668	142610	48249	47602	140710	8590	9006	2522
	210	774	389901	16929	772	97706	479	10221	43414	34603	24230	2783
	213	1725	62645	33648	67470	102247	36569	43632	183006	89430	25390	1948
	214	1171	18102	112678	78314	157299	128223	115524	70582	18267	2942	897
	215	1270	25616	42569	26380	293011	27603	90521	1689	9434	2271	2114
	228	1428	22525	8643	2582	61157	4153	6679	14364	15813	154727	1964
	234	508	50198	16841	11926	22187	6825	2690	0	0	0	256
301-400	203	480	990	1552	638	5745	3962	5910	0	0	66	110
	208	448	5947	760	4622	9768	12572	1849	53462	8012	986	2465
	211	330	4698	908	2361	4880	4835	6945	35386	23197	67475	8058
	216	384	18	740	396	317	9720	1347	2562	872	687	106
	222	441	0	20	698	61	849	182	33214	4853	1597	364
	229	567	6357	208	3536	1872	338	1222	6214	5577	11518	1508
401-500	204	354	1704	5235	0	1802	1242	5405	268	146	0	162
	217	268	0	38	0	0	184	0	0	0	74	0
	227	686	47	0	0	157	236	252	3350	18150	6810	582
	235	420	9620	404	144	0	780	462	664	3178	12537	212
total strata fished <= 500 meters			1124316	743236	615282	1249077	410570	508714	647594	260268	323637	30960
1 STD strata fished <= 500 meters			320612	112688	88262	261581	66519	74633	112157	45978	165231	5287
501-750	212	664	0	91	23	761	365	548	206	3562	41423	274
	218	420	0	**nf**	0	0	0	0	0	0	0	0
	224	270	0	0	0	0	0	0	0	0	130	0
	230	237	0	0	0	0	0	98	0	978	0	0
501-750		1591	0	91 [1]	23	761	365	646	206	4540	41553	274
751-1000	219	213	0	**nf**	0	0	0	0	0	0	0	0
	231	182	0	0	0	0	0	0	**nf** [1]	0	0	325
	236	122	0	0	0	34	0	0	**nf** [1]	0	0	0
751-1000		517	0	0	0	34	0	0	0 [1]	0	0	325
total strata fished > 500 meters			0	91	23	795	365	646	206	4540	41553	599
total all strata fished			1,124,317	743,328	615,304	1,249,871	410,936	509,360	647,797	264,807	365,191	31,560
1 STD all strata fished			320612	112687	88263	261582	66519	74635	112159	46014	170124	5304
mean number per tow			345.328	237.344	188.987	383.891	126.217	159.411	201.556	81.334	112.166	9.693

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 500 meter depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 13. Estimates of cod biomass (t) from surveys in Division 2J in 1983-1992, in Campelen equivalent units.

Stratum	Stratum	Area sq.	Gadus	Gadus	Gadus	Gadus	Gadus	Gadus	Gadus	Gadus	Gadus	Gadus
depth	number	nautical	86-88	101-102	116-118	131-132	145-146	159-160	174-176	190-191	208-209	224-226
(meters)		miles	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Mean survey date			05-Nov-83	05-Nov-84	30-Oct-85	11-Nov-86	06-Nov-87	14-Nov-88	10-Nov-89	12-Nov-90	14-Nov-91	05-Nov-92
101-200	201	1427	61842	41743	58556	88676	27395	208	0	0	0	0
	205	1823	53701	95026	30679	38754	31421	61555	691	182	0	0
	206	2582	33286	121643	49111	123683	16999	92563	38555	661	1333	1489
	207	2246	46134	55054	107180	25989	36773	18803	2352	6370	0	649
201-300	202	440	8365	7647	3064	32711	11398	1874	0	0	0	0
	209	1608	127333	17017	35398	119210	56901	28242	52339	1670	3966	990
	210	774	241006	21752	1521	87332	737	10667	36642	12536	13406	1116
	213	1725	50086	27703	55229	98497	41997	53146	120476	34360	11859	587
	214	1171	19316	104048	77051	189715	170212	137161	56924	13766	1018	399
	215	1270	30986	31690	30602	379256	36553	146322	315	8508	1073	760
	228	1428	8049	7695	1244	52833	4800	10296	12552	8973	65772	672
	234	508	16910	11930	9173	22705	7342	5157	0	0	0	68
301-400	203	480	2250	3445	582	7875	6300	9640	0	0	45	77
	208	448	7465	1115	4301	8575	16641	3653	22845	3699	455	1091
	211	330	6334	1570	3287	4661	7667	7283	56896	10465	35048	3629
	216	384	52	1592	429	435	13557	2201	3178	255	287	25
	222	441	0	32	784	59	1192	247	9028	2559	579	175
	229	567	2354	263	3823	2399	340	1889	6166	4265	4906	595
401-500	204	354	2458	5863	0	2174	1732	8318	36	37	0	48
	217	268	0	60		0	211	0	0	0	45	0
	223	180	0	0	0	0	0	57	23	212	107	13
	227	686	217	0	0	224	341	353	5407	17904	4643	311
	235	420	4348	332	133	0	1090	717	962	1930	5594	101
total strata fished <= 500 meters			722492	557160	472147	1285763	491599	598478	425387	128352	150136	12795
1 STD strata fished <= 500 meters			177183	83218	65293	325107	31381	97959	218324	25701	72612	2315
501-750	212	664	0	**nf**	0	0	0	0	0	2196	20693	159
	218	420	0	0	0	0	0	0	0	0	62	0
	224	270	0	0	0	0	0	193	0	0	0	0
	230	237	0	0	0	0	0	0	0	1395	0	0
501-750		1591	0	0 [1]	0	0	0	193	0	3591	20755	159
751-1000	219	213	0	nf	0	0	0	0	0	0	0	0
	231	182	0	0	0	0	0	0	**nf**	0	0	144
	236	122	0	0	0	62	0	0	**nf**	0	0	0
751-1000		517	0	0	0	62	0	0	0 [1]	0	0	144
total strata fished > 500 meters			0	0	0	62	0	193	0	3591	20755	303
total all strata fished			722491	557302	472214	1287042	492144	599436	425874	131943	170892	13096
1 STD all strata fished			177183	83218	65293	325108	84935	97963	85921	25746	74135	2326

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 500 meter depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 14. Estimates of cod abundance (thousands) from surveys in Division 2J in 1993-2000, in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-2000.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	GADUS 236-238 1993	GADUS 250-252 1994	TELEOST 20-23 1995-6	TELEOST 39 1996	TELEOST 54-54 1997	TELEOST 72-73 1998	TELEOST 86-88 1999	TELEOST 340-343 2000
Mean survey date			07-Nov-93	17-Nov-94	28-Dec-95	30-Oct-96	27-Oct-97	27-Oct-98	13-Nov-99	07-Nov-00
101-200	201	633	0	0	nf	0	0	44	44	0
	205	1594	63	219	nf	110	110	32	37	37
	206	1870	547	0	0	184	257	294	110	115
	207	2246	2128	2699	350	588	138	751	666	1280
	237	733	151	0	273	134	0	34	0	101
	238	778	nf	0	nf	107	36	0	0	0
201-300	202	621	0	0	49	0	0	0	0	0
	209	680	374	514	327	249	62	243	374	187
	210	1035	5731	854	1424	320	214	178	854	676
	213	1583	871	0	2504	835	1085	871	290	1161
	214	1341	1771	338	323	959	406	418	221	517
	215	1302	1719	358	90	2373	1381	498	788	609
	228	2196	436	0	949	2068	1347	2001	868	944
	234	530	0	0	nf	73	142	36	32	36
301-400	203	487	0	301	0	335	234	67	100	0
	208	588	0	162	768	566	0	40	40	335
	211	251	414	322	708	483	0	192	383	533
	216	360	0	173	927	715	99	74	275	198
	222	450	279	846	495	543	1021	272	371	495
	229	536	590	295	627	946	205	74	442	184
401-500	204	288	0	0	16	20	0	0	14	0
	217	241	66	55	561	63	0	166	33	33
	223	158	0	0	880	91	54	19	0	nf
	227	598	795	0	370	1207	41	247	0	55
	235	414	1044	1006	541	101	85	85	0	0
	240	133	9	0	123	9	18	0	128	18
total strata fished <= 500 meters			16989	8145	12305	13081	6936	6636	6074	7516
1STD strata fished <= 500 meters			4595	2584	1822	1968	1000	919	958	1132
501-750	212	557	77	128	69	136	77	0	0	38
	218	362	0	50	1660	75	0	0	0	0
	224	228	0	0	596	0	0	0	42	0
	230	185	0	34	13	0	0	0	13	13
	239	120	17	17	0	8	7	0	0	0
751-1000	219	283	0	0	0	0	0	0	0	0
	231	186	0	0	0	0	0	0	0	0
	236	193	0	0	12	0	0	0	0	0
1001-1250	220	330	nf	nf	nf	0	0		nf	
	225	195	nf	nf	nf	0	0		0	
	232	228	nf	nf	nf	0	0		0	
1001-1250[1]		753	nf	nf	nf	0	0	0	0	
1251-1500[1]		768	nf	nf	nf	0		0	0	
total strata fished > 500 meters			94	229	2350	219	84	0	55	51
total all strata fished			17082	8373	14654	13300	7020	6636	6129	7567
upper			28898	16608	19098	17696	9136	8538	8220	10060
t-value			2.571	3.182	2.16	2.228	2.11	2.07	2.18	2.2
1 STD all strata fished			4596	2588	2057	1973	1003	919	959	1133

[1] Not all strata in the depth range have been fished . Because of the short time series with the revised stratification scheme and a switch in 1995 to a different vessel and gear no attempt has been made to use a multiplicative model to fill strata which were not fished.

Table 15. Estimates of cod biomass (t) from surveys in Division 2J in 1993-2000, in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-2000.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	GADUS 236-238 1993	GADUS 250-252 1994	TELEOST 20-23 1995-6	TELEOST 39 1996	TELOST 54-55 1997	TELOST 72-73 1998	TELOST 86-88 1999	TELEOST 340-343 2000
Mean survey date			07-Nov-93	17-Nov-94	28-Dec-95	30-Oct-96	27-Oct-97	27-Oct-98	13-Nov-99	07-Nov-00
101-200	201	633	0	0	nf	0	0	30	6	0
	205	1594	63	151	nf	16	42	5	4	42
	206	1870	155	0	0	62	125	186	24	47
	207	2246	452	507	44	57	110	406	156	220
	237	733	83	0	13	8	0	2	0	3
	238	778	nf	0	nf	21	27	0	0	0
201-300	202	621	0	0	9	0	0	0	0	0
	209	680	100	67	52	20	44	162	86	60
	210	1035	1158	139	108	26	112	98	168	271
	213	1583	346	0	336	214	586	639	180	398
	214	1341	700	174	39	273	186	289	127	303
	215	1302	443	210	21	773	586	404	625	436
	228	2196	294	0	263	665	747	1258	280	433
	234	530	0	0	nf	22	83	3	1	3
301-400	203	487	0	220	0	136	157	67	107	0
	208	588	0	41	123	200	0	4	12	268
	211	251	241	110	141	81	0	139	71	208
	216	360	0	96	234	194	54	73	82	95
	222	450	146	276	124	290	495	194	200	193
	229	536	109	124	184	305	138	54	172	63
401-500	204	288	0	0	1	8	0	0	19	0
	217	241	67	19	135	26	0	177	14	7
	223	158	0	0	135	32	35	25	0	**nf**
	227	598	441	0	109	748	33	197	0	23
	235	414	318	559	175	84	30	71	0	0
	240	133	13	0	68	2	19	0	192	10
total strata fished <= 500 meters			5129	2693	2312	4261	3609	4483	2527	3082
1STD strata fished <= 500 meters			883	514	272	796	463	693	611	488
501-750	212	557	93	89	15	22	49	0	0	10
	218	362	0	51	519	12	0	0	0	0
	224	228	0	0	205	0	0	0	45	0
	230	185	0	32	14	0	0	0	18	6
	239	120	17	11	0	2	3	0	0	0
751-1000	219	283	0	0	0	0	0	0	0	0
	231	186	0	0	0	0	0	0	0	0
	236	193	0	0	2	0	0	0	0	0
1001-1250[1]		753	**nf**	**nf**	**nf**	0	0	0	0	0
1251-1500[1]		768	**nf**	**nf**	**nf**	0	0	0	0	0
total strata fished > 500 meters			110	183	755	36	52	0	63	16
total all strata fished			5238	3448	3067	4298	3662	4483	2590	3098
1 STD all strata fished			888	262	380	797	465	693	613	488

[1] Not all strata in the depth range have been fished . Because of the short time series with the revised stratification scheme and a switch in 1995 to a different vessel and gear no attempt has been made to use a multiplicative model to fill strata which were not fished.

Table 16. Estimates of cod abundance (thousands) from surveys in Division 3K in 1983-1992, in Campelen equivalent units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	GADUS 87-88 1983	GADUS 101-103 1984	GADUS 117-118 1985	GADUS 131-132 1986	GADUS 146-147 1987	GADUS 160-161 1988	GADUS 175-176 1989	GADUS 191-192 1990	GADUS 209-210 1991	GADUS 224-226 1992
Mean survey date			26-Nov-83	23-Nov-84	18-Nov-85	01-Dec-86	27-Nov-87	05-Dec-88	05-Dec-89	04-Dec-90	04-Dec-91	26-Nov-92
101-200	618	1455	**17028**	24569	26453	64689	14954	57577	14811	13210	721	1268
	619	1588	**3835**	9955	1155	17476	6826	19598	63705	2578	0	218
201-300	620	2709	126888	110535	4685	135397	32793	100337	253826	11304	3780	2236
	621	2859	33593	32109	8338	27811	16059	32525	44025	14230	2517	131
	624	668	10016	9786	2550	2573	1746	3982	4901	24948	7076	735
	632	447	30765	**9851**	4591	4735	7410	51959	4888	22044	10336	1438
	634	1618	61564	31160	29182	323578	60702	21441	269092	4610	99321	694
	635	1274	7711	29442	4682	14225	3593	9534	5934	3505	1490	701
	636	1455	8807	17788	3828	21566	6777	12743	13850	715	1134	133
	637	1132	31704	73889	15928	46132	15805	24915	13766	6634	5320	156
301-400	623	1027	29291	51057	3697	4026	11782	23649	102872	50690	3155	5557
	625	850	4677	1988	7156	3196	11400	5554	21251	11693	1676	546
	626	919	6953	3266	2705	62324	5815	5006	12566	9260	1264	632
	628	1085	7935	4670	6617	2687	1582	18448	12575	5522	9303	4179
	629	495	2357	2557	1647	5720	938	7276	3135	6521	978	1853
	630	544	1497	2170	262	262	524	524	7009	1085	499	150
	633	2179	15312	21312	38293	96780	49404	15737	220703	243039	185926	7410
	638	2059	53867	17476	37259	36467	24472	23650	137139	360185	200000	7511
	639	1463	12449	5283	8780	15127	5980	12176	19270	52757	91771	2262
401-500	622	632	304	1434	283	1652	174	3188	21561	12476	1449	1594
	627	1194	1032	1038	372	4658	2633	1173	10505	85313	4506	3692
	631	1202	1025	33	472	207	3059	6063	42471	28964	15157	992
	640	198	194	0	9	14	0	109	2982	150	1970	17459
	645	204	0	0	9	**90**	112	28	4686	379	0	75
total strata fished <=500 meters			447748	451517	208952	891302	284541	457191	1307523	971810	649350	61622
1 STD strata fished <=500 meters			61132	68574	27228	321032	44267	73335	270219	184614	159892	17726
501-750[1]		917	0	0	0	**nf**	107	**nf**	**nf**	92	122	263
751-1000[1]		1340	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	128	56	0
total strata fished > 500 meters			0	0	0	0	107	0	0	220	178	263
total all strata fished			447748	451517	208952	891302	284648	457191	1307523	972029	649529	61886
1 STD all strata fished			61132	68574	27228	321032	44267	73335	270219	184614	159892	17726

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 500 meter depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 17. Estimates of cod biomass (t) from surveys in Division 3K in 1983-1992, in Campelen equivalent units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	GADUS 87-88 1983	GADUS 101-103 1984	GADUS 117-118 1985	GADUS 131-132 1986	GADUS 146-147 1987	GADUS 160-161 1988	GADUS 175-176 1989	GADUS 191-192 1990	GADUS 209-210 1991	GADUS 224-226 1992
Mean survey date			26-Nov-83	23-Nov-84	18-Nov-85	01-Dec-86	27-Nov-87	05-Dec-88	05-Dec-89	04-Dec-90	04-Dec-91	26-Nov-92
101-200	618	1455	**7987**	18702	24894	53641	10200	2443	1575	1514	261	450
	619	1588	**1491**	4801	1113	3157	2538	1212	3363	154	0	119
201-300	620	2709	67557	87523	8223	131461	27088	13232	24447	1636	1158	847
	621	2859	18041	25813	6216	19356	3294	11590	7313	1021	359	194
	624	668	3920	3082	2340	2798	802	3087	1660	8649	3809	331
	632	447	33968	**10779**	4106	4540	7824	51549	2030	8677	5581	663
	634	1618	56301	24843	28663	436500	80357	19008	322401	1976	77639	450
	635	1274	4940	11970	3551	16754	3329	3843	2609	998	617	319
	636	1455	11657	13899	3977	13264	5871	9229	3577	431	334	138
	637	1132	36769	75369	15341	50718	15913	29982	13010	2665	2332	85
301-400	623	1027	23690	46679	5155	4602	17254	3662	22849	12857	1130	1960
	625	850	5410	2474	7062	3405	11136	5766	12105	4049	861	291
	626	919	5565	3377	4274	41267	4852	1188	5858	718	345	218
	628	1085	8807	4909	7807	2564	1484	7998	7102	2184	4028	1345
	629	495	2506	1739	955	5557	907	1391	1550	2003	95	535
	630	544	1452	1564	435	292	743	863	9065	644	267	85
	633	2179	15440	23201	39817	115810	66782	15297	148660	169097	132091	4366
	638	2059	56662	12773	35965	37822	31829	18946	184194	353107	150413	3564
	639	1463	17739	5242	8657	14185	6332	7526	7803	24244	74514	941
401-500	622	632	541	1487	215	1307	163	847	8794	2974	498	564
	627	1194	970	772	360	5307	1150	1208	4805	13523	1248	765
	631	1202	2700	138	493	273	3049	6448	31211	11300	8691	732
	640	198	**385**	0	16	22	0	299	2436	204	1231	16334
	645	204	0	0	50	**255**	139	122	1628	368	0	48
total strata fished <=500 meters			374634	370356	209686	964600	303038	216734	830045	624993	467505	35346
1 STD strata fished <=500 meters			51399	58138	26560	428297	61366	50225	289567	207590	128742	16146
501-750[1]		917	0	0	0	**nf**	174	**nf**	**nf**	72	133	258
751-1000[1]		1340	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	70	39	0
total strata fished > 500 meters			0	0	0	0	174	0	0	142	172	258
total all strata fished			374634	370356	209686	964600	303212	216734	830045	645136	649529	35604
1 STD all strata fished			51399	58138	26560	428297	61366	50225	289567	198748	159892	16146

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 500 meter depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 18. Estimates of cod abundance (thousands) from surveys in Division 3K in 1993-2000, in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-2000.

Depth range meters	Stratum number	Stratum area sq. mi.	GADUS 236-238 1993	GADUS 250-252 1994	WT 176-81 TELEOST 20-23 1995-6	WT 196-199 TELEOST 40-42 1996	WT 217 TELOEST 55-57 1997	TELEOST 73-75 1998	TELEOST 86-88 1999	TELEOST 340-343 2000
Mean survey date			23-Nov-93	07-Dec-94	26-Dec-95	14-Nov-96	18-Nov-97	14-Nov-98	30-Nov-99	23-Nov-00
101-200	618	1347	2409	159	1170	1887	1174	1065	865	2038
	619	1753	965	0	655	218	448	2411	281	2097
201-300	620	2545	3268	350	1465	947	764	1814	2514	3383
	621	2736	0	251	2393	303	44	494	1301	1700
	624	1105	391	152	813	2432	395	973	472	456
	634	1555	468	642	214	1246	31	672	397	616
	635	1274	467	0	88	386	243	491	245	361
	636	1455	734	200	286	133	267	367	300	291
	637	1132	4983	389	242	810	125	529	1093	**nf**
301-400	617	593	1876	184	693	109	1006	160	547	1332
	623	494	1138	0	578	510	136	217	34	136
	625	888	285	0	342	131	305	329	1160	275
	626	1113	714	204	2709	1415	31	1868	4651	1217
	628	1085	1443	299	1556	826	358	1151	2507	2478
	629	495	908	375	545	68	69	102	272	393
	630	332	0	0	41	0	69	23	69	95
	633	2067	1153	2218	851	1381	885	695	1788	853
	638	2059	8780	1187	1252	2155	472	661	5413	7308
	639	1463	1489	1711	712	1025	537	503	1540	786
401-500	622	691	1141	57	542	230	63	507	405	665
	627	1255	2992	604	4924	1918	514	414	2463	9091
	631	1321	0	182	501	273	84	0	784	54
	640	69	228	16	218	25	43	47	66	47
	645	216	79	119	134	30	15	43	59	104
	650	134	995	65	276	92	350	74	78	**nf**
total strata fished <= 500 meters			36907	9361	23200	18550	8428	15612	29308	35774
1 STD strata fished <= 500 meters			5817	2408	1734	2115	1130	1967	2819	8530
501-750	641	230	11	21	63	47	0	16	0	**nf**
	646	325	75	0	0	0	22	0	89	0
	651	359	16	123	691	25	0	198	0	**nf**
751-1000	642	418	115	0	0	0	0	0	0	0
	647	360	0	0	0	0	0	0	0	0
	652	516	142	106	0	0	0	71	35	0
1001-1250[3]		1264	**nf**	**nf**	0	0	0	0	0	0
1251-1500[3]		1165	**nf**	**nf**	0	0	0	0	0	0
total strata fished > 500 meters			359	250	754	72	22	285	124	0
total all strata fished			37265	9612	23954	18621	8450	15896	29433	39110
1 STD all strata fished			5819	2412	1790	2116	2586	1969	2821	8585

[1] Not all strata in the depth range have been fished. Because of the short time series with the revised stratification scheme and a switch in 1995 to a different vessel and gear no attempt has been made to use a multiplicative model to fill strata which were not fished.

Table 19. Estimates of cod biomass (t) from surveys in Division 3K in 1993-2000, in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-2000.

					WT 176-181	WT 196-199	WT 217			
Depth		Stratum	GADUS	GADUS	TELEOST	TELEOST	TELOEST	TELEOST	TELEOST	TELEOST
range	Stratum	area	236-238	250-252	20-23	40-42	55-57	73-75	86-88	340-343
meters	number	sq. mi.	1993	1994	1995-6	1996	1997	1998	1999	2000
Mean survey date			23-Nov-93	07-Dec-94	26-Dec-95	14-Nov-96	18-Nov-97	14-Nov-98	30-Nov-99	23-Nov-00
101-200	618	1347	721	40	87	221	291	170	56	252
	619	1753	708	0	32	42	36	158	20	154
201-300	620	2545	614	118	238	230	203	471	245	415
	621	2736	0	267	302	77	202	207	296	397
	624	1105	177	85	251	714	207	752	263	225
	634	1555	189	417	97	391	7	300	178	152
	635	1274	189	0	10	94	208	322	76	104
	636	1455	334	141	92	39	234	303	171	260
	637	1132	2039	74	74	358	38	321	575	**nf**
301-400	617	593	383	74	97	14	359	95	212	237
	623	494	213	0	32	144	37	70	10	41
	625	888	229	0	99	66	139	166	573	173
	626	1113	468	89	289	340	6	1034	1217	259
	628	1085	736	80	353	409	274	647	837	524
	629	495	343	20	70	12	45	54	116	192
	630	332	0	0	11	0	53	14	30	38
	633	2067	502	1067	420	535	516	624	1138	615
	638	2059	3913	401	635	723	232	593	3372	3974
	639	1463	622	761	290	415	260	494	1124	780
401-500	622	691	299	32	68	55	19	143	178	138
	627	1255	891	226	702	466	211	150	825	2917
	631	1321	0	208	99	45	90	0	481	27
	640	69	131	11	90	13	30	71	96	37
	645	216	84	87	48	14	11	44	62	84
	650	134	441	43	112	40	292	76	78	**nf**
total strata fished <= 500 meters			14227	4241	4578	5457	3978	7280	12230	11994
1 STD strata fished <= 500 meters			1925	1062	427	608	492	1022	1291	2976
501-750	641	230	16	18	83	101	0	13	0	**nf**
	646	325	51	0	0	0	42	0	200	0
	651	359	25	116	317	30	0	133	0	**nf**
751-1000	642	418	72	0	0	0	0	0	0	0
	647	360	0	0	0	0	0	0	0	0
	652	516	208	62	0	0	0	96	89	0
1001-1250[3]		1264	**nf**	**nf**	0	0	0	0	0	
1251-1500[3]		1165	**nf**	**nf**	0	0	0	0	0	0
total strata fished > 500 meters			372	196	400	131	42	242	289	
total all strata fished			14598	4437	4978	5588	4020	7522	12519	12585
1 STD all strata fished			1927	1066	475	608	741	1027	1312	2981

[1] Not all strata in the depth range have been fished. Because of the short time series with the revised stratification scheme and a switch in 1995 to a different vessel and gear no attempt has been made to use a multiplicative model to fill strata which were not fished.

Table 20. Estimates of cod abundance (thousands) from surveys in Division 3L in 1988-2000 in depths <= 200 fathoms. The 1988-1994 data are in Campelen equivalent units and the 1995-2000 data are in actual Campelen units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	WT 78 1988	WT 87 1989	WT 101 1990	WT 114-115 1991	WT 129-130 1992	WT 145-146 1993	WT 160-162 1994	WT 176-181 1995	Tel 41 WT 196-198 1996	Tel 55-57 WT 213-217 1997	WT 230-233 1998	WT 245-247 1999	WT 321-323 Tel 342-343 2000
Mean survey date			03-Nov-88	20-Oct-89	05-Nov-90	21-Nov-91	16-Nov-92	23-Nov-93	22-Nov-94	27-Nov-95	02-Nov-96	27-Nov-97	15-Nov-98	29-Nov-99	28-Nov-00
31-50	350	2071	13276	10854	5911	5359	1140	1804	122	1045	285	570	773	1587	936
	363	1780	23286	43993	52247	3702	13036	408	367	365	82	1306	481	367	184
	371	1121	4472	193	7556	411	1079	103	0	31	0	0	0	39	0
	372	2460	16269	32627	141824	3774	2919	299	0	353	414	42	1114	1269	1523
	384	1120	1489	986	41791	1061	146	154	0	0	0	0	0	385	77
51-100	328	1519	8806	1224	2090	279	1114	488	139	0	334	376	334	1226	209
	341	1574	1245	298	1985	505	217	1516	0	36	289	54	223	1256	476
	342	585	429	80	2052	161	54	0	80	40	121	40	80	724	201
	343	525	650	24	1372	481	722	72	96	36	0	68	0	361	397
	348	2120	3995	6189	6389	1896	3208	**nf**	219	250	393	167	194	767	292
	349	2114	7302	1745	4736	3722	58	1939	208	122	166	344	162	955	614
	364	2817	10048	1656	13595	291	388	1421	323	43	116	525	0	775	1163
	365	1041	1690	573	895	1575	286	95	95	215	207	191	0	0	**nf**
	370	1320	623	121	1888	121	484	666	0	73	0	91	0	0	257
	385	2356	25	29	1713	389	648	0	0	0	36	0	41	41	0
	390	1481	3107	2183	1290	0	136	0	0	34	0	0	0	204	0
101-150	344	1494	4874	4580	9454	3186	5446	2363	771	530	2950	914	715	1548	2023
	347	983	10628	4571	30560	609	676	439	34	199	391	541	406	316	371
	366	1394	66130	17888	9812	19359	44544	2972	115	230	236	652	443	345	671
	369	961	12241	1005	2809	12559	1884	227	0	78	0	220	39	1332	0
	386	983	4895	6464	7099	135	766	135	0	0	45	0	0	45	0
	389	821	13270	10023	2936	10842	0	0	0	38	0	38	0	151	113
	391	282	427	1028	1629	233	129	116	0	0	0	19	0	97	19
151-200	345	1432	11285	5881	11977	4432	985	1510	542	2780	433	302	653	2863	4436
	346	865	27058	9073	14517	37387	33292	1417	136	754	379	1269	297	881	45577
	368	334	5008	1861	11555	27437	30338	15627	88	299	128	459	368	980	9396
	387	718	1753	1350	3325	2963	2864	2601	779	66	44	1514	132	527	494
	388	361	1813	5761	1962	1556	579	414	177	99	0	135	0	5313	472
	392	145	289	40	598	259	20	27	0	19	18	20	0	928	130
total strata fished <= 200 fathoms			256383	172299	395569	144684	147159	36813	4292	7732	7066	9859	6454	25281	29010
ADJUSTED			256383	172300	395567	144684	147158	36813	4291	7735	7067	9859	6454	25281	29010
upper			312134	235628	525307	181155	215462	65605	6233	12328	12052	15027	8524	95232	52913
t-value			2.069	2.06	2.201	2.08	2.012	2.306	2.042	2.306	2.571	2.776	2.05	12.71	4.3
1 STD strata fished <= 200 fathom			26946	30742	58945	17534	33948	12486	951	1993	1939	1862	1010	5504	5559

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 200 fathom depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 21. Estimates of cod biomass (t) from surveys in Division 3L in 1988-2000 in depths <= 200 fathoms. The 1988-1994 data are in Campelen equivalent units and the 1995-2000 data are in actual Campelen units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	WT 78 1988	WT 87 1989	WT 101 1990	WT 114-115 1991	WT 129-130 1992	WT 145-146 1993	WT 160-162 1994	WT 176-181 1995	Teleost 41 WT 196-199 1996	Tel 55-57 WT 213-217 1997	WT 230-233 1998	WT 246-248 1999	WT 321-323 Tel 342-343 2000
Mean survey date			03-Nov-88	20-Oct-89	05-Nov-90	21-Nov-91	16-Nov-92	23-Nov-93	22-Nov-94	27-Nov-95	02-Nov-96	27-Nov-97	15-Nov-98	29-Nov-99	28-Nov-00
31-50	350	2071	16885	10769	6602	6434	1877	1522	179	1276	362	1355	997	1342	842
	363	1780	30177	33959	35121	4266	7504	344	211	506	224	2895	152	80	28
	371	1121	7746	457	9110	481	893	91	0	10	0	0	0	26	0
	372	2460	19194	29816	177108	3164	1896	287	0	54	557	29	431	608	66
	384	1120	1681	223	61815	674	127	67	0	0	0	0	0	212	4
51-100	328	1519	3397	1101	415	185	1748	166	248	0	537	1014	144	195	41
	341	1574	1273	198	1237	920	253	289	0	2	248	16	290	1043	120
	342	585	583	114	1029	383	123	0	36	22	184	66	5	164	135
	343	525	661	90	653	132	459	79	34	18	0	45	0	69	130
	348	2120	3906	4158	2995	1666	1504	**nf**	322	181	326	144	191	144	55
	349	2114	8207	2690	3630	5454	66	1755	54	88	117	327	357	531	228
	364	2817	7216	1681	6851	915	526	873	302	1	95	353	0	331	403
	365	1041	1961	797	509	2814	347	54	114	129	147	72	0	0	**nf**
	370	1320	1128	224	1159	189	673	171	0	72	0	41	0	0	107
	385	2356	303	110	1620	300	735	0	0	0	11	0	57	13	0
	390	1481	516	294	283	0	81	0	0	13	0	0	0	81	0
101-150	344	1494	2746	2435	5079	809	3003	988	382	233	2214	221	409	802	908
	347	983	9386	5239	18473	369	181	351	20	99	324	259	407	81	87
	366	1394	76378	18189	8194	15225	40824	2426	116	121	87	264	223	58	321
	369	961	12361	3266	3223	13072	937	180	0	174	0	170	4	1048	0
	386	983	6410	7472	10209	124	366	194	0	0	20	0	0	26	0
	389	821	2951	5134	3838	3388	0	0	0	12	0	35	0	58	54
	391	282	76	158	577	74	18	53	0	0	0	21	0	178	1
151-200	345	1432	14557	7883	7575	1775	736	957	245	1441	370	76	512	1301	1299
	346	865	33516	14619	13512	27945	29383	702	91	459	243	466	287	414	1359
	368	334	7539	4904	13883	26629	29646	10776	80	129	48	181	240	954	8268
	387	718	2623	1146	9129	3515	2018	1984	321	25	19	851	99	284	227
	388	361	1067	3506	1564	740	390	268	119	35	0	78	0	3080	335
	392	145	110	55	276	117	9	19	0	15	7	10	0	489	51
total strata fished <= 200 fathoms			274553	160688	405668	121761	126323	24594	2873	5114	6140	8991	4804	13611	15070
ADJUSTED			274554	160687	405669	121759	126323	24596	2874	5115	6140	8991	4804	13611	
upper			337286	205564	592708	154941	193308	44710	3895	7661	9799	13920	6901	56006	83892
t-value			2.086	2.069	2.306	2.131	2.014	2.306	2.035	2.145	2.306	2.228	2.04	12.71	12.71
1 STD strata fished <= 200 fathoms			30073	21690	81110	15570	33260	8723	502	1187	1587	2212	1028	3336	5415

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 200 fathom depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 22. Estimates of cod abundance (thousands) and biomass (t) from surveys in Division 3L in 1990-2000 in depths > 200 fathoms. The 1990-1994 data are in Campelen equivalent units and the 1995-2000 data are in actual Campelen units.

Stratum	Stratum	Area sq.							Teleost 41	Tel 55-57			
depth	number	nautical	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT 321-323
(fathoms)		miles	101	114-115	129-130	145-146	160-162	176-181	196-198	213-217	230-233	246-249	Tel 342-343
			1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Mean survey date			05-Nov-90	21-Nov-91	16-Nov-92	23-Nov-93	22-Nov-94	27-Nov-95	02-Nov-96	27-Nov-97	18-Nov-98	29-Nov-99	28-Nov-00
					ABUNDANCE								
201-300	729	186	38	0	13	213	0	0	0	13	0	38	0
	731	216	15	30	168	277	21	13	**nf**	178	0	40	208
	733	468	386	21	494	1223	107	32	0	193	61	64	101
	735	272	**nf**	923	886	9155	180	187	0	449	112	67	3528
301-400	730	170	**nf**	0	0	0	8	0	0	0	0	0	0
	732	231	0	0	0	0	0	0	0	0	0	0	0
	734	228	0	0	0	31	42	0	0	167	0	0	0
	736	175	0	24	0	96	28	32	0	144	0	24	0
401-500	737	227	**nf**	**nf**	**nf**	**nf**	**nf**	16	0	0	0	0	0
	741	223	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	745	348	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	748	159	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
401-500		957	**nf**	**nf**	**nf**	**nf**	**nf**	16	0	0	0		0
501-600	738	221	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0	0
	742	206	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	746	392	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	749	126	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	**nf**	0
501-600		945	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0	0
601-700	739	254	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	743	211	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	747	724	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	750	556	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
601-700		1745	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	
701-800	740	264	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	744	280	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	**nf**	0
	751	229	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	**nf**	0
701-800		773	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
total strata fished > 200 fathioms			439	998	1561	10995	386	280	0	1144	173	233	3837
total all strata fished offshore			396008	145682	148719	47809	4678	8013	7066	11003	6628	25514	32846
upper			525748	182099	217045	77554	6627	12630	12052	19944	8699	95474	58560
t-value			2.201	2.074	2.012	2.228	2.042	2.306	2.571	2.447	2.05	12.71	4.3
1 STD all strata fished offshore			58946	17559	33959	13351	954	2002	1939	3654	1010	5504	5980
					BIOMASS								
201-300	729	186	107	0	45	208	0	0	0	19	0	67	0
	731	216	19	49	131	177	23	5	**nf**	178	0	20	165
	733	468	937	28	316	837	85	14	0	161	68	66	110
	735	272	**nf**	1214	1233	4809	91	109	0	369	167	104	3973
301-400	730	170	**nf**	0	0	0	8	0	0	0	0	0	0
	732	231	0	0	0	0	0	0	0	0	0	0	0
	734	228	0	0	0	18	42	0	0	313	0	0	0
	736	175	0	56	0	51	28	15	0	169	0	37	0
401-500	737	227	**nf**	**nf**	**nf**	**nf**	**nf**	17	0	0	0	0	0
	741	223	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	745	348	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
	748	159	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
401-500		957	**nf**	**nf**	**nf**	**nf**	**nf**	17	0	0	0		0
501-600		945	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0	0
601-700		1745	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
701-800		773	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	0	0	0	0
total strata fished > 200 fathoms			1063	1347	1725	6100	277	160	0	1209	235	294	4248
total all strata fished offshore			406730	123108	128048	30694	3149	5275	6140	10200	5039	13904	19318
1 STD all strata fished offshore			81110	15618	33279	9033	506	1193	1587	3922	1019	3337	5652

nf Not all strata in the depth range hav been fished. Strata not fished in the greater than 200 fathom depth range have not been filled using a multiplicative model.

Table 23. Estimates of cod abundance (thousands) and biomass (t) from surveys in inshore strata of divisions 3K and 3L in 1996-1998 and 2000. Also shown are totals for offshore strata and for all strata fished.

Division 3K

Stratum depth (meters)	Stratum number	Area sq. nautical miles	WT 196-199 TELEOST 40-42 1996	WT 217 TELEOST 55-57 1997	WT 233 1998	WT 321-323 Tel 342-343 2000	WT 196-199 TELEOST 40-42 1996	WT 217 TELEOST 55-57 1997	WT 233 1998	WT 321-323 2000
Mean survey date			14-Nov-96	18-Nov-97	02-Dec-98	28-Nov-00	14-Nov-96	18-Nov-97	02-Dec-98	28-Nov-00
			abundance				biomass			
101-200	608	798	915	1061	1647	2023	201	142	113	288
	612	445	510	92	367	184	111	3	18	7
	616	250	103	52	206	103	4	0	5	9
201-300	609	342	436	329	155	188	108	64	30	79
	611 [3]	600	122	578	169	428	25	129	9	136
	615	251	0	17	104	86	0	0	61	8
301-400	610	256	31	405	493	317	3	117	50	63
	614	263	16	0	18	0	2	0	33	0
401-500	613	30	0	0	12	7	0	0	1	1
total inshore strata			2133	2534	3171	3336	454	455	320	592
total offshore			18622	8450	15896	35774	5588	4020	7521	11994
total all strata fished			20756	10984	19067	39110	6039	4475	7843	12585
upper			25281	13883	23352	61173	7036	5583	10141	19889
t-value			2.048	2.101	2.1	2.57	2.032	2.11	2.23	2.45
STD all strata fished			2209	1380	2040	8585	491	525	1030	2981

Division 3L

Stratum depth (fathoms)	Stratum number	Area sq. nautical miles	Teleost 41 WT 196-198 1996	WT 213-217 TELEOST 57-58 1997	WT 233 1998	WT 321-323 Tel 342-343 2000	Teleost 41 WT 196-198 1996	WT 213-217 TELEOST 57-58 1997	WT 233 1998	WT 321-323 2000
Mean survey date			02-Nov-96	27-Nov-97	28-Nov-98	28-Nov-00	02-Nov-96	27-Nov-97	28-Nov-98	28-Nov-00
			abundance				biomass			
16-30	784	268	1161	977	203	1419	80	40	3	597
31-50	785	465	3998	1279	352	1567	6627	1786	109	564
51-100	786	84	12	97	532	58	2	36	54	43
	787	613	42	84	4005	1288	135	61	105	214
	788 [1]	252	2409	323	144	1849	177	232	92	79
	790	89	55	444	61	208	56	222	24	67
	793	72	599	119	64	337	155	56	24	35
	794	216	609	97	104	**nf**	84	122	31	**nf**
	797	98	20	27	101	440	11	13	24	25
	799	72	857	30	39	89	410	19	9	9
101-150	795	164	11	64	163	1277	5	50	58	69
	791 [2]	227		200	94	710		154	53	274
101-200	789 [1]	81	0	0	0	4	0	0	0	1
	791 [2]	308	191	X	X	X	114			
	798	100	14	0	34	107	47	0	11	33
151-200	796	175	0	23	12	138	0	8	2	34
	800 [2]	81		6	49	94		2	60	21
201-300	792	50	0	0	3	3	0	0	3	1
total inshore strata			9978	3770	5960	9588	7903	2801	662	2066
total offshore			7066	11004	6628	32846	6140	10200	5039	19318
total all strata fished			17044	14774	12588	42435	14044	13000	5702	21386
upper			27958	19944	61095	62955	92802	19797	7837	93444
t-value			2.776	2.447	12.71	3.18	12.706	2.447	2.06	12.71
STD all strata fished			3932	2113	3816	6453	6198	2778	1036	5669

changes below were made before 1997 fall survey

[1] Area of strata 788 was increased by 9 sq. n. mi and the area of strata 789 was decreased by 9 sq.n. mi.

2 Strata 791 in the 100-200 depth range was divided into two separate strata 791 101-150 with area =227 sq. n. mi.and strata 800 151-200 area = 81 sq. n.mi.

[3] Strata 611 area was decreased by 27 sq. n. mi.

Table 24. Summary of estimates of cod abundance (thousands) and biomass (t) for all strata fished in 1984-2000. Data from 1984-1994 are in Campelen equivalent units and data from 1995-2000 are in actual Campelen units.

DIVISION	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total abundance all strata fished																	
2J	743,328	615,304	1,249,871	410,936	509,360	647,797	264,807	365,191	31,560	17082	8373	14654	13300	7020	6636	6129	7567
3K	451517	208952	891302	284648	457191	1307523	972029	649529	61886	37265	9612	23954	20756	10984	19067	29433	39110
3L	995804	464291	358606	325352	256383	172299	396008	145682	148719	47809	4678	8013	17044	14774	12588	25514	42435
2J3KL	2,190,649	1,288,547	2,499,779	1,020,936	1,222,934	2,127,619	1,632,844	1,160,402	242,165	102,156	22,663	46,621	51,100	32,778	38,291	61,076	89,112
Total biomass all strata fished																	
2J	557,302	472,214	1,287,042	492,144	599,436	425,874	131,943	170,892	13,096	5,238	2,877	3,067	4,298	3,662	4,483	2,590	3,098
3K	370,356	209,686	964,600	303,212	216,734	830,045	645,136	649,529	35,604	14,598	4,437	4,978	6,039	4,475	7,842	12,519	19,889
3L	479,606	369,689	387,438	284,230	274,553	160,688	406,730	123,108	128,048	30,694	3,149	5,275	14,044	13,000	5,701	13,904	21,386
2J3KL	1,407,264	1,051,589	2,639,080	1,079,586	1,090,723	1,416,607	1,183,809	943,529	176,748	50,530	10,463	13,320	24,381	21,137	18,026	29,013	44,373
Percent abundance																	
2J	34	48	50	40	42	30	16	31	13	17	37	31	26	21	17	10	8
3K	21	16	36	28	37	61	60	56	26	36	42	51	41	34	50	48	44
3L	45	36	14	32	21	8	24	13	61	47	21	17	33	45	33	42	48
Percent biomass																	
2J	40	45	49	46	55	30	11	18	7	10	27	23	18	17	25	9	7
3K	26	20	37	28	20	59	54	69	20	29	42	37	25	21	44	43	45
3L	34	35	15	26	25	11	34	13	72	61	30	40	58	62	32	48	48

Table 25. Summary of estimates of cod abundance (thousands) and biomass (t) for divisions 2J, 3K and 3L separately and combined in 1995-2000. Strata are aggregated into offshore index strata, those strata deeper than the offshore index strata and seaward of them, and those strata inshore of the offshore index strata. There are no inshore strata in Division 2J.

Division	Grouping	Abundance (thousands)						Biomass (t)					
		1995	1996	1997	1998	1999	2000	1995	1996	1997	1998	1999	2000
2J	index	12,305	13,081	6,936	6,636	6,074	7,516	2,312	4,261	3,609	4,483	2,527	3,082
	offshore deep	2,350	219	84	0	55	51	755	36	52	0	63	16
	total	14,654	13,300	7,020	6,636	6,129	7,567	3,067	4,298	3,662	4,483	2,590	3,098
3K	index	23,200	18,550	8,428	15,612	29,308	35,774	4,578	5,457	3,978	7,280	12,230	11,994
	offshore deep	754	72	22	285	124	0	400	131	42	242	289	0
	inshore	**nf**	2,133	2,534	3,171	**nf**	3,336	**nf**	454	455	320	**nf**	592
	total	23,954	20,755	10,984	19,068	29,432	39,110	4,978	6,042	4,475	7,842	12,519	12,586
3L	index	7,735	7,067	9,859	6,454	25,281	29,010	5,115	6,140	8,991	4,804	13,611	15,070
	offshore deep	280	0	1,144	173	233	3,837	160	0	1,209	235	294	4,282
	inshore	**nf**	9,978	3,770	5,960	**nf**	9,588	**nf**	7,903	2,801	662	**nf**	2,066
	total	8,015	17,045	14,773	12,587	25,514	42,435	5,275	14,043	13,001	5,701	13,905	21,418
2J3KL	index	43,240	38,698	25,223	28,702	60,663	72,300	12,005	15,858	16,578	16,567	28,368	30,146
	offshore deep	3,384	291	1,250	458	412	3,888	1,315	167	1,303	477	646	4,298
	inshore	**nf**	12,111	6,304	9,131	**nf**	12,924	**nf**	8,357	3,256	982	**nf**	2,658
	total	46,624	51,100	32,777	38,291	61,075	89,112	13,320	24,382	21,137	18,026	29,014	37,102

Table 26. Autumn bottom-trawl mean number per tow at age in index strata adjusted for missing strata. The 2J3KL total is the mean of the divisional means, weighted by the divisional survey areas.

2J

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
1	46.58	7.57	1.71	0.65	1.46	20.52	4.86	2.75	0.37	0.00	0.00	0.18	2.46	0.52	0.00	0.10	0.21	0.58
2	147.86	41.01	14.01	18.71	3.03	17.69	108.44	13.80	11.17	0.68	3.22	1.21	1.24	2.10	0.43	0.19	0.82	0.68
3	61.64	86.28	48.03	39.16	8.12	10.83	33.77	46.34	19.04	4.45	1.03	0.83	0.80	1.21	1.47	0.74	0.58	0.79
4	61.08	38.75	74.50	97.79	12.11	12.14	16.27	12.48	60.31	1.70	1.05	0.34	0.31	0.49	0.40	0.92	0.31	0.47
5	25.59	53.27	28.44	153.27	50.67	16.35	10.85	4.79	14.89	3.29	0.32	0.15	0.08	0.13	0.12	0.30	0.17	0.04
6	10.44	14.98	27.11	68.45	43.15	41.46	12.35	2.39	1.73	0.31	0.27	0.01	0.03	0.02	0.00	0.04	0.00	0.04
7	4.87	2.87	9.75	29.99	9.98	42.71	17.99	1.44	0.70	0.01	0.02	0.02	0.00	0.02	0.00	0.01	0.00	0.00
8	12.46	1.83	1.35	10.84	6.58	6.93	11.13	2.35	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	5.05	3.46	0.83	0.70	2.64	4.27	1.45	1.08	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2.87	1.49	1.14	0.64	0.41	2.06	0.77	0.23	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.58	0.54	0.39	0.55	0.04	0.28	0.35	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.04	0.12	0.17	0.29	0.16	0.11	0.12	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.03	0.02	0.03	0.07	0.06	0.08	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.02	0.00	0.00	0.02	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	379.11	252.19	207.46	421.13	138.45	175.48	218.36	87.76	109.11	10.44	5.91	2.74	4.92	4.49	2.42	2.30	2.10	2.60

3K

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.15	0.28	0.71
1	22.84	8.27	0.28	7.91	7.35	37.54	36.91	22.21	0.59	0.65	0.28	0.20	2.78	0.70	0.07	1.13	1.07	2.61
2	32.49	32.45	5.07	18.35	6.63	29.28	111.95	32.45	15.74	2.85	4.67	0.39	1.56	2.28	0.92	0.80	2.71	2.33
3	27.87	24.34	13.32	21.13	8.34	18.49	58.16	83.98	23.97	4.12	2.24	1.16	0.97	1.20	0.85	0.92	2.01	2.24
4	15.09	22.21	12.39	65.26	10.01	8.40	44.92	48.74	70.05	2.33	1.27	0.38	0.34	0.34	0.20	0.59	0.87	1.17
5	17.24	11.98	10.93	56.87	17.27	6.92	25.69	23.11	37.29	4.01	0.30	0.14	0.10	0.10	0.09	0.20	0.36	0.27
6	4.39	8.97	4.13	29.01	11.21	7.54	17.17	12.35	9.09	1.16	0.34	0.02	0.02	0.00	0.00	0.06	0.03	0.05
7	2.58	3.12	3.23	13.32	4.17	3.70	14.93	7.74	2.80	0.16	0.09	0.03	0.00	0.01	0.00	0.05	0.02	0.01
8	4.26	1.41	0.86	6.66	2.67	1.00	7.06	7.62	1.03	0.03	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.00
9	2.98	2.12	0.65	2.41	1.21	0.44	2.54	2.35	0.56	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
10	0.91	1.06	0.55	0.64	0.52	0.22	1.41	0.68	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.22	0.34	0.40	0.79	0.21	0.04	0.65	0.22	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.12	0.11	0.09	0.58	0.08	0.04	0.16	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.02	0.05	0.01	0.09	0.06	0.01	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.01	0.02	0.00	0.07	0.02	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	131.02	116.45	51.91	223.09	69.75	113.64	321.74	241.51	161.39	15.31	9.20	2.34	5.78	4.63	2.21	3.91	7.36	9.39

(cont'd)

Table 26 (cont'd). Autumn bottom-trawl mean number per tow at age in offshore index strata adjusted for missing strata. The 2J3KL total is the mean of the divisional means, weighted by the divisional survey areas.

3L

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.30	0.04
1	17.62	7.68	0.15	1.03	3.87	1.26	0.54	0.82	1.06	0.08	0.00	0.00	0.11	0.04	0.07	0.16	0.79	1.18
2	27.24	75.48	11.11	9.71	22.54	12.57	5.36	6.54	5.27	3.25	1.66	0.19	0.34	0.21	0.64	0.17	1.51	1.59
3	40.89	56.42	32.05	9.02	7.70	13.43	12.73	22.12	5.02	8.14	2.44	0.28	0.52	0.36	0.61	0.30	1.86	1.62
4	9.53	35.05	24.62	22.23	6.96	4.08	7.03	24.38	7.89	7.96	2.46	0.23	0.27	0.43	0.27	0.16	0.20	0.98
5	9.21	6.44	13.18	13.13	10.93	5.57	2.17	11.06	5.59	5.64	0.79	0.09	0.15	0.19	0.15	0.04	0.15	0.31
6	1.50	10.12	5.23	10.20	6.81	5.91	2.30	5.29	2.66	3.07	0.32	0.04	0.11	0.09	0.04	0.04	0.08	0.09
7	1.45	1.48	3.04	2.97	2.86	4.19	2.20	3.21	0.44	0.79	0.05	0.02	0.03	0.05	0.07	0.01	0.01	0.03
8	2.36	1.02	0.57	2.09	1.10	1.86	0.81	2.38	0.22	0.06	0.01	0.00	0.01	0.01	0.09	0.06	0.02	0.03
9	1.26	0.88	0.69	0.80	0.85	0.90	0.56	1.31	0.23	0.04	0.00	0.00	0.00	0.01	0.01	0.00	0.03	0.01
10	0.44	0.94	0.35	0.32	0.09	0.46	0.17	0.51	0.09	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
11	0.13	0.38	0.25	0.41	0.12	0.12	0.06	0.24	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
12	0.06	0.22	0.11	0.22	0.19	0.10	0.03	0.15	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.02	0.04	0.04	0.09	0.10	0.12	0.03	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.05	0.03	0.01	0.03	0.03	0.07	0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.01	0.03	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.02	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	111.87	196.27	91.42	72.30	64.19	50.68	34.04	78.19	28.59	29.08	7.73	0.85	1.54	1.39	1.95	1.26	4.98	5.88

2J3KL

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.18	0.22	0.25
1	26.49	7.85	0.58	3.23	4.44	18.12	13.75	8.44	0.73	0.25	0.09	0.11	1.58	0.38	0.05	0.47	0.74	1.51
2	58.68	52.62	9.81	14.81	12.42	19.41	66.33	16.98	10.22	2.48	3.05	0.51	0.97	1.37	0.68	0.39	1.74	1.61
3	41.65	53.05	29.73	20.48	8.02	14.48	33.08	48.74	14.80	5.89	2.03	0.71	0.74	0.85	0.90	0.62	1.60	1.62
4	24.08	31.67	32.81	55.20	9.25	7.51	21.96	29.59	41.55	4.54	1.72	0.31	0.30	0.41	0.28	0.49	0.45	0.92
5	15.93	19.82	16.18	62.23	22.83	8.67	12.16	13.54	18.47	4.52	0.51	0.12	0.12	0.15	0.12	0.16	0.23	0.23
6	4.67	10.93	10.25	30.82	17.22	15.21	9.74	6.93	4.58	1.75	0.31	0.03	0.06	0.04	0.02	0.05	0.04	0.06
7	2.67	2.37	4.76	13.08	5.05	13.51	10.34	4.29	1.29	0.39	0.06	0.02	0.01	0.03	0.03	0.02	0.01	0.02
8	5.48	1.35	0.86	5.77	2.97	2.82	5.44	4.12	0.54	0.04	0.01	0.01	0.00	0.00	0.04	0.03	0.01	0.01
9	2.77	1.93	0.71	1.31	1.41	1.58	1.44	1.60	0.35	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
10	1.20	1.12	0.61	0.51	0.31	0.77	0.73	0.50	0.15	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
11	0.27	0.41	0.33	0.57	0.13	0.13	0.33	0.19	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.07	0.16	0.12	0.36	0.15	0.08	0.10	0.10	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.02	0.04	0.03	0.09	0.08	0.07	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.03	0.02	0.00	0.04	0.03	0.04	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.02	0.00	0.01	0.00	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	184.04	183.38	106.79	208.52	84.33	102.43	175.50	135.09	92.76	19.89	7.77	1.81	3.79	3.24	2.13	2.22	5.07	6.25

Table 27. Autumn bottom-trawl mean catch (number) per tow at age in inshore strata in 3K and 3L in 1996-1998 and 2000. For each year and Division, an age-length key was constructed from sampling conducted both inshore and offshore, and this key was applied to the catch rate at length from the inshore strata in the appropriate year and Division. The lower part of the table indicates with an X those strata that were fished during each year.

	3K						3L				
Age	1996	1997	1998	1999	2000		1996	1997	1998	1999	2000
0	0.04	0.70	0.64		0.48		0.04	1.53	6.55		2.34
1	1.87	2.15	4.76		3.27		10.28	1.31	4.75		10.83
2	1.70	2.19	1.33		2.43		5.67	1.39	1.52		6.20
3	0.76	0.49	0.31		1.15		2.50	1.75	0.54		2.90
4	0.33	0.05	0.08		0.10		2.12	1.54	0.33		1.18
5	0.10	0.07	0.04		0.12		1.49	0.86	0.08		0.32
6	0.02	0.00	0.02		0.00		2.06	0.12	0.11		0.12
7		0.08	0.02				1.10	0.15	0.02		0.09
8							0.54	0.11	0.02		0.07
9							0.48	0.10	0.02		0.03
10							0.11				0.00
11											0.01
12											
13											
14											
15											
Total	4.82	5.73	7.20		7.55		26.39	8.86	13.94		24.09
Stratum						Stratum					
608	X	X	X		X	784	X	X	X		X
609	X	X	X		X	785	X	X	X		X
610	X	X	X		X	786	X	X	X		X
611	X	X	X		X	787	X	X	X		X
612	X	X	X		X	788	X	X	X		X
613	X	X	X		X	789	X	X	X		X
614	X	X	X		X	790	X	X	X		X
615	X	X	X		X	791	X	X	X		X
616	X	X	X		X	792	X	X	X		X
						793	X	X	X		X
						794	X	X	X		
						795	X	X	X		X
						796	X	X	X		X
						797	X	X	X		X
						798	X	X	X		X
						799	X	X	X		X
						800		X	X		X

Table 28. Autumn bottom-trawl mean catch (number) per tow at age in inshore strata in 3KL combined in 1996-1998 and 2000. Each 3KL catch at age index is the mean of the divisional means (Table 27), weighted by the divisional survey areas (where the area of inshore strata is 3235 sq n miles in 3K and 3107 sq n miles in 3L). (Note that corrections have been made to the comparable table from last year; Table 22b in Lilly et al. MS 2000.)

	3KL				
Age	1996	1997	1998	1999	2000
0	0.04	1.11	3.54		1.39
1	5.99	1.74	4.76		6.97
2	3.64	1.80	1.42		4.28
3	1.61	1.11	0.42		2.01
4	1.21	0.78	0.20		0.63
5	0.78	0.46	0.06		0.22
6	1.02	0.06	0.06		0.06
7	0.54	0.11	0.02		0.04
8	0.26	0.05	0.01		0.03
9	0.24	0.05	0.01		0.01
10	0.05	0.00	0.00		0.00
11	0.00	0.00	0.00		0.00
12	0.00	0.00	0.00		0.00
13	0.00	0.00	0.00		0.00
14	0.00	0.00	0.00		0.00
15	0.00	0.00	0.00		0.00
Total 0+	15.39	7.26	10.50		15.65
Total 1+	15.35	6.16	6.97		14.26
Total 5+	2.89	0.73	0.16		0.37

Table 29. Estimates of cod abundance (thousands) from spring surveys in Division 3L in 1988-2000 in depths <= 200 fathoms. The 1988-1995 data are in Campelen equivalent units and the 1996-2000 data are in actual Campelen units.

Depth range (fath)	Stratum number	Stratum area sq mi.	WT 70-71 1988	WT 83 1989	WT 96 1990	WT 106-107 1991	WT 119-122 1992	WT 137-138 1993	WT 152-154 1994	WT 168-170 1995	WT 189-191 1996	WT 207-208 1997	WT 223-224 1998	WT 240-241 1999	WT 317-318 2000
Mean Date			15-May-88	18-May-89	26-May-90	20-May-91	24-May-92	31-May-93	01-Jun-94	06-Jun-95	14-Jun-96	15-Jun-97	19-Jun-98	22-Jun-99	17-Jun-00
31-50	350	2071	90559	24682	8018	748	414	32	0	0	412	122	47	1268	71
	363	1780	46453	21738	3918	1504	789	306	0	0	111	0	0	281	420
	371	1121	3115	4086	3315	32260	123	93	0	0	0	0	0	0	0
	372	2460	37778	17675	2852	541	34	62	0	0	217	0	42	602	1203
	384	1120	1078	1566	193	270	0	31	0	0	102	0	0	0	77
51-100	328	1519	522	0	3194	1846	0	453	0	0	90	35	125	376	1254
	341	1574	20425	7984	2436	469	0	0	736	0	340	1728	172	577	476
	342	585	402	5445	523	0	1314	322	188	0	0	121	80	121	322
	343	525	2744	8065	891	2239	1565	614	361	361	36	0	217	108	72
	348	2120	19062	12022	6575	73	227	109	365	510	151	65	328	231	109
	349	2114	14649	25115	10986	1066	711	905	0	0	424	145	73	646	332
	364	2817	13718	24050	4456	1902	0	97	0	0	234	49	106	201	155
	365	1041	15931	8306	2076	322	36	0	0	0	58	0	0	95	0
	370	1320	8861	18226	1219	34833	0	91	0	0	61	0	0	0	36
	385	2356	5736	25360	7808	17055	97	383	0	0	30	0	0	46	81
	390	1481	0	891	41	122	34	102	0	0	59	0	0	150	0
101-150	344	1494	4110	31503	4864	986	1165	514	0	822	565	300	355	509	260
	347	983	11981	6694	913	1690	34	304	0	0	0	34	203	336	135
	366	1394	8885	33414	15053	12651	415	384	0	0	245	447	141	133	1630
	369	961	28158	13021	6134	3701	198	0	0	0	30	33	66	39	132
	386	983	26504	37547	32048	32544	68	54	0	0	0	30	34	265	406
	389	821	11181	13214	5788	9524	75	0	0	56	0	33	33	113	1412
	391	282	1494	2819	45154	6750	0	0	0	0	0	0	0	19	0
151-200	345	1432	19723	29548	14232	3217	492	525	2167	197	773	972	460	1121	2151
	346	865	11602	9965	145882	10812	1577	833	278	476	487	579	71	670	948
	368	334	414	4150	51551	4992	10866	1355	184	23	402	158	46	92	863
	387	718	2272	16336	241169	93995	23145	6288	0	560	142	1037	1635	684	3556
	388	361	1738	1606	36947	10809	4618	2235	0	174	84	0	72	372	564
	392	145	2094	645	22130	4618	40	479	0	110	111	0	80	41	195
total strata fished <= 200 fath			411190	405673	680365	263087	48038	16569	4278	3289	5166	5888	4386	9096	16860
ADJUSTED			411189	405673	680366	291539	48037	16571	4279	3289	5164	5888	4386	9096	16860
upper			521077	475378	1169116	395962	105950	29261	7094	5694	6223	10529	10169	11449	52643
t-value			2.16	2.04	2.776	2.365	4.303	3.182	2.201	2.306	2.023	2.447	4.30	2.05	12.71
1 STD strata fished <= 200 fath			50874	34169	176063	56184	13459	3989	1279	1043	522	1897	1345	1148	2815

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 200 fathom depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 30. Estimates of cod biomass (t) from spring surveys in Division 3L in 1988-2000 in depths <= 200 fathoms. The 1988-1995 data are in Campelen equivalent units and the 1996-2000 data are in actual Campelen units.

Depth		Stratum	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
range	Stratum	area	70-71	83	96	106-107	119-122	137-138	152-154	168-170	189-191	207-208	223-224	240-241	317-318
(fath)	number	sq mi.	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Mean Date			15-May	18-May	26-May	20-May	24-May	31-May	01-Jun	06-Jun	14-Jun	15-Jun	19-Jun-98	22-Jun	17-Jun
31-50	350	2071	116896	41232	14057	1636	315	35	0	0	359	135	6	3708	17
	363	1780	49356	30897	12388	2289	526	111	0	0	61	0	0	693	193
	371	1121	6714	7089	5149	44086	36	37	0	0	0	0	0	0	0
	372	2460	52582	31350	12849	1553	112	96	0	0	83	0	0	598	392
	384	1120	1515	1308	1029	653	0	71	0	0	65	0	0	0	20
51-100	328	1519	879	0	5670	180	0	243	0	0	6	5	115	739	89
	341	1574	32613	9121	5854	376	0	0	65	0	127	4497	9	1238	96
	342	585	600	1400	1035	0	66	64	33	0	0	346	8	209	23
	343	525	2878	3927	255	207	70	52	46	42	9	0	36	254	27
	348	2120	40777	18921	6772	273	37	43	47	87	53	13	536	395	10
	349	2114	34821	50689	3835	836	125	158	0	0	303	419	101	1903	615
	364	2817	26822	34642	15553	1228	0	124	0	0	20	11	225	683	43
	365	1041	18776	10427	2210	154	81	0	0	0	5	0	0	178	0
	370	1320	12422	15405	1288	29422	0	74	0	0	6	0	0	0	1
	385	2356	4572	10414	2269	13797	95	256	0	0	4	0	0	227	2
	390	1481	0	520	129	604	58	83	0	0	31	0	0	6	0
101-150	344	1494	2949	15613	696	103	167	83	0	95	111	115	124	496	152
	347	983	17943	5283	669	199	35	83	0	0	0	8	150	52	9
	366	1394	15741	32354	12386	6899	111	121	0	0	104	173	61	83	210
	369	961	37815	18342	7693	3547	78	0	0	0	16	3	20	11	218
	386	983	10110	19985	59202	17066	154	66	0	0	0	16	183	94	311
	389	821	3284	3509	1529	1654	114	0	0	36	0	9	25	16	587
	391	282	316	513	6018	1220	0	0	0	0	0	0	0	4	0
151-200	345	1432	24326	40145	5601	466	332	120	437	108	149	294	159	359	956
	346	865	13037	10501	136822	4834	613	302	86	91	178	238	32	407	582
	368	334	1286	5297	41814	3318	4684	590	120	22	148	96	8	63	499
	387	718	1609	8453	101468	37550	18465	2329	0	227	84	303	1199	578	2057
	388	361	695	676	35162	4031	1078	1431	0	60	12	0	27	167	251
	392	145	573	251	6418	1107	22	63	0	37	18	0	23	30	19
total strata fished <= 200 fathoms			531905	428264	505819	164236	27374	6633	834	805	1951	6667	3048	12962	7378
ADJUSTED			531907	428264	505820	179288	27374	6635	834	805	1952	6667	3048	12962	7378
upper			669157	490124	742119	286846	71593	14791	1310	1234	2468	17631	6102	18566	30307
t-value			2.16	1.998	2.228	2.447	4.303	4.303	2.365	2.179	2.017	2.571	3.18	2.16	12.71
1 STD strata fished <= 200 fathoms			63543	30961	106059	50106	10276	1896	201	197	256	4264	960	2594	1804

[1] **Not all strata in the depth range have been fished. Strata not fished in the <= 200 fathom depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.**

Table 31. Estimates of cod abundance (thousands) and biomass (t) from spring surveys in Division 3L in 1988-1999 in depths > 200 fathoms. The 1988-1995 data are in Campelen equivalent units and the 1996-1999 data are in actual Campelen units. Estimates for 2000 are not yet available.

Depth range (fath)	Stratum number	Stratum area nautical miles	WT 70-71 1988	WT 83 1989	WT 96 1990	WT 106-107 1991	WT 119-122 1992	WT 137-138 1993	WT 152-154 1994	WT 168-170 1995	WT 189-191 1996	WT 207-208 1997	WT 223-224 1998	WT 240-241 1999
Mean Date			15-May	18-May	26-May	20-May	24-May	31-May	01-Jun	06-Jun	14-Jun	15-Jun	19-Jun-98	22-Jun
					abundance									
201-300	729	186	**nf**	**nf**	**nf**	141	3876	192	77	0	13	0	13	0
	731	216	**nf**	**nf**	**nf**	3046	267	416	9701	0	152	0	13	104
	733	468	**nf**	**nf**	**nf**	7339	2672	880	1513	483	41	89	0	258
	735	272	**nf**	**nf**	**nf**	**nf**	92905	0	6080	673	5512	524	3480	35
301-400	730	170	**nf**	**nf**	**nf**	0	0	0	0	0	0	0	0	0
	732	231	**nf**	**nf**	**nf**	0	0	0	0	0	0	0	0	0
	734	228	**nf**	**nf**	**nf**	267	0	0	0	0	0	0	0	0
	736	175	**nf**	**nf**	**nf**	**nf**	60	0	0	0	0	0	0	0
401-500	737	227	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**
	741	223	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**
	745	348	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**
	748	159	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**
Total >200 fathoms			0	0	0	10793	99780	1488	17371	1156	5718	613	3506	397
Total all strata fished			411190	405673	680365	273879	147819	18056	21649	4445	10884	6501	7892	9493
1 STD all strata fished			50874	34169	176063	56567	93188	4007	9990	1275	2473	1933	3694	1183
					biomass									
201-300	729	186	**nf**	**nf**	**nf**	320	1683	78	29	0	2	0	31	0
	731	216	**nf**	**nf**	**nf**	1967	389	248	5913	0	69	0	15	57
	733	468	**nf**	**nf**	**nf**	6351	1959	345	556	219	28	74	0	111
	735	272	**nf**	**nf**	**nf**	**nf**	50199	0	3238	386	3823	352	2646	24
301-400	730	170	**nf**	**nf**	**nf**	0	0	0	0	0	0	0	0	0
	732	231	**nf**	**nf**	**nf**	0	0	0	0	0	0	0	0	0
	734	228	**nf**	**nf**	**nf**	437	0	0	0	0	0	0	0	0
	736	175	**nf**	**nf**	**nf**	**nf**	69	0	0	0	0	0	0	0
401-500	737	227	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**
	741	223	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**
	745	348	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**
	748	159	**nf**	**nf**	**nf**	**nf**	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	**nf**
Total >200 fathoms			0	0	0	9075	54299	671	9736	605	3922	426	2692	192
Total all strata fished			531905	428264	505819	173311	81673	7304	10570	1410	5874	7093	5740	13154
1 STD all strata fished			63543	30961	106059	50374	50990	1899	5960	440	6255	4271	2804	2598

nf Not all strata in the depth range were fished. Strata not fished in the greater than 200 fathom depth range have not been filled using a multiplicative model.

Table 32. Spring bottom-trawl mean number per tow at age in index strata (<=200 fath) in Division 3L adjusted for missing strata.

Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
0												0.00	0.00	0.00	0.00	0.02
1	0.00	0.00	0.24	0.05	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.05	0.23	0.69
2	24.66	4.71	6.20	4.56	6.56	8.14	4.82	1.29	0.08	0.19	0.25	0.43	0.18	0.08	0.54	0.87
3	85.66	17.70	11.95	24.30	23.92	46.84	13.81	2.26	1.71	0.33	0.19	0.23	0.43	0.25	0.26	0.86
4	48.28	31.74	11.45	10.16	20.06	41.76	19.67	1.82	0.79	0.12	0.16	0.15	0.16	0.25	0.17	0.69
5	23.76	18.51	19.07	9.93	5.23	18.34	9.80	2.54	0.34	0.06	0.05	0.05	0.07	0.11	0.11	0.08
6	8.24	9.85	13.15	17.32	3.62	5.05	4.25	1.09	0.24	0.01	0.01	0.05	0.03	0.07	0.08	0.08
7	7.17	3.96	6.27	7.39	8.32	4.30	1.07	0.36	0.07	0.00		0.03	0.20	0.02	0.08	0.01
8	1.39	2.95	1.95	3.71	6.06	4.74	0.85	0.06	0.04				0.06	0.02	0.05	0.00
9	0.65	0.65	1.52	1.25	1.58	2.53	0.80	0.01	0.00				0.02	0.01	0.16	0.00
10	0.92	0.56	0.58	1.04	0.62	1.02	0.28	0.04					0.01	0.00	0.06	0.00
11	1.04	0.96	0.41	0.30	0.54	0.44	0.28	0.00					0.01		0.03	0.01
12	0.35	0.62	0.54	0.36	0.14	0.28	0.09	0.00							0.01	0.01
13	0.14	0.21	0.33	0.32	0.19	0.21	0.03	0.01							0.01	0.01
14	0.04	0.07	0.10	0.25	0.33	0.15	0.01	0.01							0.01	
15	0.06	0.06	0.05	0.10	0.13	0.13	0.02									
16	0.01	0.02	0.01	0.04	0.04	0.07	0.00									
17	0.00	0.00	0.00	0.03	0.03	0.05	0.00									
18	0.01	0.02	0.01	0.02	0.02	0.01	0.00									
19	0.00	0.00	0.01	0.00	0.01	0.01	0.01									
20	0.01	0.00		0.01			0.01									
21	0.01															
22	0.00															
23	0.01															
24																
25																
Total	202.41	92.59	73.84	81.14	77.40	134.23	55.80	9.49	3.27	0.71	0.66	1.00	1.17	0.86	1.80	3.33

Table 33. Mean length (cm) at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-2000. Highlighted entries are based on fewer than 5 aged fish. There were no surveys in Division 3L in 1978-1980 and 1984.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1																		19.9	19.8		22.9	21.5	22.0
2	29.3	30.1	30.6	29.9	30.0	26.6	27.4	27.0	28.2	29.4	30.3	28.1	26.5	28.1	26.5	26.2	25.8	26.2	28.0	30.7	23.9	27.4	27.8
3	38.0	41.3	39.4	38.7	37.9	38.8	34.3	33.6	35.5	36.5	37.3	36.9	33.8	32.9	33.8	32.6	36.8	33.1	34.5	37.6	38.7	33.7	37.6
4	45.6	47.3	49.6	47.0	47.0	46.1	44.4	40.1	41.1	43.4	44.2	43.7	41.9	38.7	38.8	40.1	42.3	42.1	41.8	43.2	44.4	42.5	44.2
5	54.0	55.3	54.5	54.4	53.4	53.9	50.9	48.5	47.6	48.9	48.5	50.1	46.9	43.9	41.8	43.9	46.6	46.7	49.3	48.0	47.7	52.3	**54.6**
6	59.7	60.9	60.7	58.2	59.3	60.0	56.6	53.2	52.7	52.4	53.6	53.8	53.4	51.1	47.0	47.5	**56.8**	**55.4**	**52.6**		**52.5**	**69.0**	**62.3**
7	66.4	67.9	64.3	62.8	61.3	62.9	63.4	57.5	56.7	57.3	55.8	57.0	56.6	56.9	**56.8**	**47.0**	**56.2**		**61.1**		**51.0**		
8	69.7	73.9	69.5	66.9	64.5	64.7	65.8	64.3	59.5	58.9	59.8	59.6	59.4	58.3								**79.0**	
9	79.3	69.2	82.0	73.6	68.9	68.6	66.9	67.2	67.6	61.7	63.8	62.7	61.1	63.8									
10	80.4	76.9	83.3	84.2	77.0	73.5	71.6	70.2	68.2	67.8	66.2	64.7	63.1	65.5									
11	87.7	87.6	86.5	90.1	85.5	75.0	78.4	72.8	72.2	77.5	73.9	69.8	73.6	**72.7**									
12	91.6	85.9	87.9	88.6	94.6	95.0	83.0	75.9	76.2	75.5	80.5	67.8	73.5	**68.5**									

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1																		18.6	19.2	21.6	19.2	20.5	20.9
2	27.9	30.9	30.7	31.3	29.3	28.5	26.5	28.7	29.5	29.7	25.9	27.3	28.1	29.2	28.5	28.5	29.3	25.6	28.7	29.5	25.3	29.1	27.7
3	37.6	42.1	39.9	42.2	40.3	40.5	36.8	36.0	36.5	38.1	36.5	37.2	36.2	36.6	36.4	37.5	36.5	34.2	34.9	39.2	39.0	36.8	36.7
4	47.0	49.5	47.2	50.4	50.1	47.9	47.0	43.9	43.8	44.6	44.2	45.0	44.0	42.7	42.4	43.6	42.2	41.8	43.3	47.9	45.4	45.7	45.4
5	54.8	55.4	54.7	56.1	54.0	56.2	54.3	51.8	49.9	50.9	51.5	51.5	49.7	47.9	47.0	50.0	51.1	46.8	50.0	56.2	51.4	52.5	52.0
6	62.4	62.8	61.8	60.3	60.5	62.3	61.6	57.3	56.1	54.3	56.0	56.3	56.1	54.9	51.8	51.4	**53.5**	**54.7**	**58.5**		58.6	**55.7**	60.8
7	69.5	69.9	69.7	65.2	64.3	66.8	64.4	62.5	58.8	60.1	58.6	59.9	58.4	59.7	57.9	53.0	**58.1**		**69.0**		62.4	**72.9**	**73.0**
8	74.4	76.8	76.3	69.2	69.0	67.7	68.8	69.6	64.1	62.9	66.3	63.1	61.2	62.7	65.2	**64.0**	**61.7**			**68.0**	**83.0**		
9	76.6	83.3	86.0	81.7	74.8	72.5	72.9	70.2	67.3	69.7	73.1	68.1	63.6	65.6	**64.0**			**68.0**			**80.0**	**81.0**	
10	81.9	78.3	87.6	90.5	79.8	76.4	78.1	73.1	76.8	74.5	78.7	74.0	64.7	69.1								**89.0**	
11	**88.4**	86.0	**103.4**	91.6	89.6	84.9	84.9	79.2	75.9	80.8	82.4	75.7	69.3	**80.7**									
12	92.1	**78.9**	94.2	92.1	97.0	85.1	90.2	87.1	73.7	86.6	88.5	82.2	71.1	**68.4**									

Division 3L

Age	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1															16.8	17.7	19.7	18.4	19.3	19.3
2	28.5	28.7	30.1		26.8	27.9	27.5	28.7	28.7	27.0	29.7	27.9	30.1	28.1	27.8	30.0	30.3	31.5	30.0	28.3
3	40.0	38.2	39.4		36.1	35.4	34.7	37.4	37.6	35.3	36.7	38.5	38.3	34.8	36.9	38.3	38.6	39.9	39.4	39.4
4	44.8	50.2	48.0		43.7	43.7	44.2	44.9	44.2	44.9	44.4	44.5	45.2	45.7	41.7	44.2	45.9	46.5	47.2	45.8
5	52.6	56.4	56.8		52.2	50.3	52.3	53.1	52.3	52.7	51.1	50.4	51.5	51.8	49.6	49.3	54.9	**54.5**	55.4	53.3
6	60.6	63.5	62.4		58.0	58.2	58.9	58.6	59.0	59.2	56.5	54.9	55.8	57.9	58.6	58.9	**62.3**	**58.4**	59.7	58.0
7	66.7	69.7	64.7		65.4	62.6	65.1	62.4	63.9	66.4	61.1	56.8	61.9	**66.7**	**66.7**	66.7	68.6	**78.0**	**64.0**	**65.4**
8	73.1	73.8	69.5		73.3	69.9	69.0	66.7	68.7	70.9	68.0	66.0	**61.4**	**67.0**	**74.0**	**70.0**	72.6	**74.3**	**72.9**	**77.9**
9	82.2	83.0	73.6		72.8	73.1	75.2	69.6	74.4	75.3	71.5	77.3				**66.0**	**72.0**		**86.3**	**81.0**
10	91.2	93.1	76.3		82.6	77.7	80.8	74.3	83.7	76.2	73.2	70.4	**87.0**						**90.7**	
11	**103.7**	94.1	90.0		86.5	81.5	87.9	88.9	88.1	82.5	74.5	**77.1**							**79.0**	
12	**119.2**	110.5	87.5		97.8	86.8	85.4	96.7	94.1	86.9	81.1	**94.5**							**100.0**	

Table 34. Mean weight (kg) at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-2000. Highlighted entries are based on fewer than 5 aged fish. There were no surveys in Division 3L in 1978-1980 and 1984.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1																		0.064	0.064		0.100	0.091	0.086
2	0.223	0.263	0.240	0.228	0.215	0.176	0.153	0.200	0.254	0.266	0.253	0.204	0.158	0.187	0.139	0.153	0.155	0.162	0.193	0.258	0.121	0.196	0.194
3	0.487	0.682	0.528	0.548	0.501	0.587	0.384	0.363	0.350	0.545	0.553	0.488	0.355	0.307	0.318	0.300	0.433	0.319	0.371	0.480	0.544	0.358	0.472
4	0.947	1.023	1.046	1.077	0.955	0.956	0.829	0.622	0.645	0.913	0.819	0.810	0.697	0.518	0.482	0.575	0.646	0.671	0.670	0.733	0.796	0.758	0.776
5	1.580	1.593	1.363	**1.663**	1.601	1.554	1.303	1.138	1.054	1.355	1.145	1.263	0.987	0.743	0.620	0.751	0.909	0.898	1.160	1.052	1.006	1.382	**1.416**
6	2.199	2.379	2.055	1.982	2.004	1.853	1.782	1.486	1.660	1.483	1.653	1.567	1.462	1.139	0.844	0.923	**1.664**	**1.540**	**1.427**		**1.416**	**3.210**	**2.463**
7	2.515	2.748	2.548	2.519	2.392	**2.252**	2.388	1.880	1.914	2.067	1.690	1.907	1.784	1.540	**1.478**	**0.860**	**1.700**		**2.150**		**1.190**		
8	3.862	2.753	**3.090**	3.197	2.686	2.773	2.562	2.497	2.292	2.409	2.379	2.259	2.108	1.692								**5.180**	
9	4.365	6.193	5.986	3.944	3.872	3.346	3.023	2.652	**3.810**	1.818	2.717	2.616	2.299	2.367									
10	5.771	**5.428**	7.628	6.586	6.507	4.022	3.459	3.223	4.513	4.648	2.880	3.143	2.539	2.721									
11	6.358	7.191	6.546	**6.906**	**7.660**	4.165	5.669	4.178	4.638	**4.550**	3.868	3.771	4.397	**3.963**									
12	**9.736**	**6.206**	7.723	**10.797**	**10.055**	8.946	6.539	4.014	6.161	**4.649**	6.732	3.206	4.340	**3.391**									

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1																		0.054	0.057	0.085	0.060	0.074	0.075
2	0.171	0.207	0.238	0.275	0.234	0.227	0.146	0.209	0.192	0.204	0.177	0.193	0.190	0.213	0.205	0.205	0.217	0.153	0.206	0.230	0.150	0.238	0.194
3	0.410	0.577	0.578	0.720	0.738	0.540	0.404	0.466	0.454	0.493	0.476	0.491	0.414	0.423	0.398	0.473	0.434	0.362	0.380	0.543	0.547	0.468	0.443
4	0.876	1.190	0.950	1.222	1.218	1.120	0.867	0.891	0.817	0.904	0.838	0.874	0.761	0.705	0.665	0.735	0.688	0.649	0.721	0.979	0.868	0.888	0.818
5	1.478	1.644	1.410	**1.730**	1.555	1.670	1.412	1.219	1.154	1.350	1.411	1.325	1.100	1.006	0.947	1.119	1.188	0.907	1.161	1.619	1.299	1.346	1.189
6	2.393	2.259	2.011	2.051	1.966	2.114	2.041	1.818	1.993	1.409	1.734	1.821	1.630	1.517	1.301	1.296	**1.442**	**1.527**	**1.898**		1.874	**1.560**	2.060
7	2.938	3.161	3.462	2.620	2.445	2.804	2.343	2.590	2.421	2.580	2.264	2.190	1.908	1.923	1.828	1.461	**1.978**		**3.240**		2.550	**3.743**	**3.330**
8	**5.830**	4.281	3.179	5.051	3.151	3.440		3.396	3.739	2.784	3.012	2.566	2.203	2.274	2.561	**2.290**	**2.326**			**2.610**	**6.320**		
9	4.671	4.861	6.003	7.332	4.375	3.736	3.693	4.149	3.247	3.398	4.257	3.229	2.441	2.626	**2.190**			**3.280**			**5.310**	**6.130**	
10	6.499	4.608	7.532	6.321	6.192	4.862	4.667	4.890	4.920	5.354	4.888	4.204	2.711	3.107								**7.270**	
11	**5.243**	8.365	**13.000**	9.326	6.515	7.512	6.300	6.520	5.847	**10.631**	5.408	4.604	3.251	**4.933**									
12	**9.492**	**10.190**	7.097	8.103	**9.555**	**6.047**	6.089	6.329	**6.465**	7.017	7.628	5.593	3.665	**3.222**									

Division 3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1																		0.110	0.047	0.068	0.055	0.063	0.061
2				**0.224**	0.169	0.236		0.167	0.223	0.179	0.224	0.186	0.173	0.248	0.198	0.240	0.198	0.235	0.256	0.255	0.274	0.264	0.210
3				0.564	0.380	0.539		0.436	0.468	0.353	0.459	0.443	0.395	0.456	0.581	0.505	0.402	0.459	0.501	0.533	0.587	0.584	0.578
4				0.820	**0.480**	1.142		0.801	0.796	0.735	0.764	0.789	0.810	0.836	0.883	0.849	0.880	0.668	0.785	0.896	0.937	0.937	0.891
5				1.245		1.477		1.382	1.227	1.313	1.372	1.556	1.330	1.280	1.303	1.274	1.319	1.134	1.122	1.629	**1.589**	1.620	1.427
6				1.980		1.984		2.049	1.807	1.796	1.879	1.937	1.902	1.748	1.700	1.764	1.893	2.055	2.084	**2.633**	**1.814**	2.069	1.849
7				2.638		2.278		2.247	2.703	2.351	2.103	2.567	2.767	2.191	1.862	2.327	**2.986**	**3.253**	3.229	3.386	**4.250**	**2.615**	**2.757**
8				5.077	**5.440**	2.930		3.521	2.579	2.818	3.043	3.653	3.481	3.089	2.781	**2.550**	**3.160**	**4.200**	**3.440**	4.473	**4.601**	**3.904**	**5.164**
9				5.804	6.647	4.005		4.111	4.197	3.801	3.015	3.666	4.274	3.678	4.926				**3.200**			**6.627**	**4.850**
10				11.762	8.339	4.390		6.132	5.476	**7.540**	3.483	6.830	4.557	3.949	3.349	**6.440**						**8.278**	
11				**11.560**	7.486	8.333		5.312	4.460	7.402	7.471	7.461	5.847	4.471	**4.946**							**5.630**	
12				**18.553**	**10.653**	**9.902**		12.081	10.511	5.525	9.410	**11.395**	6.642	5.307	**8.652**							**10.050**	

Table 35. Mean Fulton's condition (gutted weight) at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-2000. Highlighted entries are based on fewer than 5 aged fish.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	0.733	0.718	0.738	0.781	0.735	0.731	0.713	0.722	0.718	0.730	0.753	0.745	0.714	0.710	0.666	0.741	0.803	0.740	0.733	0.743	0.733	0.729	0.721
3	0.729	0.755	0.788	0.811	0.775	0.772	0.758	0.741	0.779	0.813	0.786	0.764	0.741	0.736	0.710	0.758	0.755	0.743	0.755	0.758	0.776	0.754	0.734
4	0.762	0.763	0.718	0.810	0.757	0.803	0.774	0.755	0.814	0.792	0.816	0.772	0.745	0.735	0.693	0.759	0.745	0.758	0.791	0.755	0.750	0.751	0.755
5	0.771	0.750	0.764	**0.816**	0.816	0.774	0.784	0.769	0.816	0.770	0.786	0.786	0.744	0.724	0.709	0.752	0.773	0.736	0.809	0.787	0.754	0.776	**0.736**
6	0.747	0.785	0.750	0.821	0.801	0.729	0.767	0.757	0.815	0.783	0.812	0.789	0.753	0.702	0.678	0.717	**0.771**	**0.735**	**0.769**		**0.770**	**0.816**	**0.822**
7	0.731	0.762	0.738	0.795	0.757	**0.661**	0.776	0.751	0.814	0.783	0.798	0.782	0.743	0.707	**0.687**	**0.722**	**0.779**		**0.824**		**0.686**		
8	0.722	0.695	**0.743**	0.809	0.737	0.789	0.732	0.761	0.776	0.836	0.815	0.806	0.762	0.705								**0.842**	
9	0.764	0.823	0.806	0.749	0.729	0.789	0.751	0.669	**0.849**	0.768	0.811	0.793	0.771	0.738									
10	0.779	**0.794**	0.814	0.859	0.814	0.758	0.755	0.724	0.794	0.772	0.813	0.874	0.748	0.783									
11	0.834	0.831	0.760	**0.855**	**0.855**	0.801	0.786	0.730	0.870	**0.792**	0.798	0.806	0.817	**0.835**									
12	**0.904**	**0.766**	0.838	**0.845**	**0.858**	0.786	0.799	0.725	0.828	**0.795**	0.827	0.766	0.828	**0.830**									

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	0.683	0.707	0.708	0.793	0.722	0.725	0.685	0.730	0.749	0.768	0.753	0.716	0.711	0.733	0.735	0.727	0.741	0.733	0.739	0.744	0.723	0.735	0.735
3	0.719	0.741	0.786	0.793	0.815	0.742	0.719	0.744	0.714	0.757	0.785	0.750	0.714	0.719	0.700	0.741	0.767	0.744	0.746	0.758	0.758	0.761	0.738
4	0.747	0.757	0.805	0.769	0.758	0.781	0.733	0.731	0.774	0.772	0.796	0.755	0.724	0.736	0.711	0.720	0.768	0.730	0.753	0.747	0.761	0.759	0.74
5	0.747	0.780	0.747	**0.826**	0.754	0.768	0.753	0.765	0.783	0.785	0.799	0.763	0.734	0.733	0.718	0.717	0.730	0.737	0.782	0.766	0.780	0.761	0.711
6	0.739	0.747	0.726	0.789	0.738	0.728	0.744	0.784	0.798	0.778	0.808	0.781	0.744	0.742	0.739	0.746	**0.765**	**0.766**	**0.745**		0.746	**0.740**	0.748
7	0.730	0.739	0.729	0.749	0.731	0.799	0.784	0.746	0.820	0.819	0.808	0.768	0.749	0.730	0.754	0.721	**0.780**		**0.801**		0.864	**0.784**	**0.743**
8	**0.773**	0.746	0.687	0.751	0.732	0.809		0.764	0.795	0.788	0.833	0.779	0.749	0.738	0.736	**0.732**	**0.799**			**0.706**	**0.867**		
9	0.784	0.738	0.758	0.847	0.721	0.760	0.781	0.841	0.821	0.796	0.819	0.791	0.732	0.755	**0.679**			**0.795**			**0.873**	**0.896**	
10	0.744	0.761	0.795	0.756	0.766	0.762	0.717	0.744	0.849	0.811	0.831	0.793	0.749	0.776								**0.817**	
11	**0.642**	0.752	**0.861**	0.836	0.749	0.838	0.822	0.778	0.840	**0.832**	0.788	0.808	0.771	**0.741**									
12	**0.845**	**0.812**	0.762	0.815	**0.813**	**0.755**	0.789	0.835	**0.785**	0.810	0.852	0.792	0.778	**0.803**									

Division 3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2				**0.718**	0.707	0.718		0.680	0.769	0.721	0.748	0.734	0.716	0.746	0.744	0.721	0.750	0.935	0.772	0.757	0.744	0.740	0.715
3				0.778	0.803	0.724		0.749	0.765	0.733	0.781	0.759	0.734	0.748	0.801	0.741	0.784	0.752	0.749	0.758	0.751	0.798	0.757
4				0.794	**0.765**	0.746		0.740	0.757	0.745	0.730	0.764	0.729	0.769	0.788	0.737	0.741	0.758	0.770	0.756	0.748	0.749	0.762
5				0.767		0.735		0.756	0.790	0.748	0.781	0.782	0.752	0.769	0.795	0.715	0.758	0.761	0.760	0.773	**0.814**	0.776	0.75
6				0.729		0.700		0.717	0.781	0.714	0.796	0.776	0.742	0.773	0.796	0.777	0.776	0.804	0.806	**0.770**	**0.751**	0.788	0.754
7				0.751		0.775		0.715	0.816	0.724	0.741	0.768	0.763	0.741	0.793	0.737	**0.775**	**0.861**	0.847	0.824	**0.748**	**0.790**	**0.771**
8				0.824	**0.767**	0.764		0.708	0.730	0.735	0.758	0.804	0.777	0.763	0.723	**0.741**	**0.725**	**0.780**	**0.825**	0.882	**0.861**	**0.822**	**0.806**
9				0.798	0.800	0.744		0.790	0.775	0.743	0.781	0.729	0.773	0.779	0.803				**0.939**			**0.809**	**0.743**
10				**0.888**	0.827	0.749		0.783	0.808	**0.852**	0.746	0.798	0.785	0.758	0.743	**0.787**						**0.890**	
11				**0.800**	0.807	0.793		0.774	0.775	0.803	0.736	0.802	0.795	0.817	**0.814**							**0.909**	
12				**0.885**	**0.771**	**0.752**		0.817	0.811	0.783	0.828	**0.822**	0.792	0.771	**0.808**							**0.750**	

Table 36. Mean liver index at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-2000. Highlighted entries are based on fewer than 5 aged fish. (Instances where fewer than 5 fish were available are not indicated for years prior to 1995.) There were no surveys in Division 3L in 1978-1980 and 1984.

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2		0.037	0.035	0.046	0.031	0.030	0.032	0.023	0.043	0.031	0.036	0.045	0.042	0.036	0.025	0.032	0.038	0.042	0.037	0.041	0.034	0.045	0.035
3		0.061	0.051	0.049	0.047	0.057	0.050	0.036	0.049	0.052	0.049	0.059	0.050	0.042	0.028	0.038	0.039	0.041	0.044	0.043	0.050	0.049	0.038
4		0.062	0.034	0.069	0.048	0.078	0.061	0.048	0.079	0.061	0.067	0.067	0.060	0.045	0.040	0.037	0.035	0.041	0.039	0.045	0.047	0.046	0.036
5		0.064	0.052	0.053	0.051	0.063	0.066	0.057	0.077	0.073	0.057	0.076	0.061	0.037	0.036	0.038	0.043	0.045	0.043	0.053	0.052	0.054	**0.035**
6		0.080	0.054	0.062	0.060	0.065	0.062	0.056	0.089	0.065	0.074	0.074	0.064	0.033	0.037	0.038	0.049	**0.017**	**0.037**		**0.065**	**0.069**	**0.042**
7		0.060	0.055	0.056	0.057	0.057	0.055	0.053	0.074	0.061	0.070	0.077	0.067	0.031	0.036	0.030	0.073		**0.047**		**0.057**		
8		0.040	0.041	0.067	0.051	0.077	0.055	0.061	0.051	0.077	0.076	0.089	0.066	0.033								**0.090**	
9		0.060	0.071	0.058	0.048	0.081	0.066	0.034	0.093	0.045	0.065	0.074	0.073	0.038									
10		0.083	0.084	0.083	0.058	0.053	0.063	0.052	0.071	0.060	0.072	0.097	0.058	0.034									
11		0.097	0.074	0.058	0.052	0.062	0.065	0.065	0.092	0.075	0.068	0.083	0.065	0.042									
12		0.076	0.083	0.061	0.099	0.050	0.053	0.052	0.098	0.089	0.082	0.073	0.084	0.043									

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	0.030	0.019	0.021	0.040	0.020	0.024	0.013	0.035	0.029	0.029	0.025	0.032	0.035	0.037	0.035	0.042	0.034	0.045	0.039	0.040	0.037	0.046	0.036
3	0.020	0.033	0.038	0.044	0.033	0.039	0.032	0.053	0.049	0.046	0.044	0.047	0.042	0.044	0.037	0.043	0.044	0.046	0.044	0.045	0.043	0.052	0.042
4	0.032	0.054	0.047	0.041	0.045	0.052	0.037	0.053	0.061	0.049	0.056	0.056	0.052	0.052	0.048	0.045	0.049	0.047	0.044	0.045	0.050	0.054	0.042
5	0.040	0.066	0.046	0.035	0.061	0.047	0.046	0.054	0.069	0.056	0.069	0.057	0.051	0.054	0.055	0.051	0.053	0.050	0.046	0.049	0.055	0.052	0.037
6	0.037	0.062	0.052	0.054	0.044	0.035	0.041	0.054	0.082	0.064	0.070	0.071	0.055	0.052	0.059	0.058	0.054	**0.048**	**0.038**		0.061	**0.055**	0.041
7	0.040	0.061	0.045	0.043	0.049	0.035	0.047	0.044	0.082	0.078	0.061	0.071	0.057	0.043	0.064	0.050	0.065		**0.059**		0.070	**0.056**	**0.040**
8	0.057	0.058	0.049	0.049	0.052	0.066		0.055	0.074	0.051	0.078	0.072	0.066	0.046	0.059	0.032	0.071			**0.032**	**0.138**		
9	0.059	0.055	0.045	0.070	0.042	0.046	0.047	0.075	0.064	0.053	0.059	0.072	0.060	0.052	0.061			**0.036**			**0.073**	**0.113**	
10	0.062	0.061	0.047	0.059	0.057	0.049	0.037	0.049	0.081	0.070	0.069	0.071	0.064	0.054								**0.096**	
11	0.033	0.066	0.051	0.077	0.055	0.063	0.065	0.066	0.080	0.091	0.073	0.075	0.062	0.038									
12	0.071	0.080	0.066	0.066	0.062	0.024	0.046	0.052	0.097	0.073	0.070	0.071	0.079	0.034									

Division 3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2				0.021	0.013	0.025		0.029	0.030	0.026	0.025	0.026	0.039	0.046	0.041	0.043	0.039	0.039	0.039	0.042	0.040	0.046	0.039
3				0.041	0.025	0.022		0.031	0.032	0.032	0.028	0.036	0.038	0.056	0.067	0.053	0.078	0.048	0.040	0.047	0.045	0.056	0.043
4				0.038	0.042	0.024		0.039	0.035	0.031	0.035	0.039	0.037	0.062	0.073	0.062	0.053	0.049	0.044	0.049	0.051	0.050	0.048
5				0.039		0.027		0.039	0.047	0.035	0.043	0.052	0.042	0.059	0.076	0.066	0.052	0.050	0.044	0.055	**0.067**	0.055	0.047
6				0.039		0.030		0.033	0.040	0.030	0.045	0.045	0.048	0.060	0.071	0.075	0.074	0.066	0.064	**0.053**	**0.062**	0.047	0.052
7				0.041		0.041		0.030	0.045	0.029	0.051	0.053	0.057	0.059	0.073	0.066	0.044	**0.080**	0.078	0.069	**0.042**	**0.091**	**0.066**
8				0.065	0.039	0.032		0.046	0.033	0.032	0.043	0.058	0.055	0.069	0.065	0.033	0.035	**0.053**	**0.102**	0.068	0.079	**0.066**	**0.086**
9				0.049	0.061	0.039		0.051	0.056	0.036	0.050	0.051	0.059	0.075	0.070				**0.137**	**0.087**	**0.080**	**0.076**	**0.051**
10				0.077	0.054	0.041		0.066	0.052	0.091	0.039	0.059	0.057	0.066	0.074	0.098						**0.084**	
11				0.052	0.068	0.042		0.060	0.048	0.059	0.044	0.067	0.069	0.074	0.090						**0.082**	**0.081**	
12				0.068	0.066	0.045		0.071	0.060	0.050	0.070	0.055	0.065	0.056	0.068							**0.060**	

Table 37. Observed proportion mature at age of female cod in divisions 2J3KL (1982-2001). A50=median age at maturity (years); L95% and U95% = lower and upper 95% confidence intervals. Parameter estimates of the logit model are shown: Int=intercept, SE=standard error, n=number of fish examined, dot=no fish sampled. Years are spawning years. (Each observations was made during the autumn survey of the previous year.)

AGE	1982	1983	1984	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
2	0	0	0	0	0	0	0	0	0	0	0 .		0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0.01	0	0	0.01	0	0	0	0.02	0.05	0.07	0.02	0.01	0.10	0.13	0.04	0.04
5	0.01	0.05	0.05	0.03	0.02	0.08	0.08	0.11	0.13	0.29	0.30	0.55	0.59	0.39	0.31	0.50	0.47	0.52	0.36
6	0.44	0.45	0.49	0.42	0.47	0.39	0.67	0.70	0.43	0.63	0.84	0.90	1	0.70	0.49	0.94	0.75	0.84	0.50
7	0.88	0.93	0.84	0.85	0.88	0.90	0.90	0.91	0.88	0.83	0.84	0.98	1	0.86	1	.	0.78	1	1.00
8	0.96	0.99	0.93	1	0.97	0.96	0.97	0.99	0.97	0.98	1	1	1	1	1	1	0.75	.	1
9	1	1	1	1	0.98	1	1	1	1	1	1	1	1	.	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	.	.	.	1	1	1	1	1
11	1	1	1	1	1	1	1	1	0.84	1	1	1	.	.	.	.	.	1	.
12	1	1	1	1	1	1	1	1	1	1	1	.	.	.	.	.	.	1	.
13	1	1	1	1	1	1	1	1	1	1	.	.	.	.	.	.	.	.	.
A50	6.27	6.07	6.13	6.20	6.18	6.16	5.91	5.81	6.19	5.72	5.44	5.01	4.86	5.44	5.66	4.95	5.25	5.11	5.52
L 95%	6.12	5.96	6.01	6.10	6.06	6.05	5.78	5.70	6.06	5.60	5.32	4.89	4.68	5.22	5.44	4.78	5.04	4.93	5.30
U 95%	6.41	6.20	6.26	6.29	6.30	6.28	6.03	5.93	6.33	5.84	5.56	5.13	5.04	5.75	5.95	5.18	5.51	5.33	5.82
Slope	2.30	2.70	2.22	2.48	2.25	2.21	2.17	2.48	1.59	1.61	2.00	2.52	3.38	2.11	2.16	2.51	1.45	2.70	1.86
SE	0.18	0.23	0.19	0.17	0.17	0.17	0.14	0.18	0.09	0.11	0.15	0.24	0.65	0.28	0.27	0.31	0.17	0.32	0.24
Int	-14.45	-16.43	-13.59	-15.37	-13.91	-13.65	-12.81	-14.39	-9.84	-9.19	-10.90	-12.64	-16.46	-11.48	-12.22	-12.43	-7.59	-13.79	-10.26
SE	1.17	1.34	1.15	1.05	1.08	1.05	0.86	1.04	0.55	0.61	0.82	1.22	3.22	1.41	1.38	1.42	0.85	1.54	1.19
n	1028	1354	1202	1260	1037	1146	1386	1422	1361	1045	697	489	139	389	501	339	351	496	440

Table 38. Estimated proportion mature at age of female cod in divisions 2J3KL (1982-2001) and projection to 2003.

	Age														
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1982	0.0000	0.0000	0.0001	0.0005	0.0053	0.0509	0.3498	0.8437	0.9819	0.9982	0.9998	1.0000	1.0000	1.0000	1.0000
1983	0.0000	0.0000	0.0000	0.0002	0.0036	0.0518	0.4499	0.9244	0.9946	0.9996	1.0000	1.0000	1.0000	1.0000	1.0000
1984	0.0000	0.0000	0.0001	0.0010	0.0088	0.0754	0.4279	0.8728	0.9844	0.9983	0.9998	1.0000	1.0000	1.0000	1.0000
1985	0.0000	0.0000	0.0000	0.0004	0.0062	0.0989	0.6603	0.9718	0.9984	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
1986	0.0000	0.0000	0.0000	0.0004	0.0043	0.0490	0.3813	0.8805	0.9888	0.9991	0.9999	1.0000	1.0000	1.0000	1.0000
1987	0.0000	0.0000	0.0001	0.0008	0.0074	0.0658	0.4007	0.8640	0.9837	0.9983	0.9998	1.0000	1.0000	1.0000	1.0000
1988	0.0000	0.0000	0.0001	0.0009	0.0082	0.0704	0.4094	0.8638	0.9831	0.9981	0.9998	1.0000	1.0000	1.0000	1.0000
1989	0.0000	0.0000	0.0002	0.0018	0.0158	0.1229	0.5506	0.9146	0.9894	0.9988	0.9999	1.0000	1.0000	1.0000	1.0000
1990	0.0000	0.0000	0.0001	0.0010	0.0112	0.1183	0.6147	0.9499	0.9956	0.9996	1.0000	1.0000	1.0000	1.0000	1.0000
1991	0.0000	0.0000	0.0013	0.0062	0.0297	0.1304	0.4234	0.7825	0.9463	0.9885	0.9976	0.9995	0.9999	1.0000	1.0000
1992	0.0000	0.0000	0.0025	0.0125	0.0594	0.2396	0.6112	0.8869	0.9751	0.9949	0.9990	0.9998	1.0000	1.0000	1.0000
1993	0.0000	0.0000	0.0008	0.0061	0.0468	0.2822	0.7589	0.9618	0.9951	0.9994	0.9999	1.0000	1.0000	1.0000	1.0000
1994	0.0000	0.0000	0.0000	0.0062	0.0727	0.4942	0.9242	0.9935	0.9995	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1995	0.0000	0.0000	0.0001	0.0018	0.0508	0.6122	0.9790	0.9993	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1996	0.0000	0.0001	0.0007	0.0058	0.0455	0.2824	0.7644	0.9640	0.9955	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1997	0.0000	0.0000	0.0004	0.0032	0.0270	0.1939	0.6762	0.9477	0.9937	0.9993	0.9999	1.0000	1.0000	1.0000	1.0000
1998	0.0000	0.0001	0.0006	0.0074	0.0835	0.5283	0.9323	0.9995	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1999	0.0000	0.0021	0.0090	0.0372	0.1408	0.4102	0.7470	0.9261	0.9816	0.9956	0.9990	1.0000	1.0000	1.0000	1.0000
2000	0.0000	0.0000	0.0002	0.0034	0.0481	0.4293	0.9181	0.9941	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2001	0.0000	0.0002	0.0014	0.0092	0.0563	0.2769	0.7110	0.9405	0.9903	0.9985	0.9998	1.0000	1.0000	1.0000	1.0000
2002	0.0000	0.0007	0.0037	0.0195	0.0955	0.3596	0.7493	0.9408	0.9883	0.9978	0.9996	1.0000	1.0000	1.0000	1.0000
2003	0.0000	0.0007	0.0037	0.0195	0.0955	0.3596	0.7493	0.9408	0.9883	0.9978	0.9996	1.0000	1.0000	1.0000	1.0000

Table 39. Tag reporting rates by region and year (see Section 4.4.1.3).

NAFO Unit Areas	Year	Reporting Rates	
		Single	Double
3K(d,h,i)	1997-2000	0.77	0.77
Northern 3L(a,b)	1997-1998	0.96	0.96
Northern 3L(a,b)	1999	0.47	0.52
Northern 3L(a,b)	2000	0.46	0.76
Southern 3L(f,j,q)	1997-2000	0.75	0.94
3Pn+4R(a-d)+S(v,w)	1997-2000	0.43	0.65
3Ps(c)	1997-2000	0.73	0.76
3Ps(a,b,d,e)	1997-2000	0.64	0.73
3Ps(f-h)+3NO	1997-2000	0.70	0.70

Table 40. Cod age-length key from spring research bottom-trawl surveys in NAFO Division 3L in 1996-1998 combined. This age-length key was used for aging cod found in seal stomachs in the first half of the year.

	Age											
Length	1	2	3	4	5	6	7	8	9	10	11	Total
4	3	.	.	.	.	.	.	.	.	.	.	3
7	3	.	.	.	.	.	.	.	.	.	.	3
10	3	.	.	.	.	.	.	.	.	.	.	3
13	6	1	.	.	.	.	.	.	.	.	.	7
16	5	6	.	.	.	.	.	.	.	.	.	11
19	3	17	3	.	.	.	.	.	.	.	.	23
22	.	45	15	.	.	.	.	.	.	.	.	60
25	.	39	24	.	.	.	.	.	.	.	.	63
28	.	15	36	1	.	.	.	.	.	.	.	52
31	.	5	39	10	.	.	.	.	.	.	.	54
34	.	.	45	29	1	.	.	.	.	.	.	75
37	.	.	36	47	2	.	.	.	.	.	.	85
40	.	.	10	48	11	.	.	.	.	.	.	69
43	.	.	3	38	14	1	.	.	.	.	.	56
46	.	.	.	28	25	.	.	.	.	.	.	53
49	.	.	.	14	24	13	.	.	.	.	.	51
52	.	.	.	2	26	9	1	.	.	.	.	38
55	.	.	.	1	7	15	2	.	.	.	.	25
58	.	.	.	.	4	15	8	1	.	.	.	28
61	.	.	.	.	.	9	5	.	.	.	.	14
64	.	.	.	.	1	3	10	2	.	.	.	16
67	.	.	.	.	.	1	9	2	.	.	.	12
70	.	.	.	.	.	2	6	3	.	.	.	11
73	.	.	.	.	.	.	3	2	1	1	.	7
76	.	.	.	.	.	.	1	1	.	.	.	2
79	.	.	.	.	.	.	2	3	2	1	.	8
82	.	.	.	.	.	.	.	.	1	.	.	1
85	.	.	.	.	.	.	.	1	.	1	1	3
88	.	.	.	.	.	.	.	.	1	.	.	1
All	23	128	211	218	115	68	47	15	5	3	1	834

Table 41. Cod age-length key from autumn research bottom-trawl surveys in NAFO Division 2J3KL in 1995-1997 combined. This age-length key was used for aging cod found in seal stomachs in the second half of the year.

	Age												
Length	0	1	2	3	4	5	6	7	8	9	10	11	Total
4	4	.	.	.	.	.	.	.					4
7	18	.	.	.	.	.	.	.					18
10	25	1	.	.	.	.	.	.					26
13	14	19	.	.	.	.	.	.					33
16	.	139	6	.	.	.	.	.					145
19	.	243	28	.	.	.	.	.					271
22	.	144	99	.	.	.	.	.					243
25	.	21	252	12	.	.	.	.					285
28	.	.	347	61	.	.	.	.					408
31	.	.	278	126	3	.	.	.					407
34	.	.	110	212	18	1	.	.					341
37	.	.	19	278	45	1	.	.					343
40	.	.	1	236	91	5	.	.					333
43	.	.	.	96	119	14	.	.					229
46	.	.	.	26	90	33	2	.					151
49	.	.	.	2	80	43	3	.					128
52	.	.	.	.	27	36	3	1					67
All	61	567	1140	1049	473	133	8	1					3432

Table 42. Estimates of the number (thousands) of cod at age consumed by harp seals during 1986-1998, by half-year and year.

	Age								
Year	0	1	2	3	4	5	6	7	All
First half									
1986		201,003	138,469	46,901	6,700	2,233	.	.	395,305
1987		490,097	176,083	38,151	5,869	.	.	.	710,201
1988		1,115,669	147,258	34,943	4,992	.	.	.	1,302,862
1989		345,673	193,298	23,509	6,966	5,224	.	.	574,671
1990		279,136	183,976	48,637	4,229	4,229	.	.	520,208
1991		84,724	34,660	25,032	12,516	10,591	.	.	167,523
1992		472,095	232,723	31,030	4,433	4,433	.	.	744,713
1993		84,546	106,287	60,390	9,662	4,831	.	.	265,717
1994		326,542	24,523	23,878	18,715	10,971	1,936	.	406,565
1995		35,420	39,891	34,904	15,647	10,145	2,235	.	138,242
1996		161,924	36,275	26,286	13,406	11,303	2,366	789	252,349
1997		19,314	18,107	20,219	13,882	11,467	3,018	905	86,911
1998		8,688	8,124	12,807	14,386	11,227	3,329	1,015	59,576
Second half									
1986	172,411	81,503	29,780	1,567	1,567	1,567	.	.	288,397
1987	398,486	55,345	31,626	7,906	.	.	.	.	493,363
1988	6,636	5,530	3,503	4,240	3,134	2,396	1,106	.	26,545
1989	702,182	100,312	80,249	.	.	.	.	.	882,743
1990	835	5,843	9,322	6,261	3,756	2,365	835	.	29,217
1991	40,226	53,635	25,700	7,822	3,352	3,352	.	.	134,088
1992	6,827	9,103	11,948	7,624	3,983	2,162	683	.	42,329
1993	259,178	25,034	12,763	2,454	2,454	1,473	.	.	303,356
1994	421,435	45,015	23,284	11,642	3,881	2,328	.	.	507,584
1995	502,703	98,088	49,044	12,261	.	.	.	.	662,096
1996	39,328	17,258	11,367	5,974	4,397	4,066	996	249	83,634
1997	8,939	8,710	10,772	5,845	4,011	4,011	344	.	42,631
1998	2,517	3,011	5,700	5,602	4,664	3,973	888	296	26,652
Full year									
1986	172,411	282,506	168,249	48,468	8,267	3,801	.	.	683,702
1987	398,486	545,443	207,709	46,058	5,869	.	.	.	1,203,564
1988	6,636	1,121,200	150,761	39,183	8,126	2,396	1,106	.	1,329,407
1989	702,182	445,985	273,548	23,509	6,966	5,224	.	.	1,457,414
1990	835	284,979	193,297	54,898	7,986	6,595	835	.	549,425
1991	40,226	138,359	60,360	32,854	15,868	13,943	.	.	301,611
1992	6,827	481,198	244,670	38,653	8,415	6,595	683	.	787,042
1993	259,178	109,581	119,049	62,845	12,117	6,304	.	.	569,074
1994	421,435	371,557	47,807	35,519	22,595	13,299	1,936	.	914,149
1995	502,703	133,508	88,935	47,165	15,647	10,145	2,235	.	800,338
1996	39,328	179,182	47,642	32,260	17,803	15,369	3,361	1,038	335,983
1997	8,939	28,023	28,879	26,064	17,893	15,478	3,362	905	129,542
1998	2,517	11,699	13,824	18,408	19,050	15,200	4,217	1,312	86,228
All years	2,561,702	4,133,220	1,644,730	505,884	166,603	114,348	17,735	3,254	9,147,478

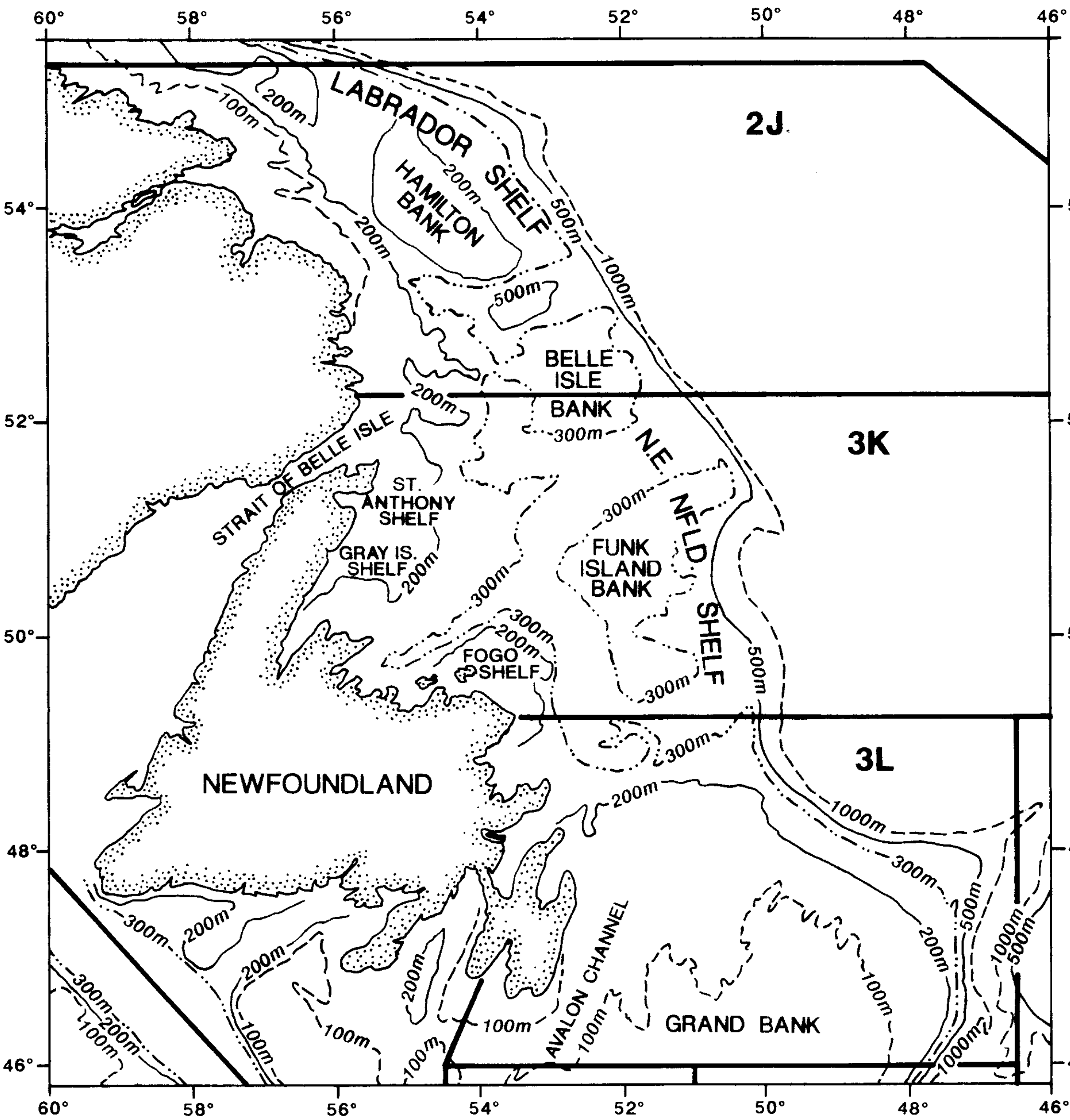

Fig. 1a. Map of the stock area, showing physiographic features and NAFO Divisions.

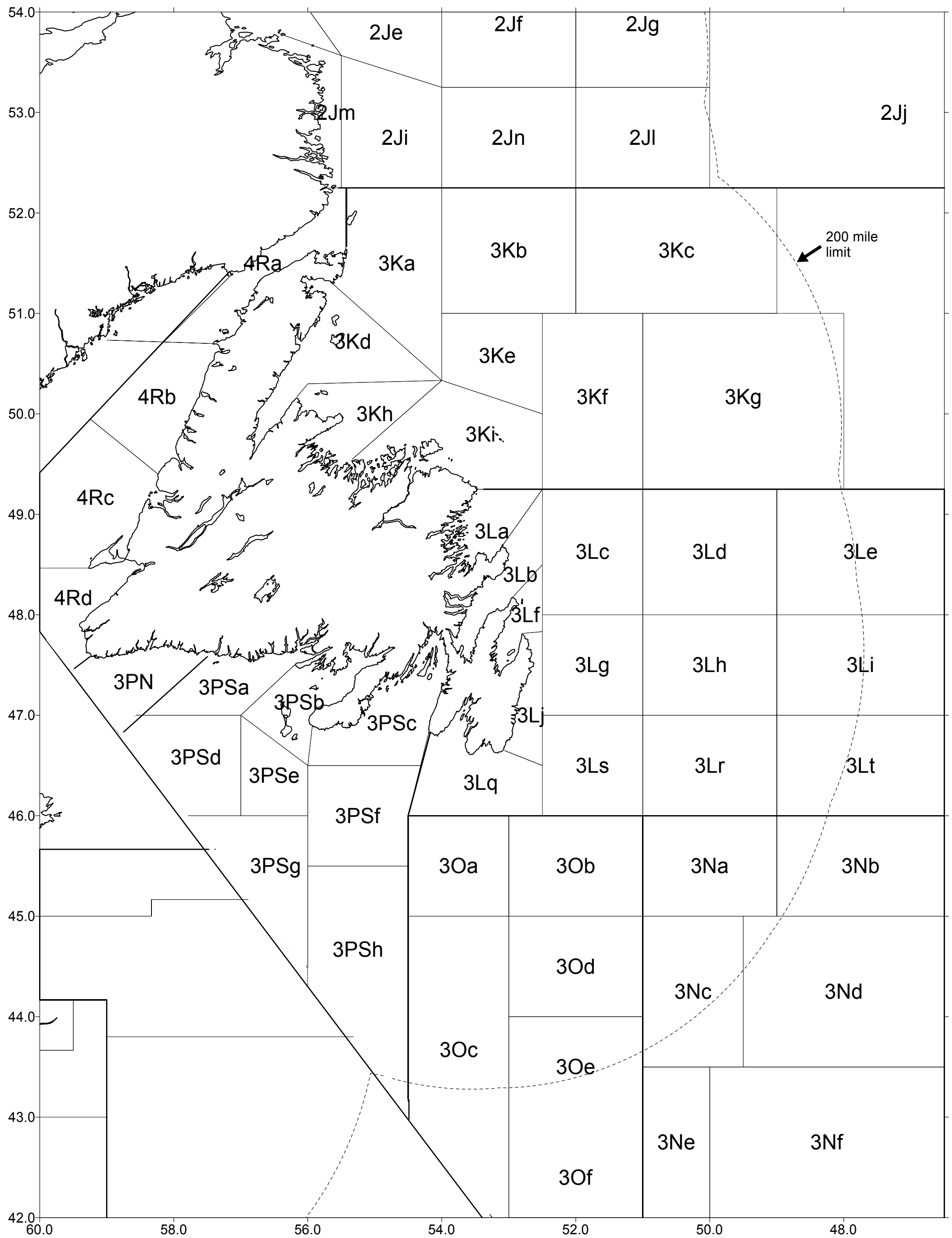

Fig. 1b. Map of the stock area, showing commercial fishery statistical unit areas.

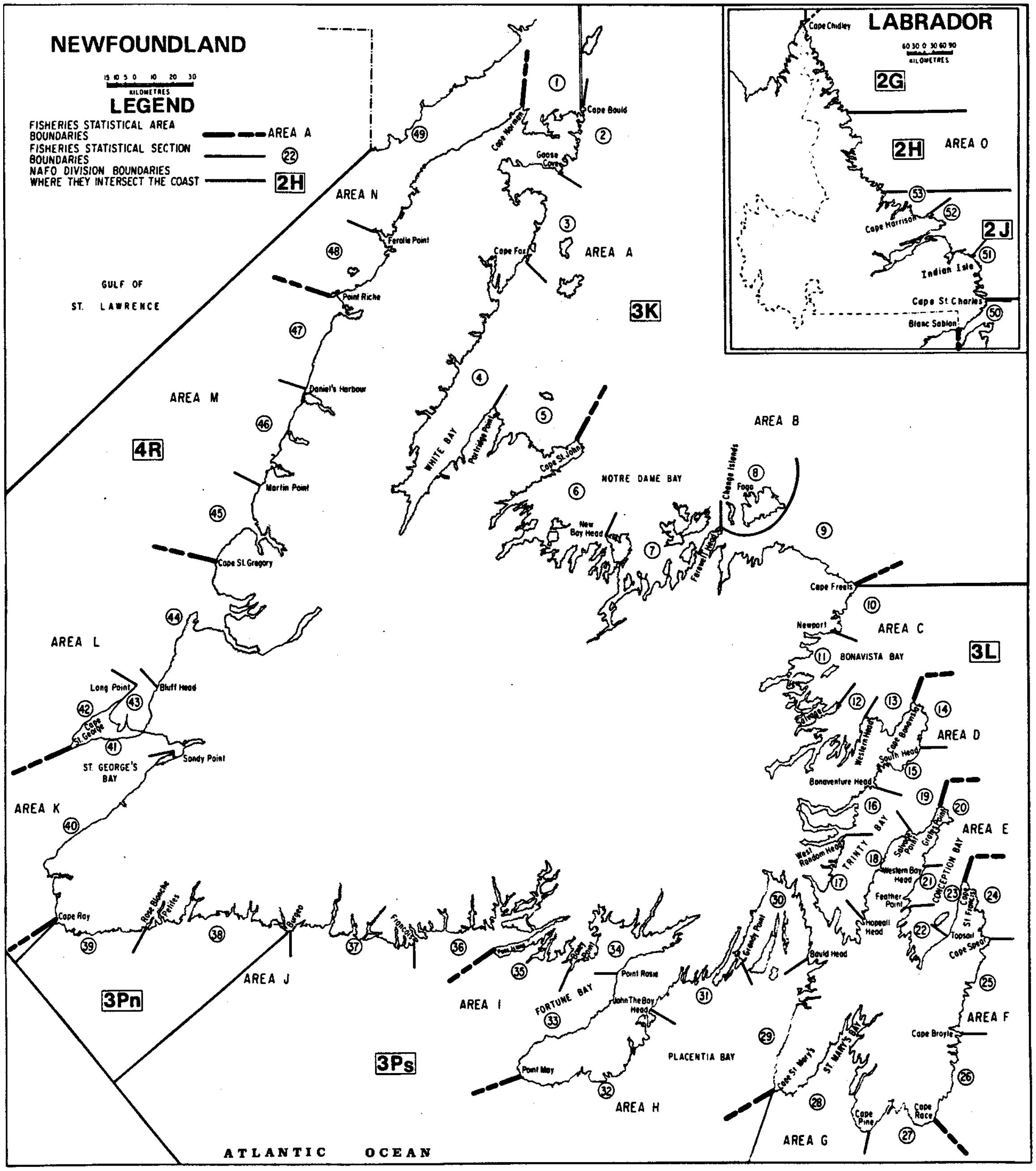

Fig. 1c. Map of the stock area, showing commercial fishery statistical sections.

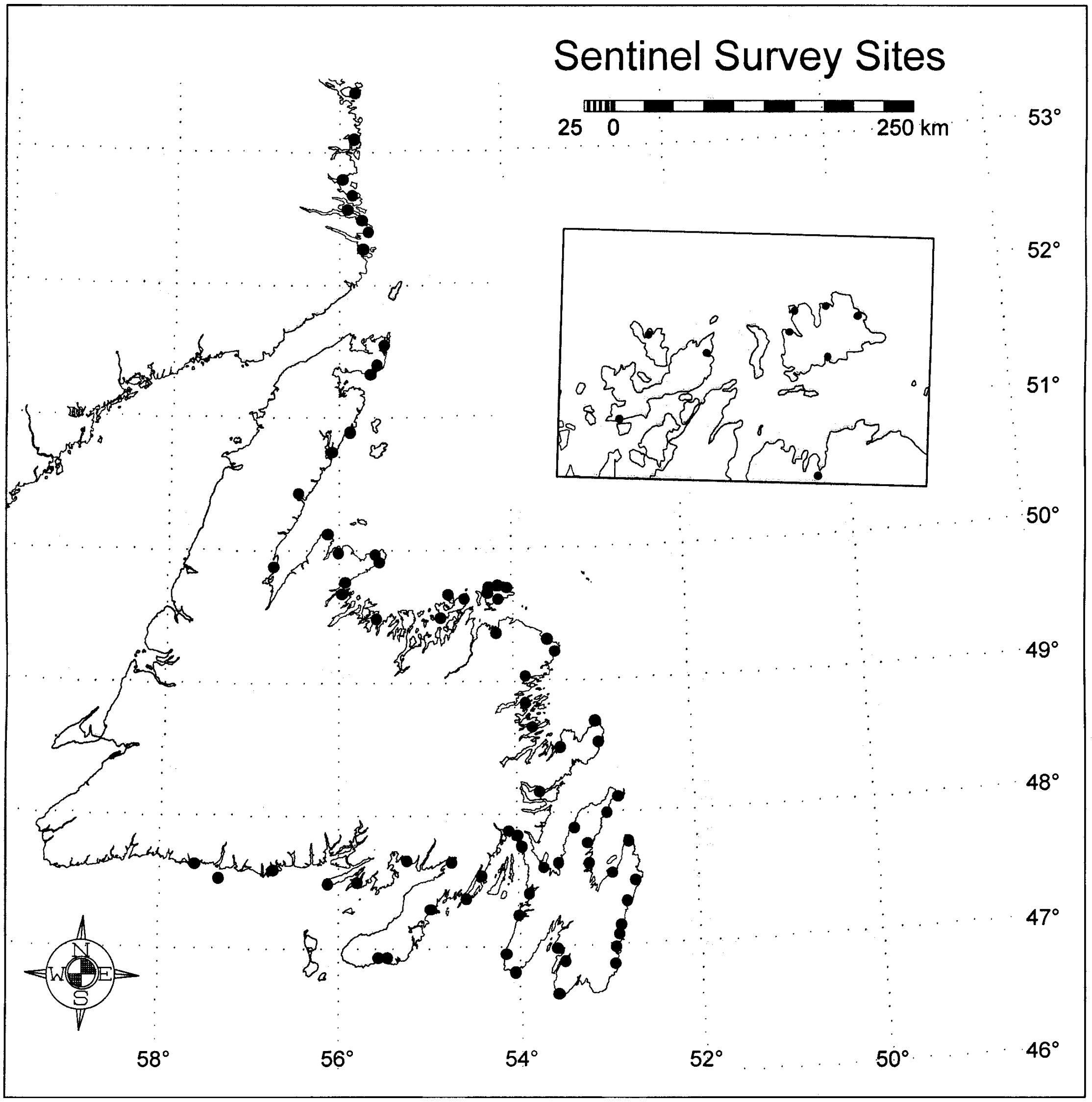

Fig. 1d. Map of the stock area, showing sentinel survey sites.

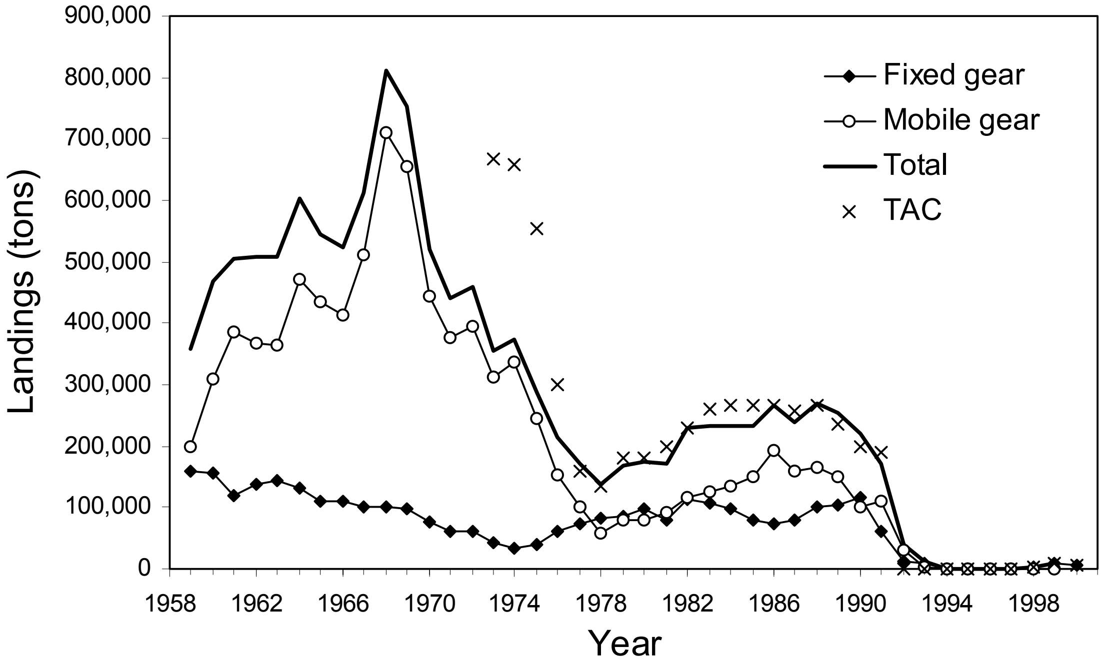

Fig. 2. Divisions 2J+3KL TAC and landings from fixed and mobile gear, 1959-2000.

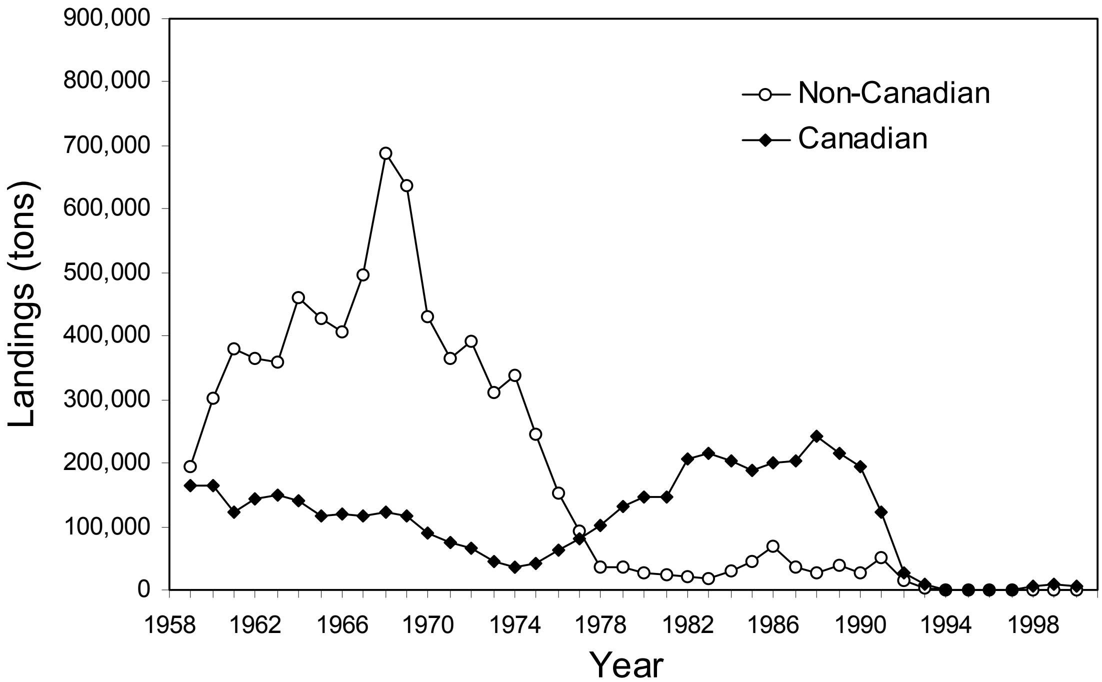

Fig. 3. Divisions 2J+3KL landings by Canadian and non-Canadian vessels, 1959-2000.

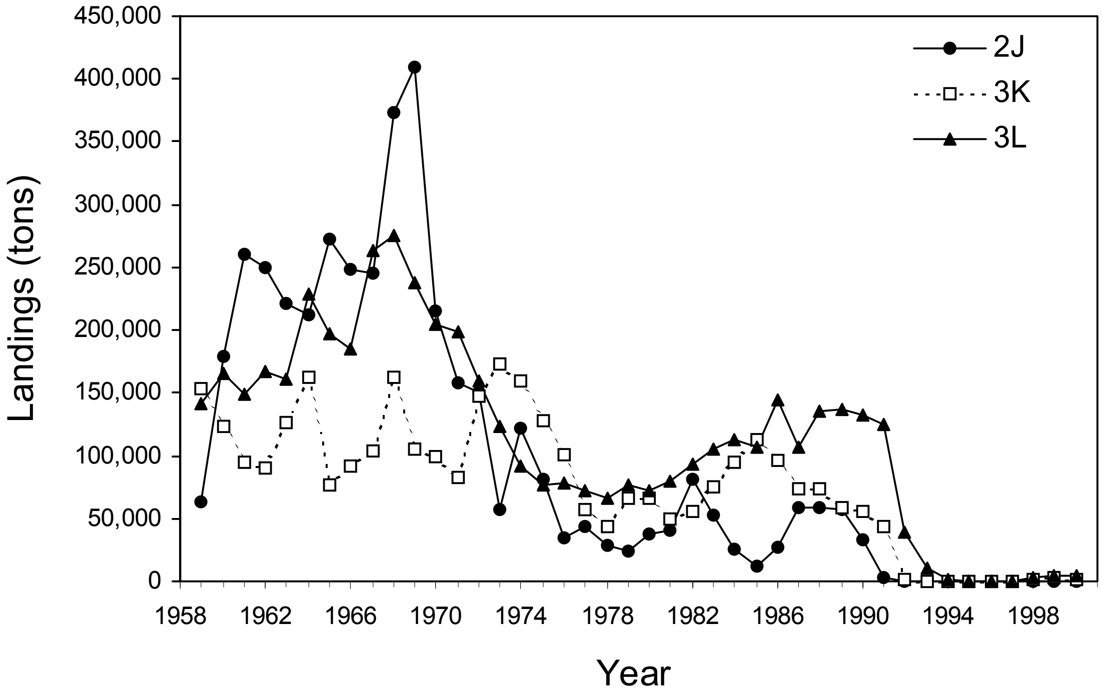

Fig. 4. Division 2J+3KL landings by Division, 1959-2000.

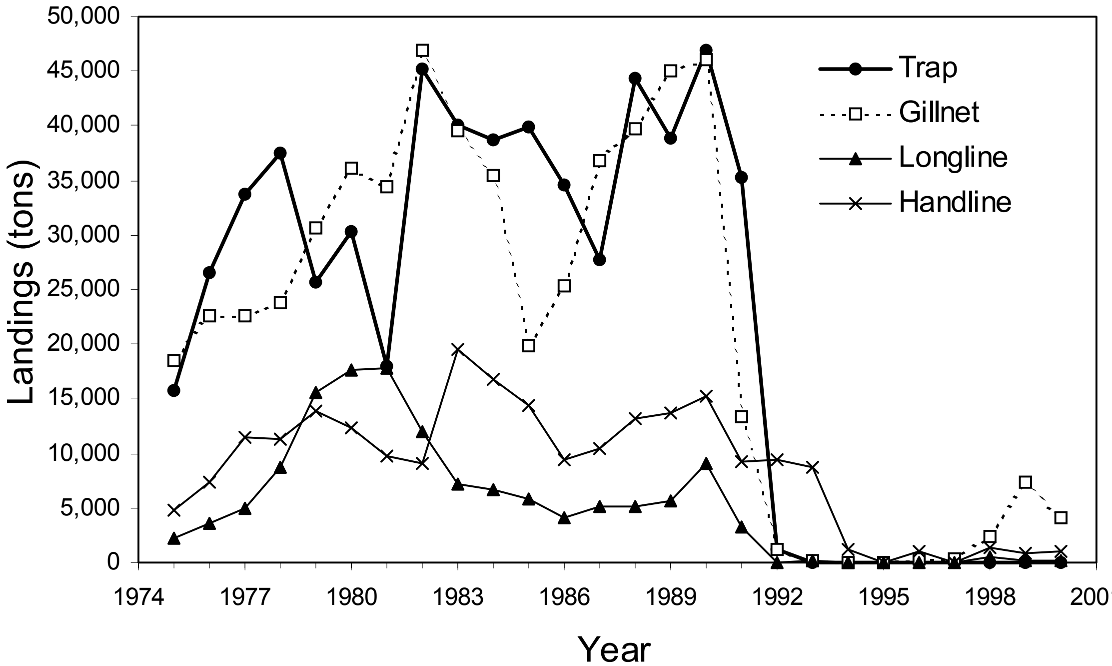

Fig. 5. Division 2J+3KL fixed gear landings by gear type, 1975-2000.

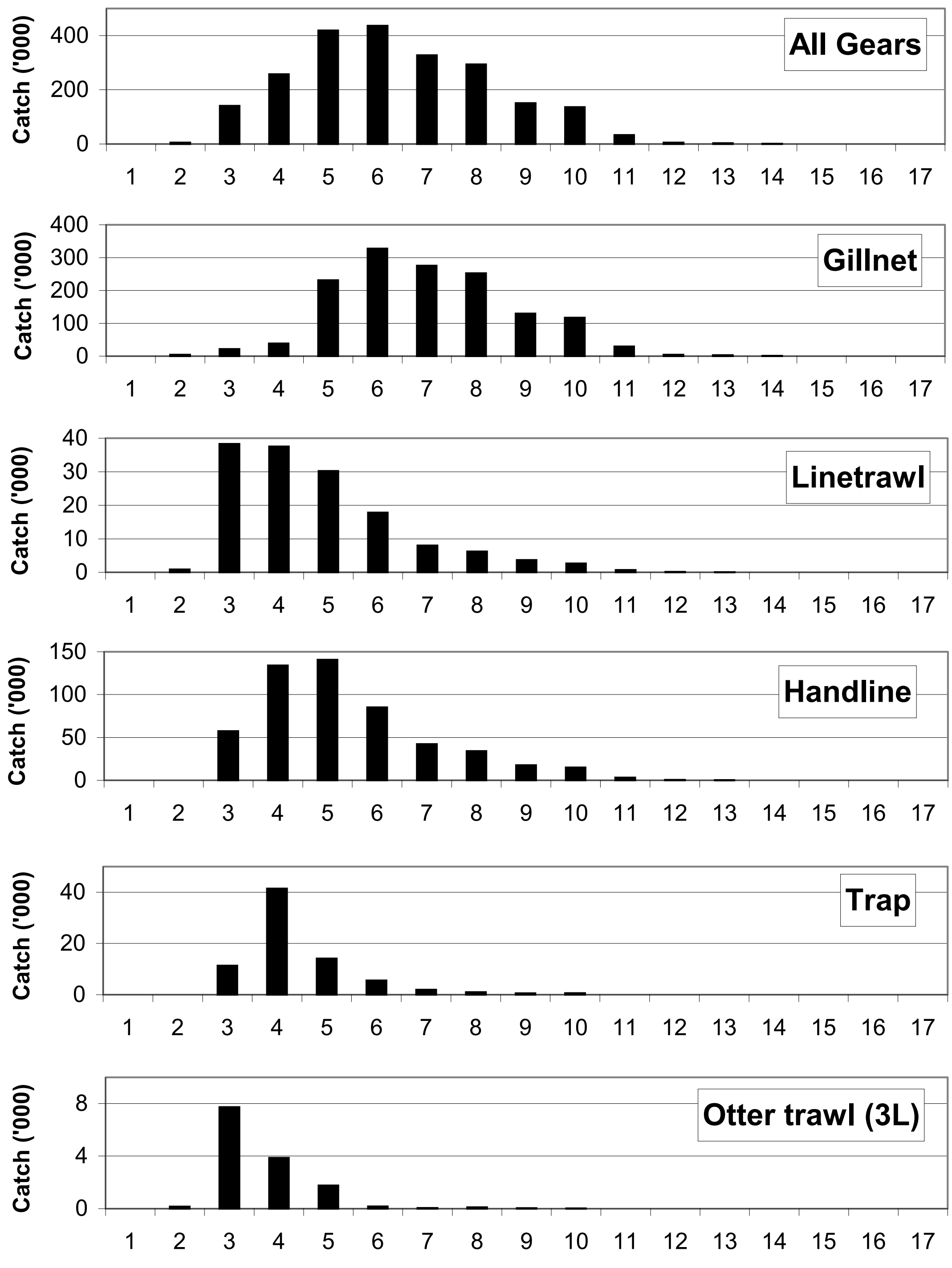

Fig. 6. The estimated catch at age for all gears combined and for individual gears in 2J3KL in 2000. All sources of catch (commercial, sentinel survey and food / recreational) are combined.

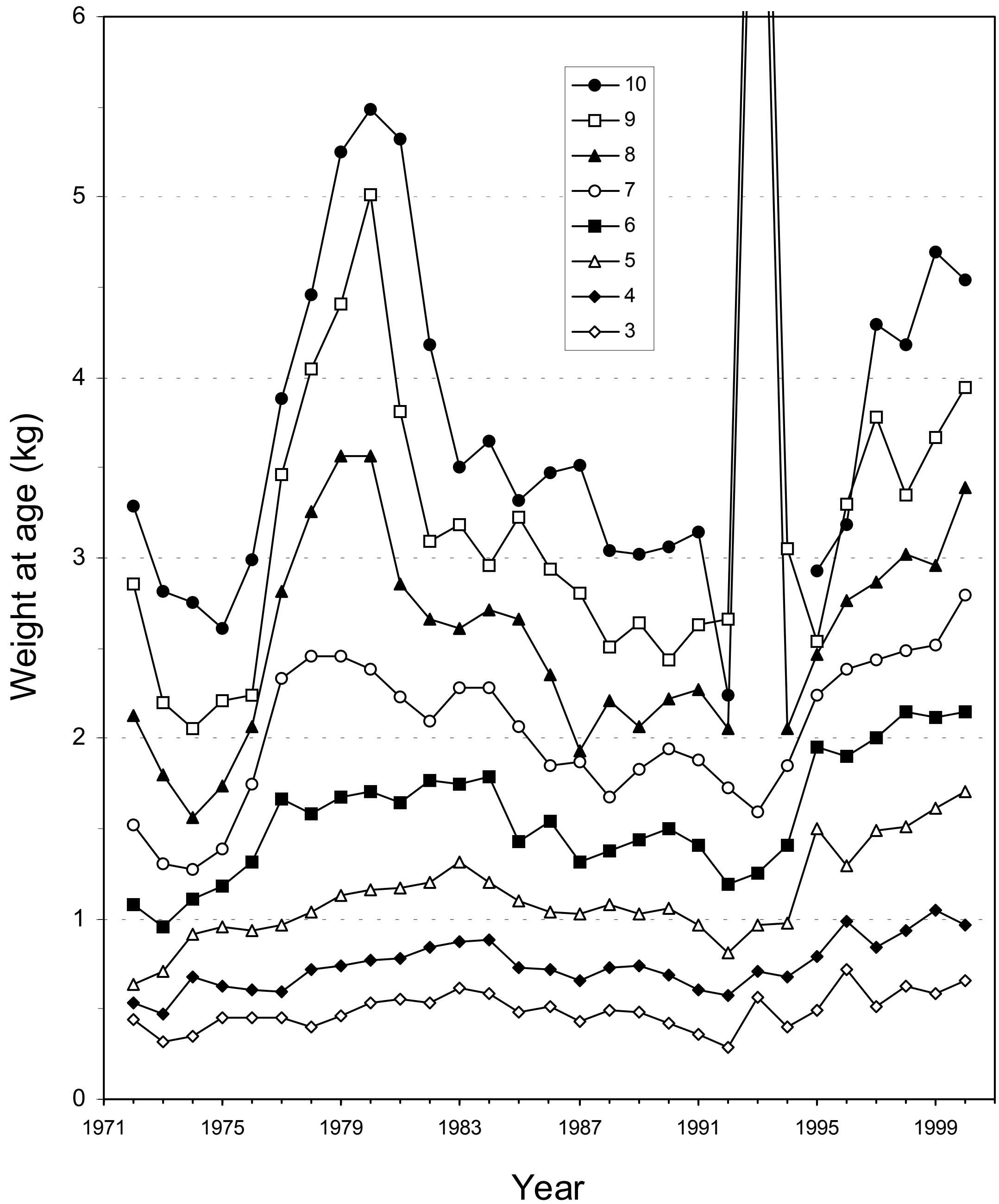

Fig. 7. Mean weights-at-age calculated from mean lengths-at-age in the catch, 1972-2000.

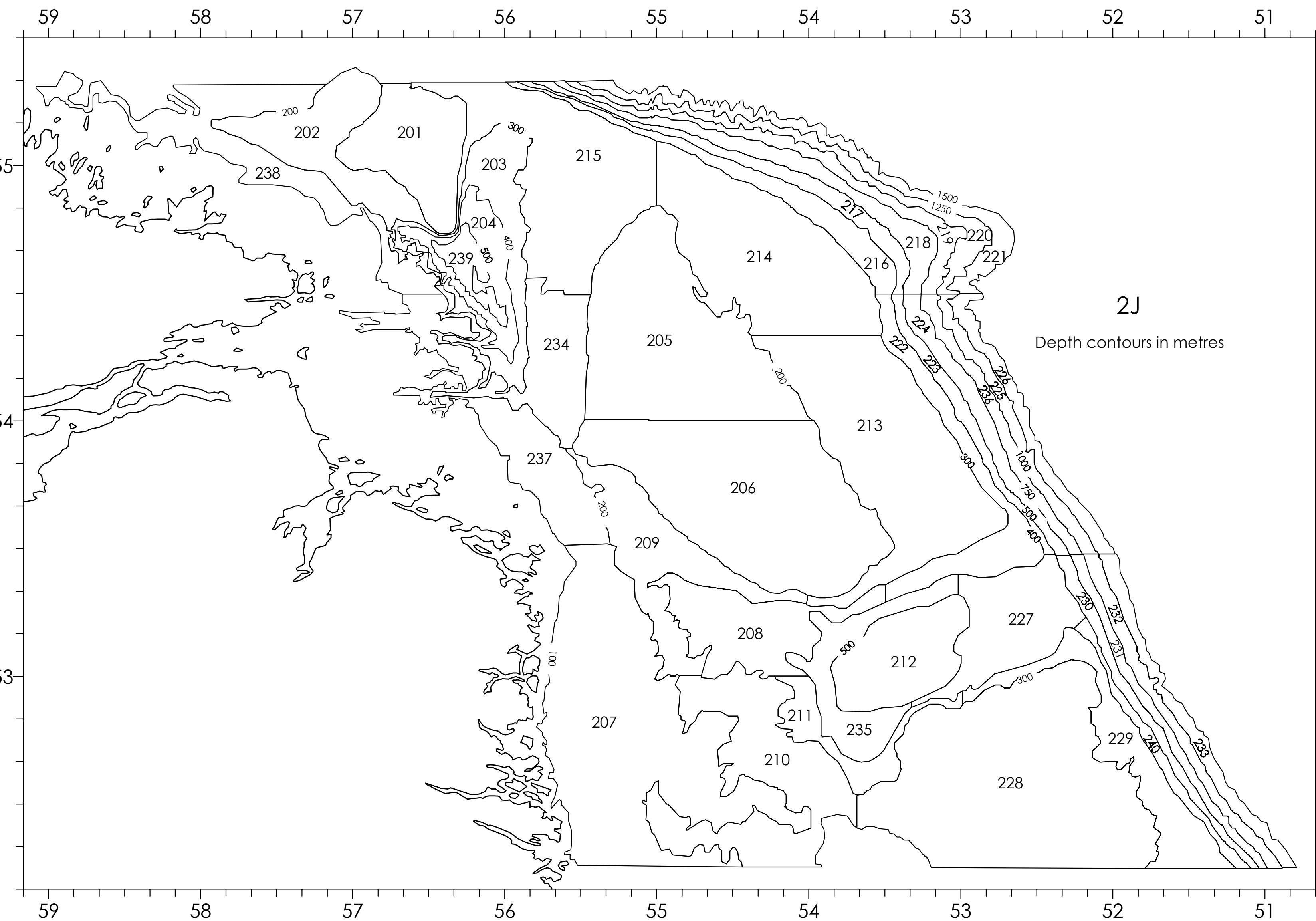

Fig. 8. Strata used for research bottom-trawl surveys in Division 2J.

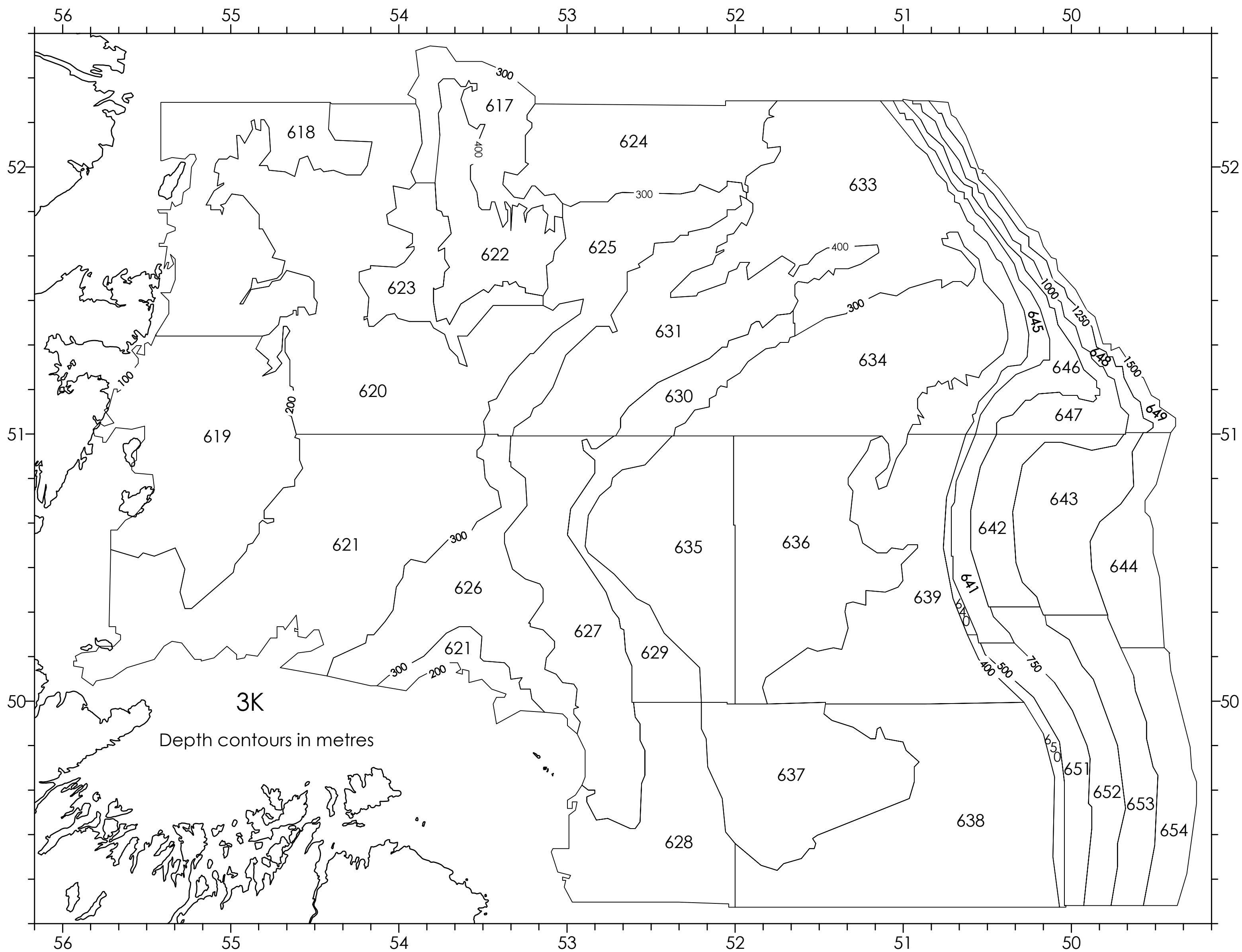

Fig. 9. Strata used for research bottom-trawl surveys in Division 3K.

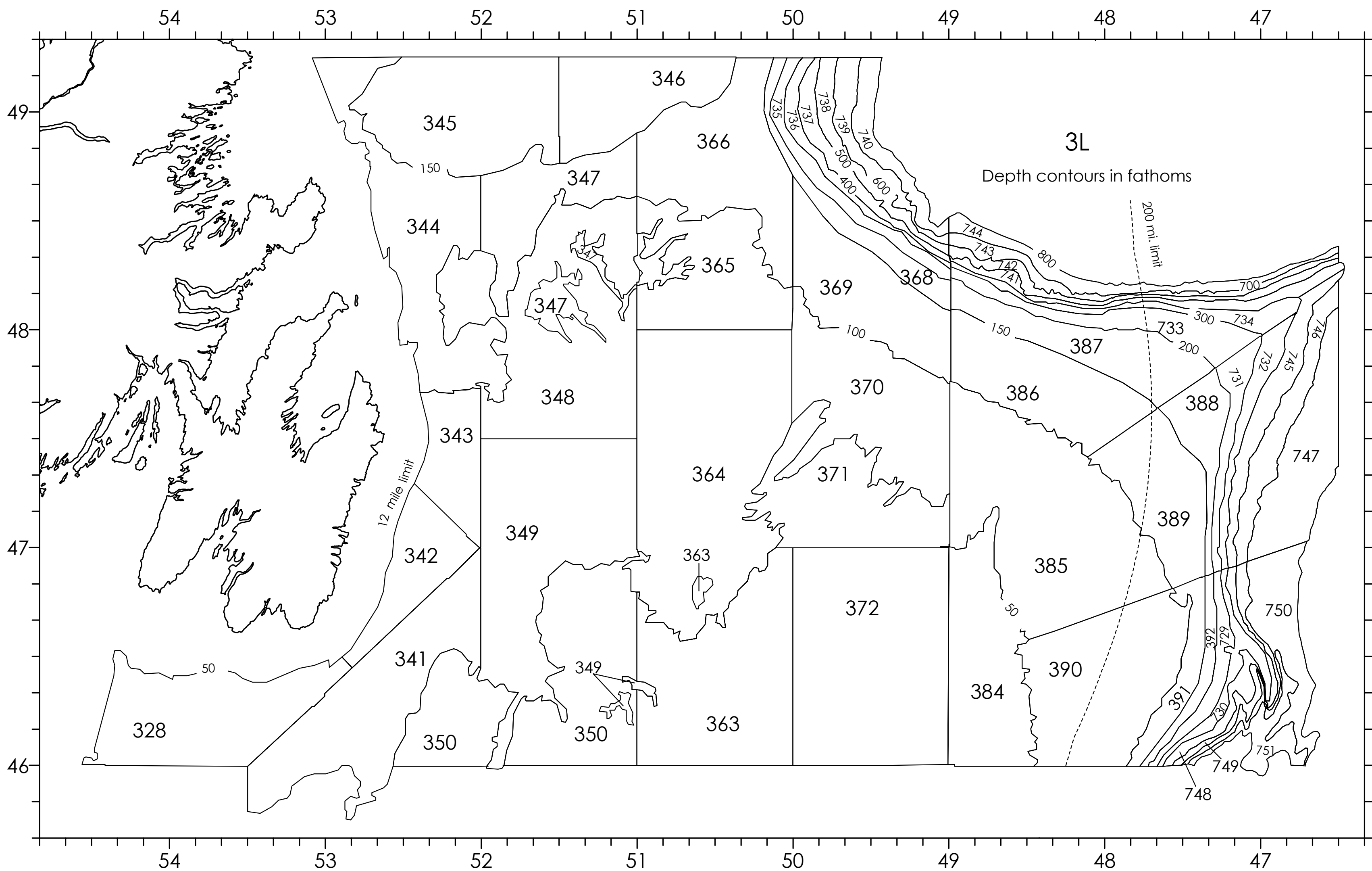

Fig. 10. Strata used for research bottom-trawl surveys in Division 3L.

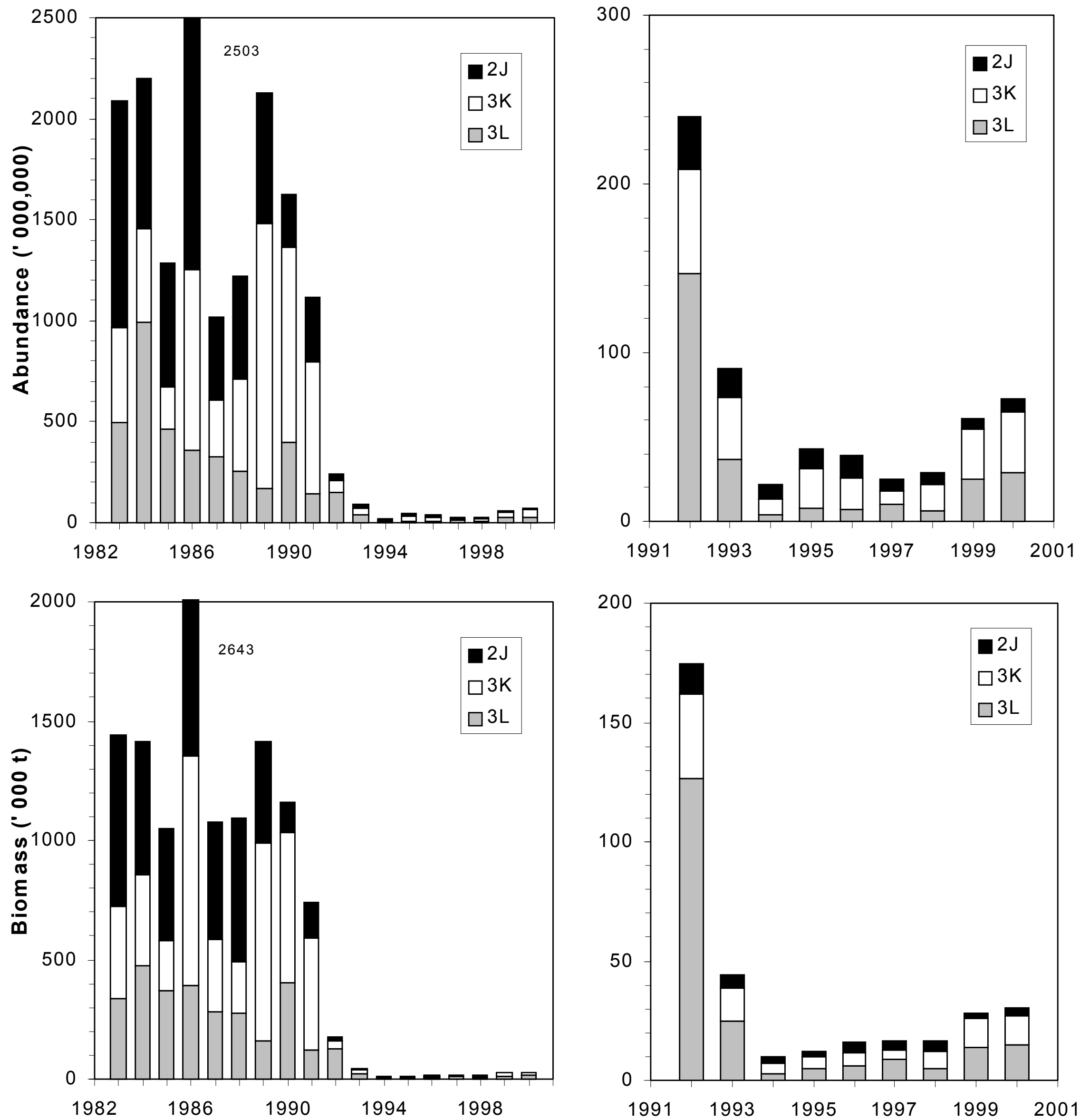

Fig. 11. Indices of abundance and biomass of cod from autumn bottom-trawl surveys in the offshore index strata of divisions 2J3KL in 1983-2000. The estimates for 1983-1994 are adjusted to Campelen equivalents.

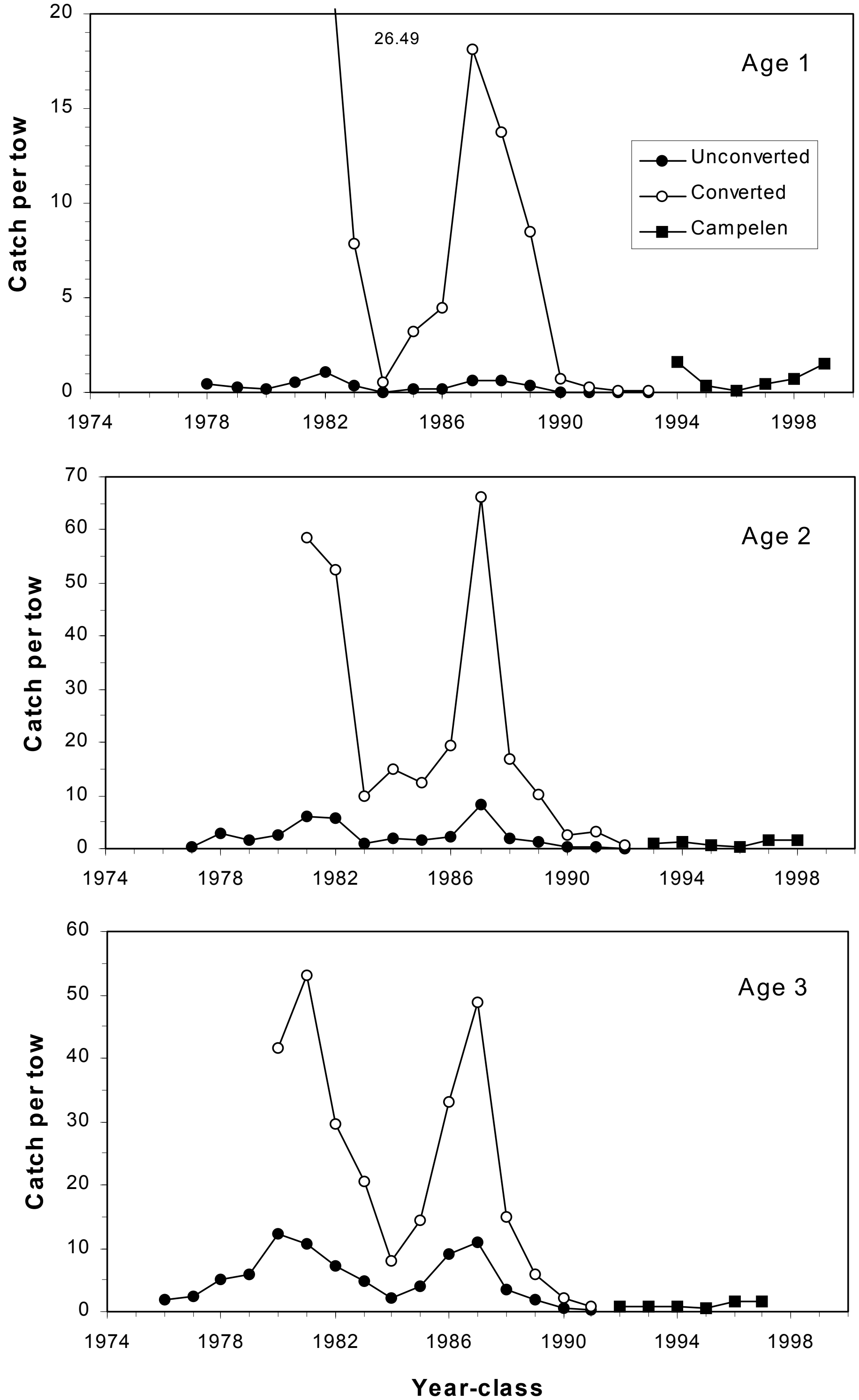

Fig. 12. Mean catch per tow of the 1976-1999 year-classes at ages 1-3 during autumn bottom-trawl surveys in divisions 2J, 3K and 3L combined. Data obtained prior to the introduction of the Campelen trawl in 1995 are shown as actual (unconverted) numbers (from Shelton et al. (MS 1996)) and in numbers converted to Campelen equivalents.

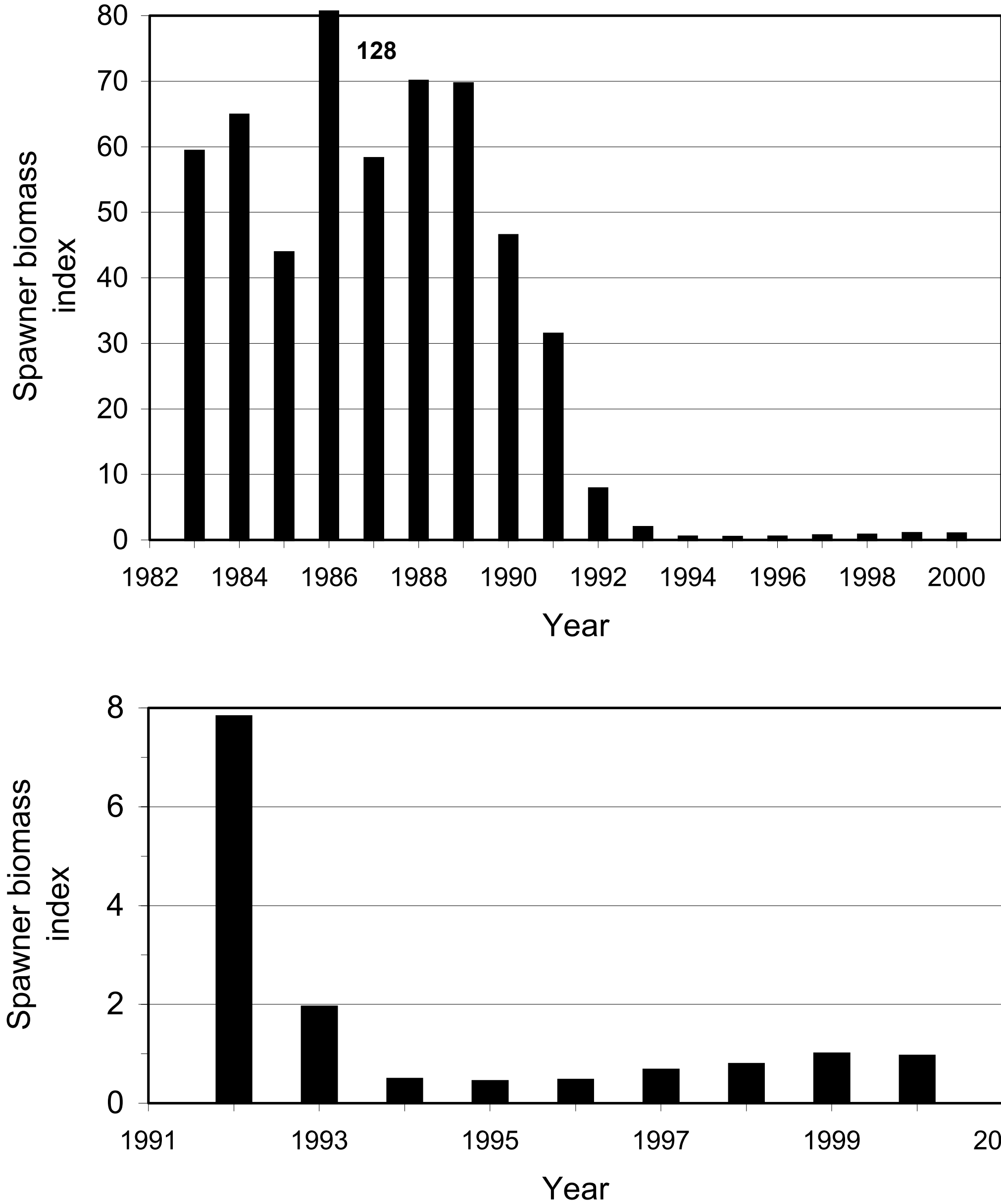

Fig. 13. Index of spawner biomass of cod from autumn bottom-trawl surveys in divisions 2J3KL in 1983-2000. The index is calculated from the mean catch per tow at age (with 1983-1994 adjusted to Campelen equivalents), the proportion mature at age, and the commercial Jan. 1 weights-at-age. (The latter two were moved back one age and one year to correspond to the timing of the autumn survey.)

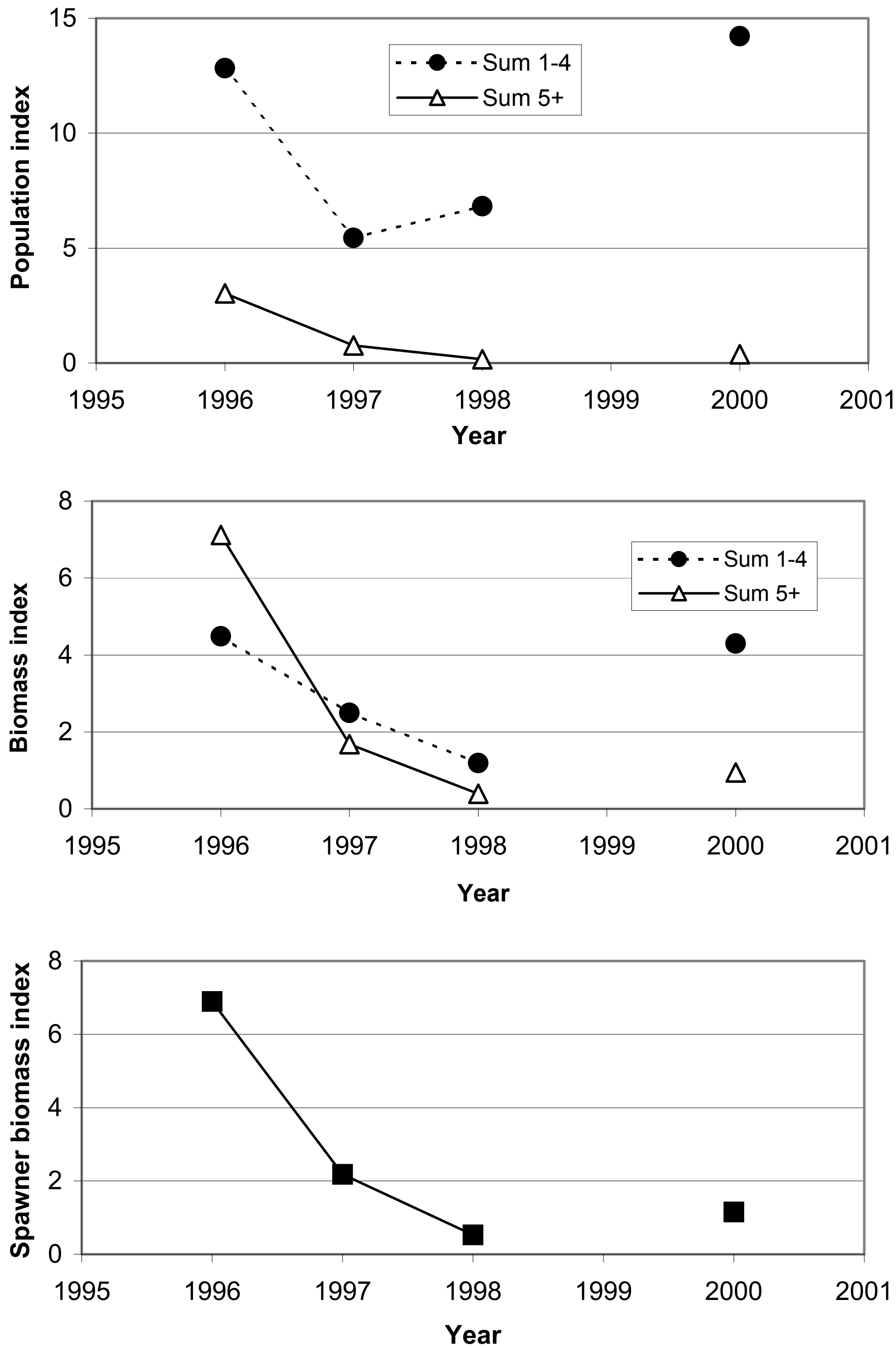

Fig. 14. Indices of abundance (top), biomass (middle) and spawner biomass of cod from autumn bottom-trawl surveys in inshore strata of divisions 3KL in 1996-1998 and 2000. The abundance index is calculated from mean catch per tow at age, the biomass index is the abundance index with commercial Jan. 1 weights-at-age applied, and the spawner biomass index is the biomass index with the proportions mature at age applied. (The Jan. 1 weights-at-age and proportions mature at age were moved back one age and one year to correspond to the timing of the autumn survey.)

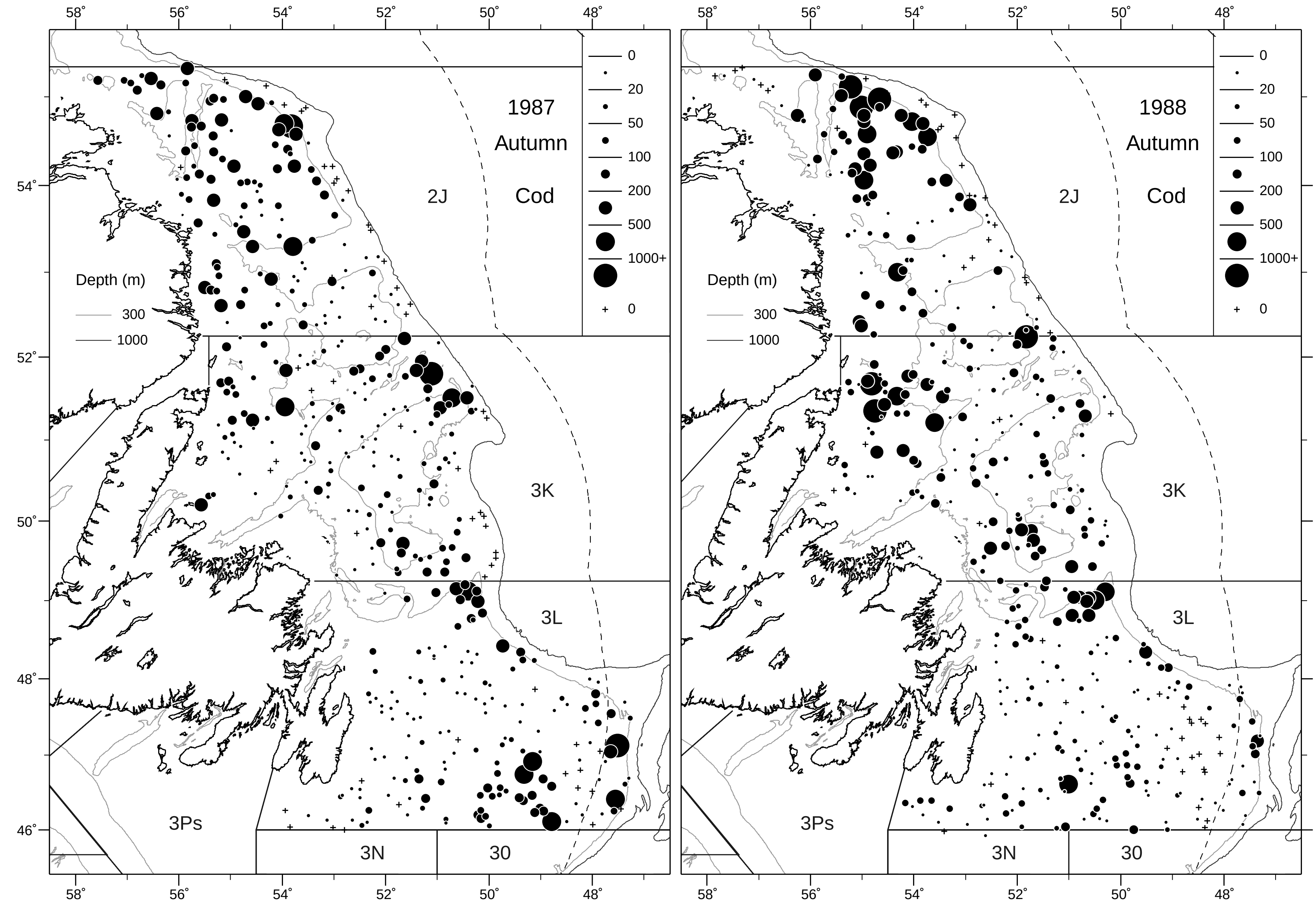

Fig. 15. Cod distribution (number per standard tow) during the autumn surveys in divisions 2J3KL in 1987 and 1988.

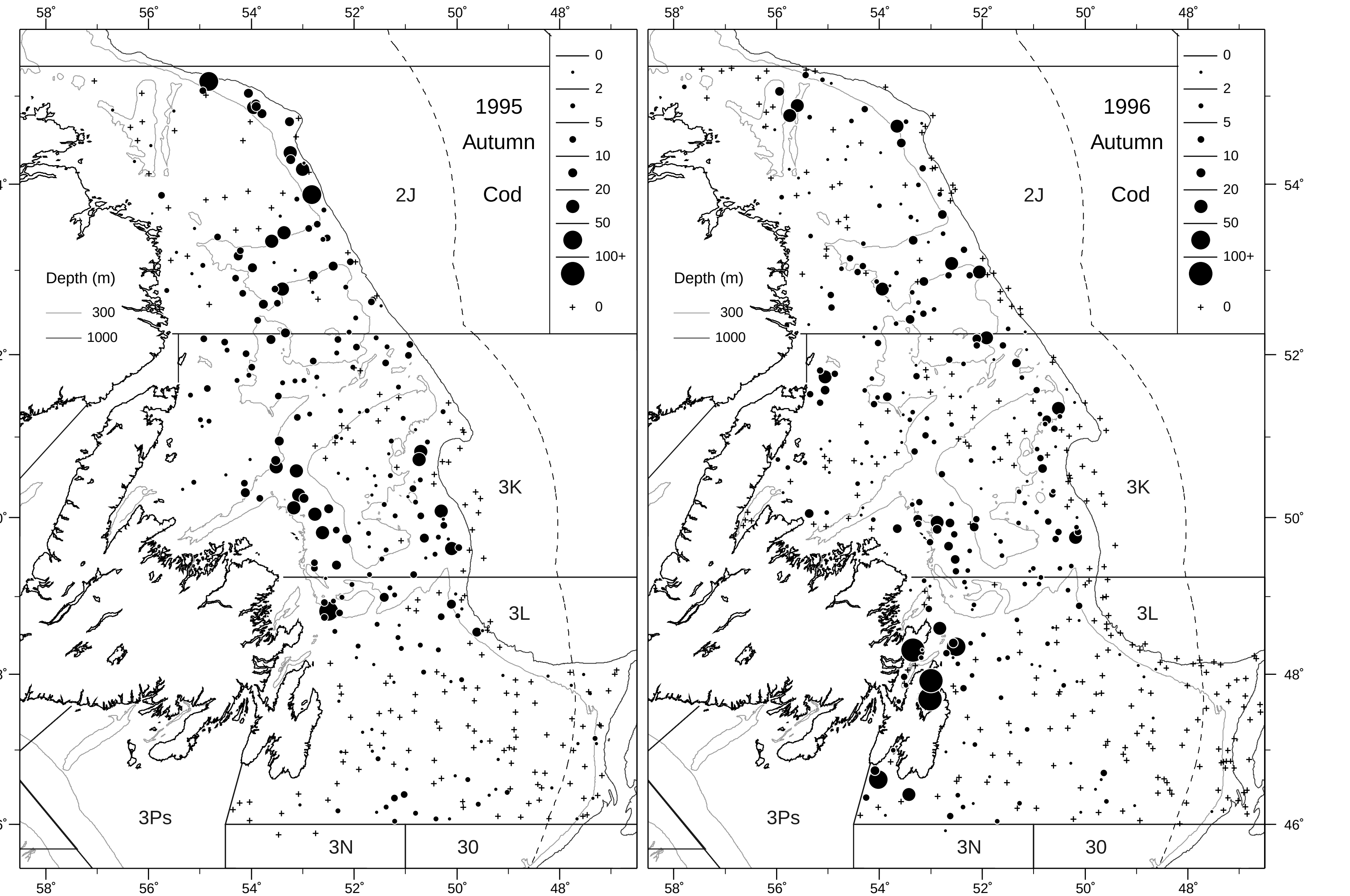

Fig. 16a. Cod distribution (number per standard tow) during the autumn surveys in divisions 2J3KL in 1995 and 1996.

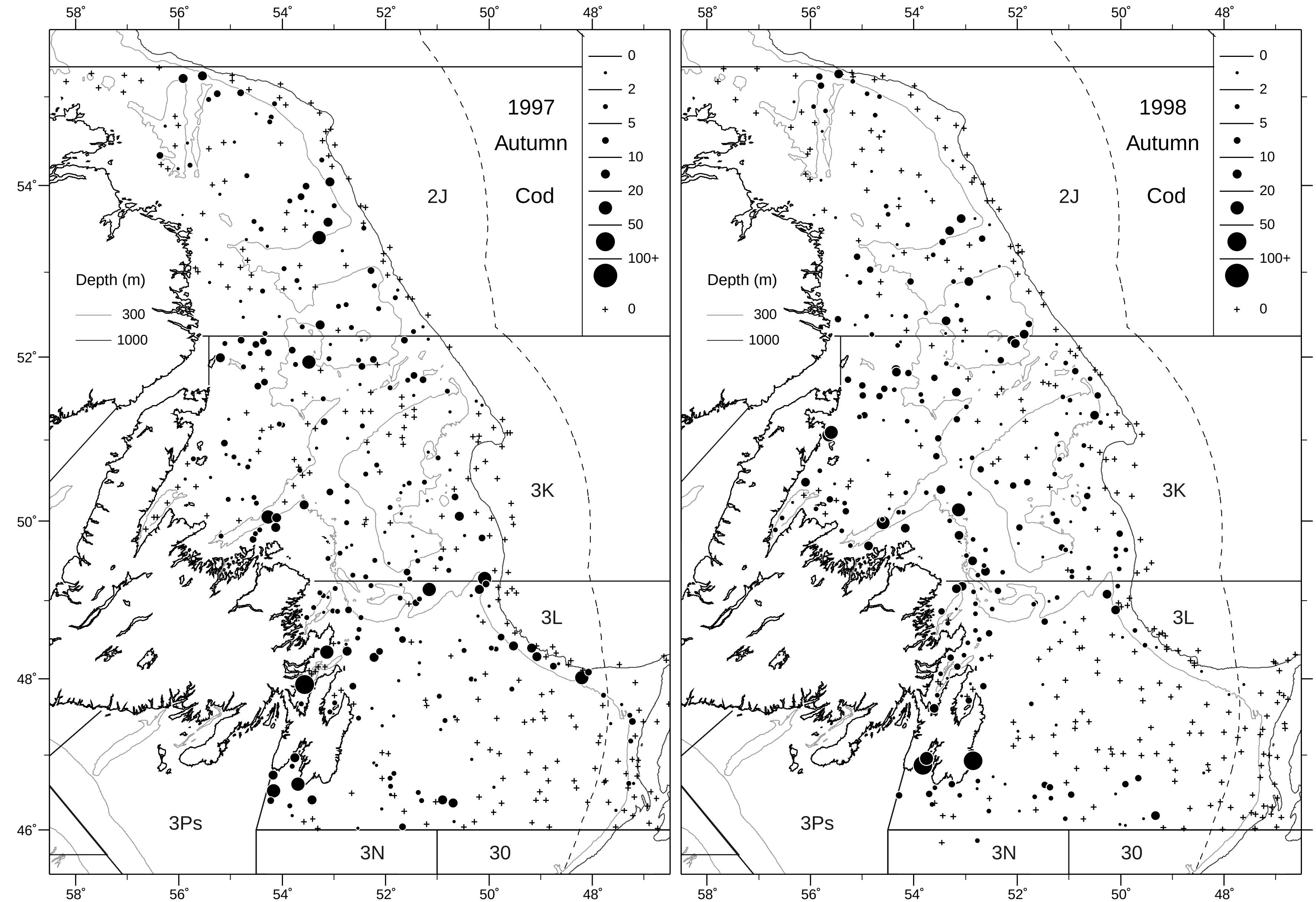

Fig. 16b. Cod distribution (number per standard tow) during the autumn surveys in divisions 2J3KL in 1997 and 1998.

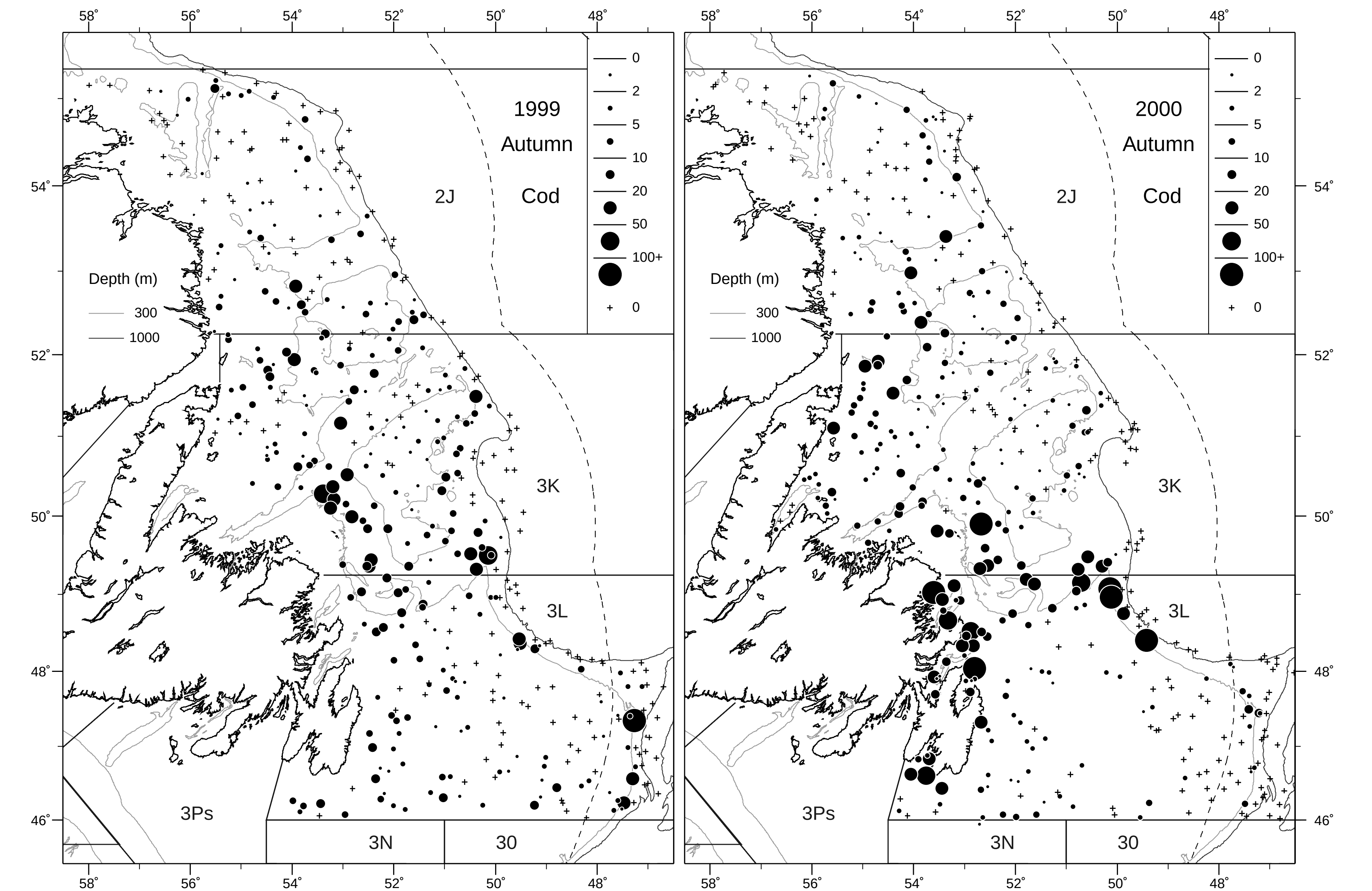

Fig. 16c. Cod distribution (number per standard tow) during the autumn surveys in divisions 2J3KL in 1999 and 2000.

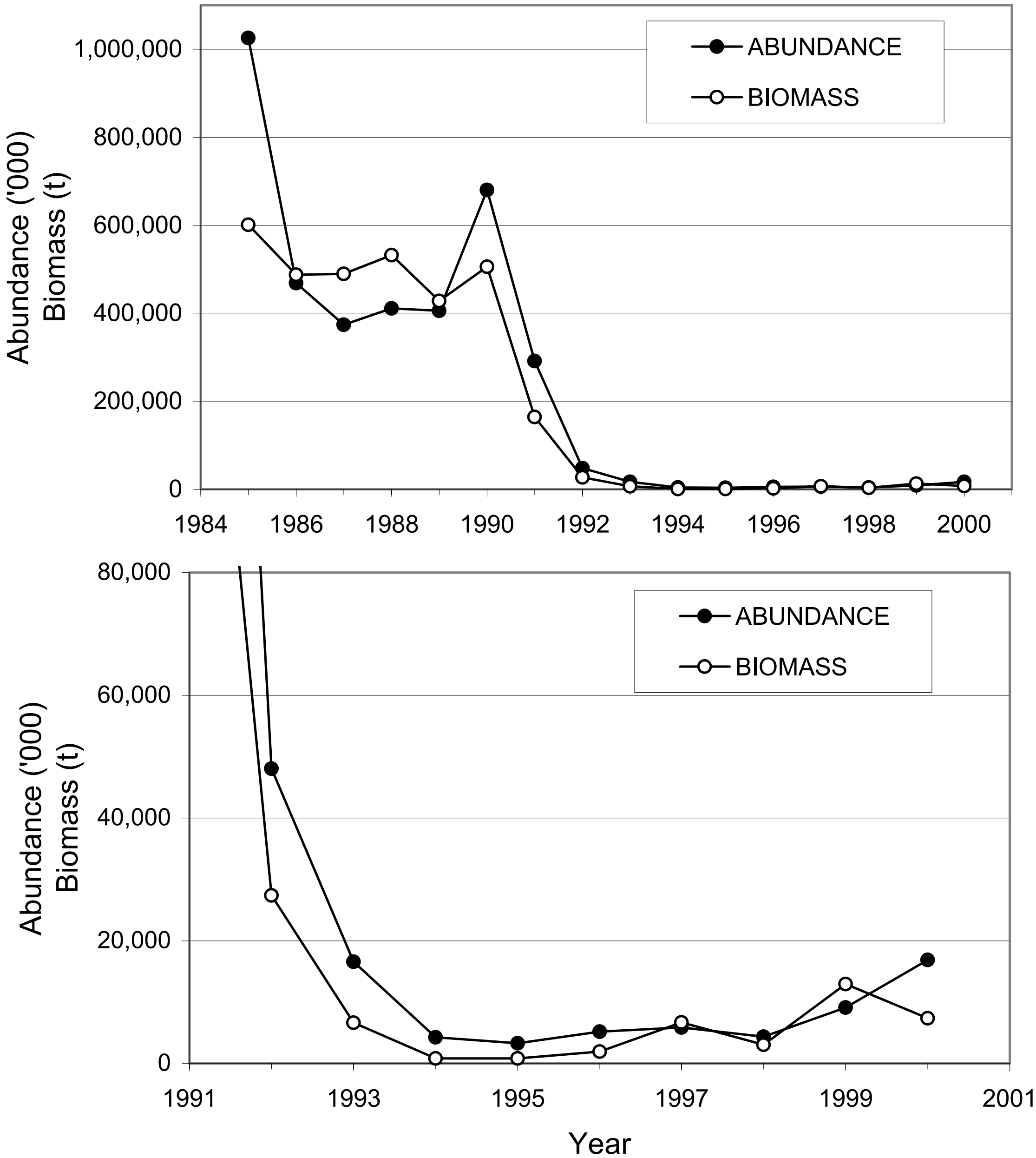

Fig. 17. Indices of abundance and biomass of cod from spring bottom-trawl surveys in Division 3L. Estimates for 1985-1995 are based on Campelen equivalents and those for 1996-2000 are based on actual catches.

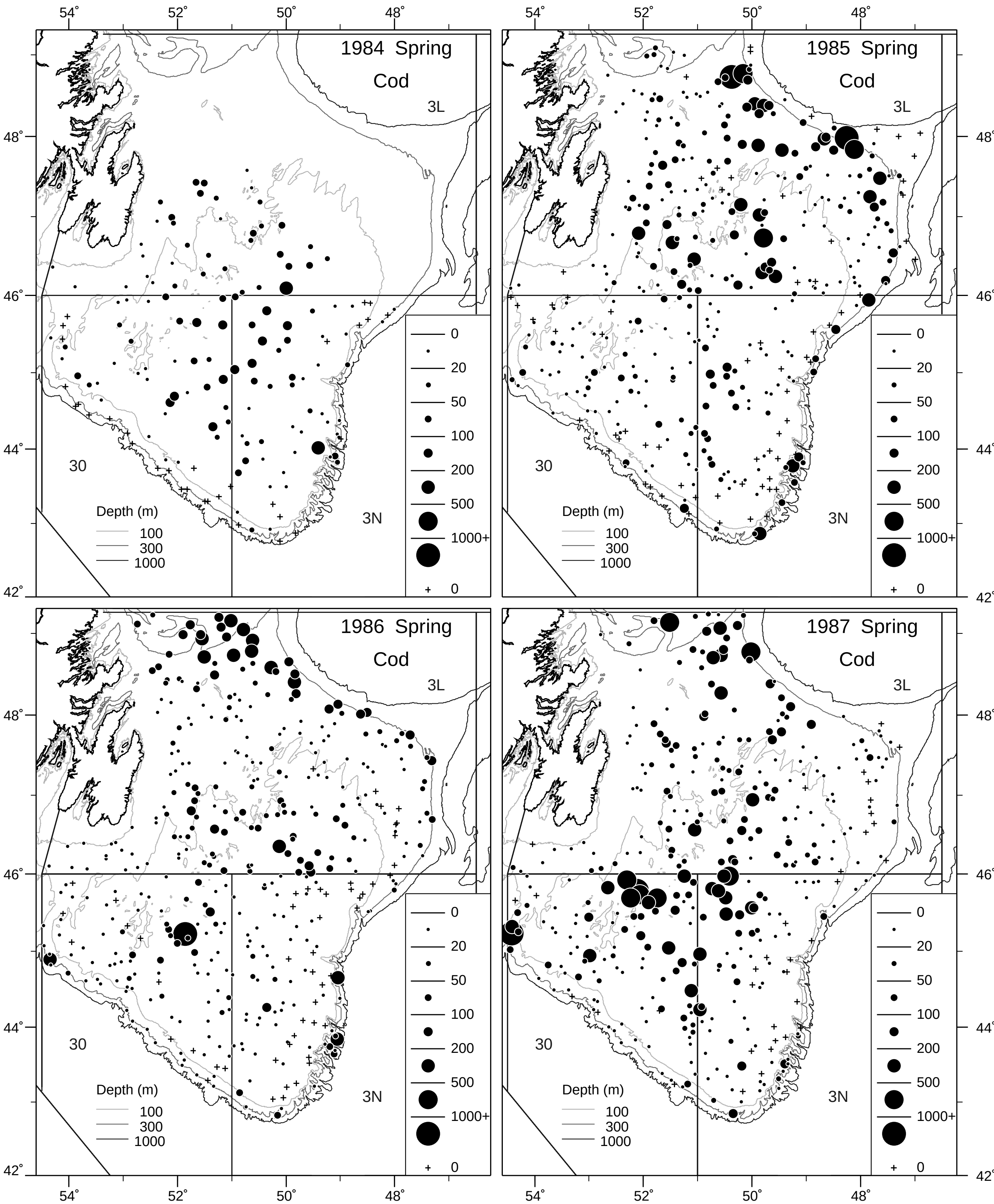

Fig. 18a. Geographic distribution (number per standard tow) during the spring surveys in divisions 3LNO in 1984-1987.

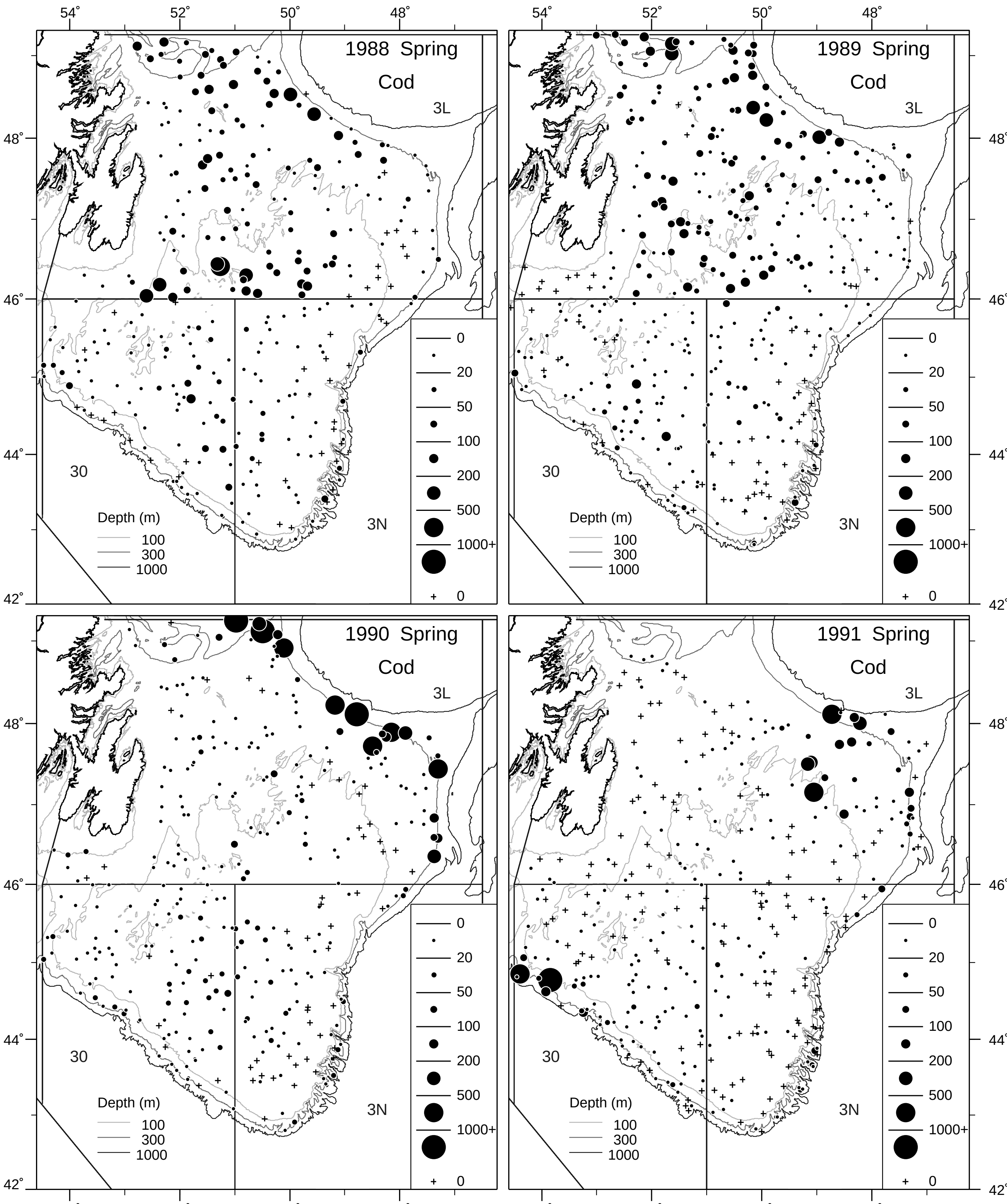

Fig. 18b. Geographic distribution (number per standard tow) during the spring surveys in divisions 3LNO in 1988-1991.

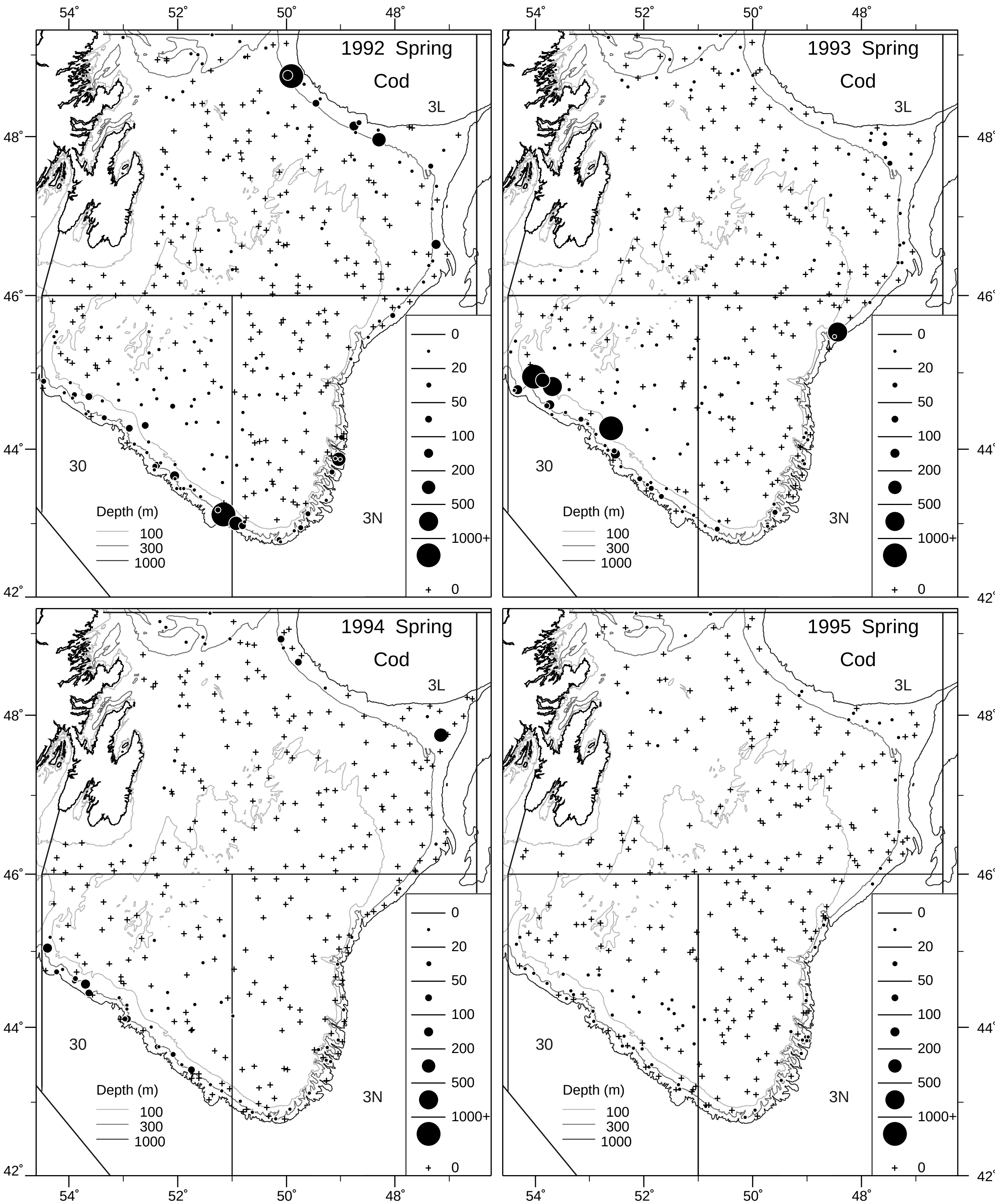

Fig. 18c. Geographic distribution (number per standard tow) during the spring surveys in divisions 3LNO in 1992-1995.

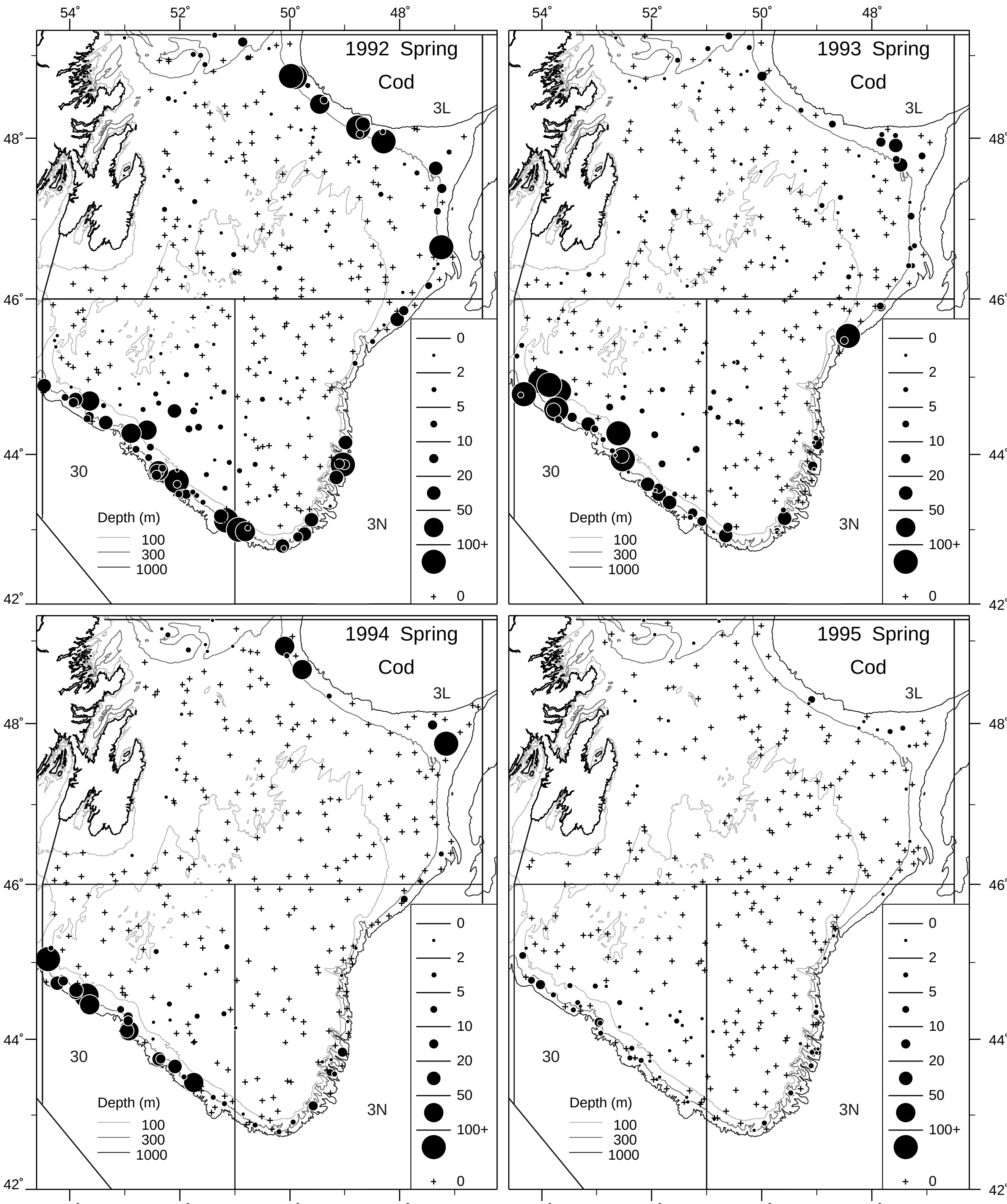

Fig. 19a. Geographic distribution (number per standard tow) during the spring surveys in divisions 3LNO in 1992-1995.

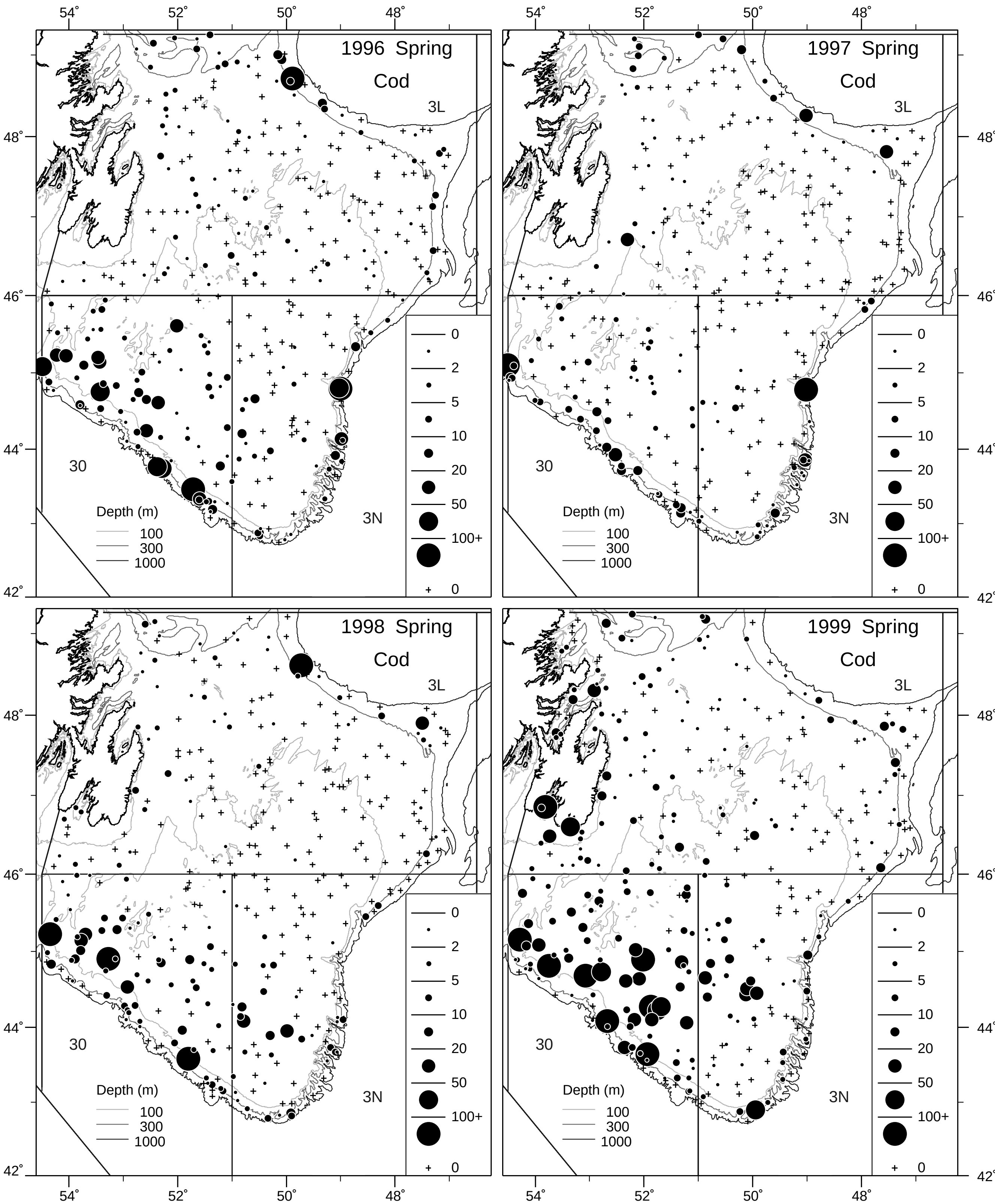

Fig. 19b. Geographic distribution (number per standard tow) during the spring surveys in divisions 3LNO in 1996-1999.

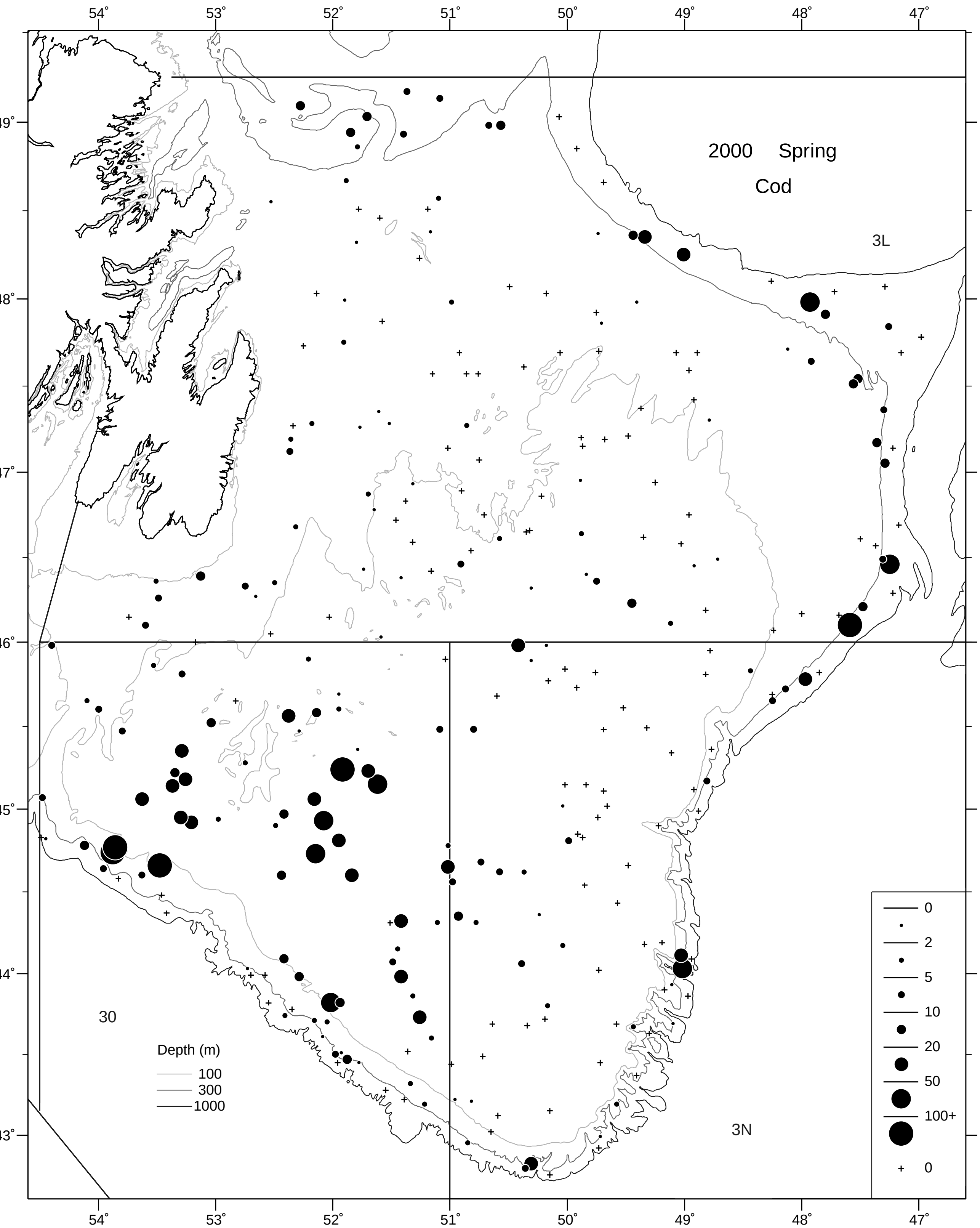

Fig. 20. Geographic distribution (number per standard tow) during the spring survey in divisions 3LNO in 2000.

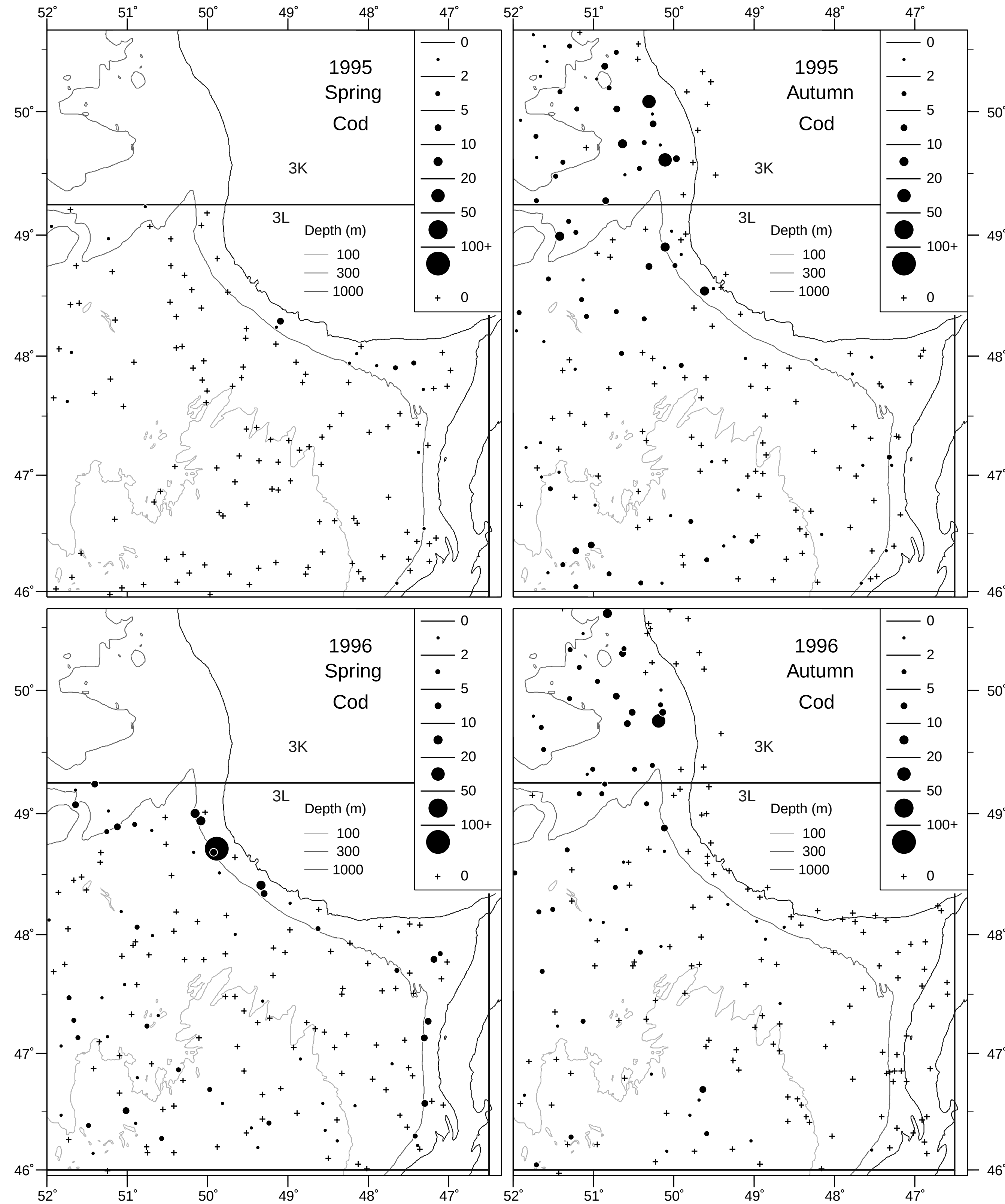

Fig. 21a. Cod distribution (number per standard tow) during spring and autumn surveys in southeastern 3K and eastern 3L in 1995 and 1996. The spring 1995 data are Engel trawl catches converted to Campelen equivalents.

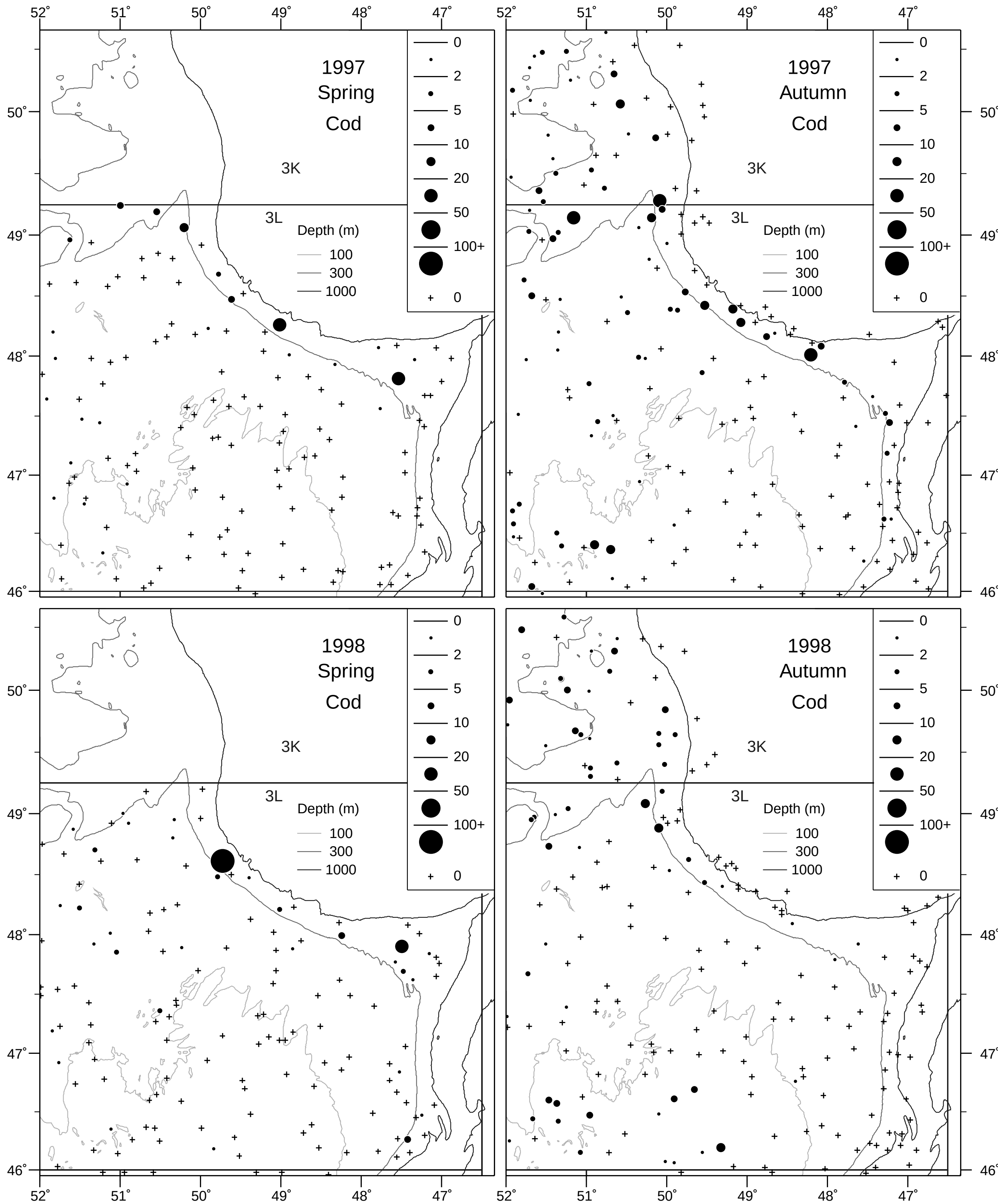

Fig. 21b. Cod distribution (number per standard tow) during spring and autumn surveys in southeastern 3K and eastern 3L in 1997 and 1998.

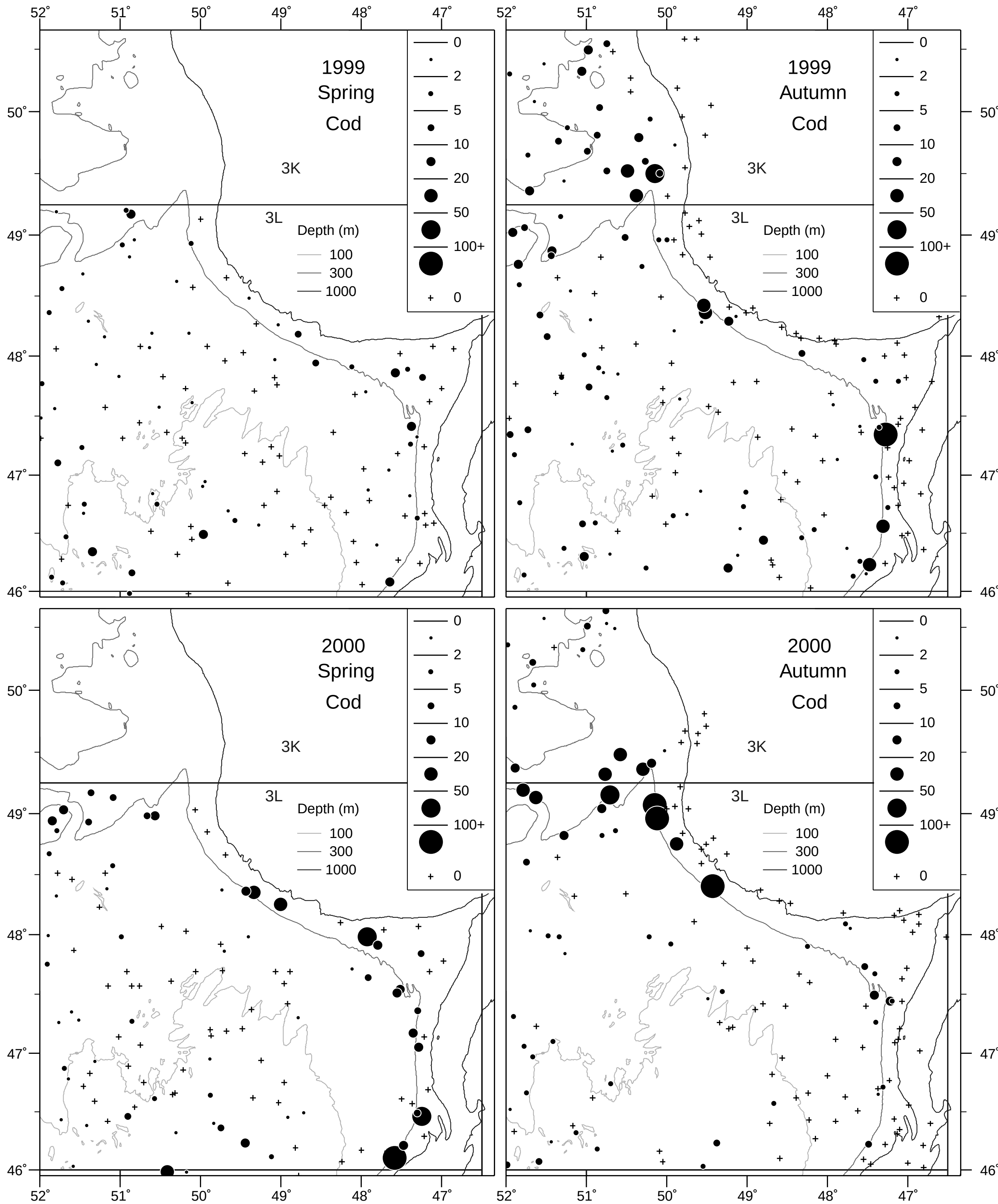

Fig. 21c. Cod distribution (number per standard tow) during spring and autumn surveys in southeastern 3K and eastern 3L in 1999 and 2000.

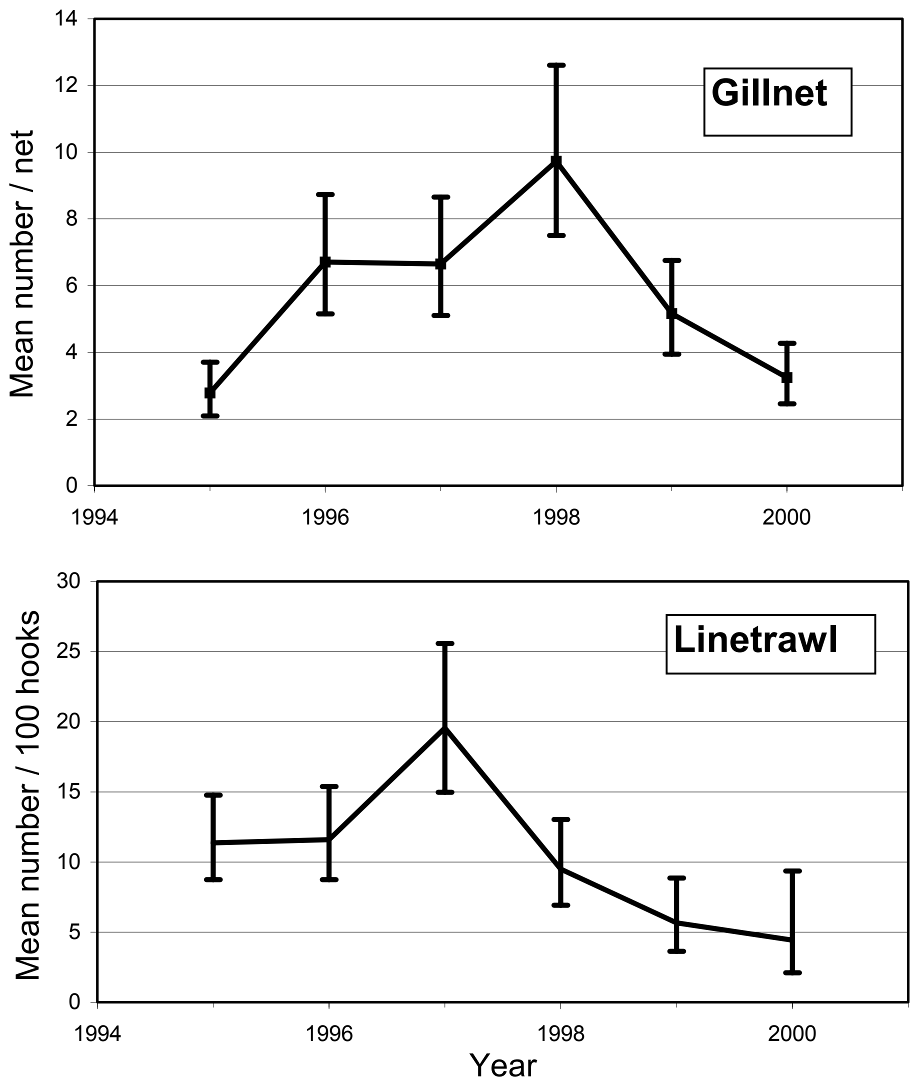

Fig. 22. Standardized catch rates from sentinel surveys in 3KL combined.

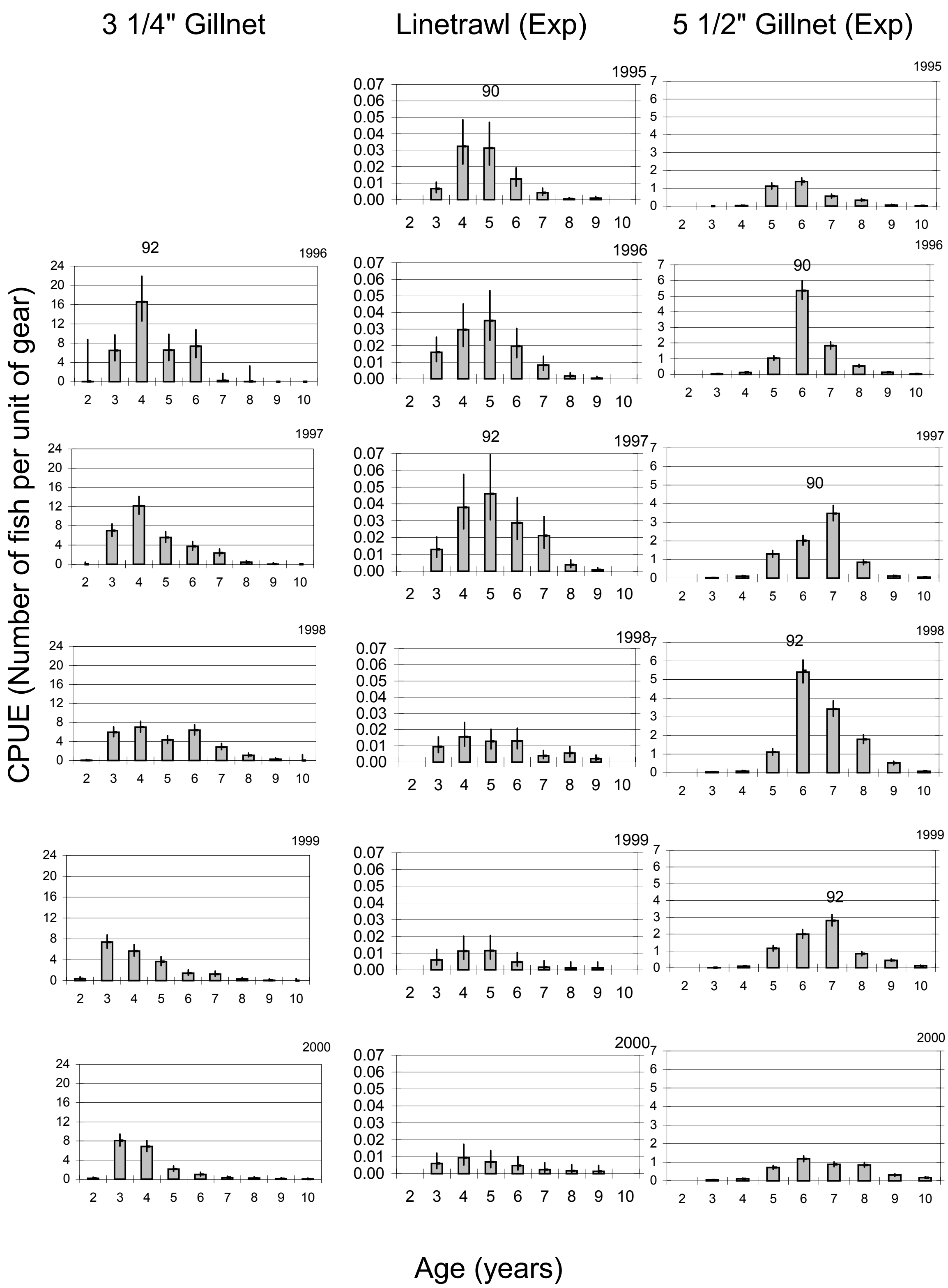

Fig. 23. Standardized catch rate at age for three gear types fished by the sentinel surveys in 1995-2000.

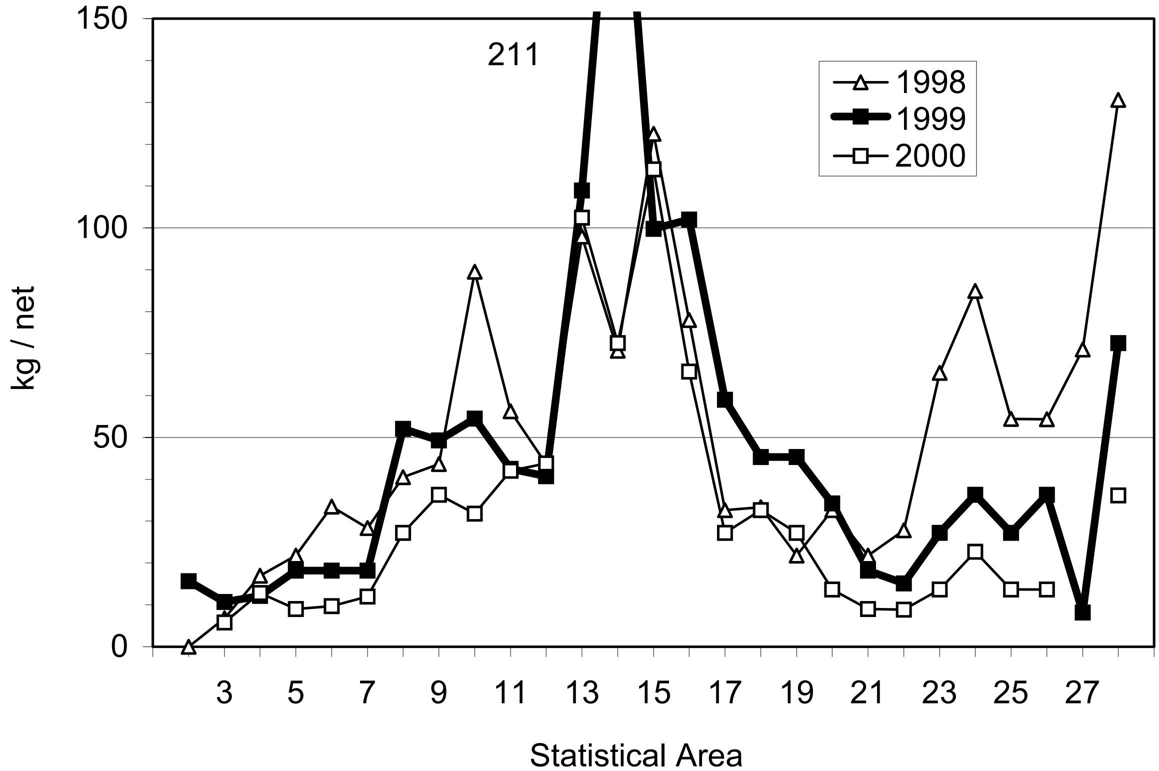

Fig. 24. Median gillnet catch rates by statistical section (Fig. 1c) from the gillnet fisheries for cod by vessels <35 feet during the 1998 and 2000 index fisheries and the 1999 commercial fishery.

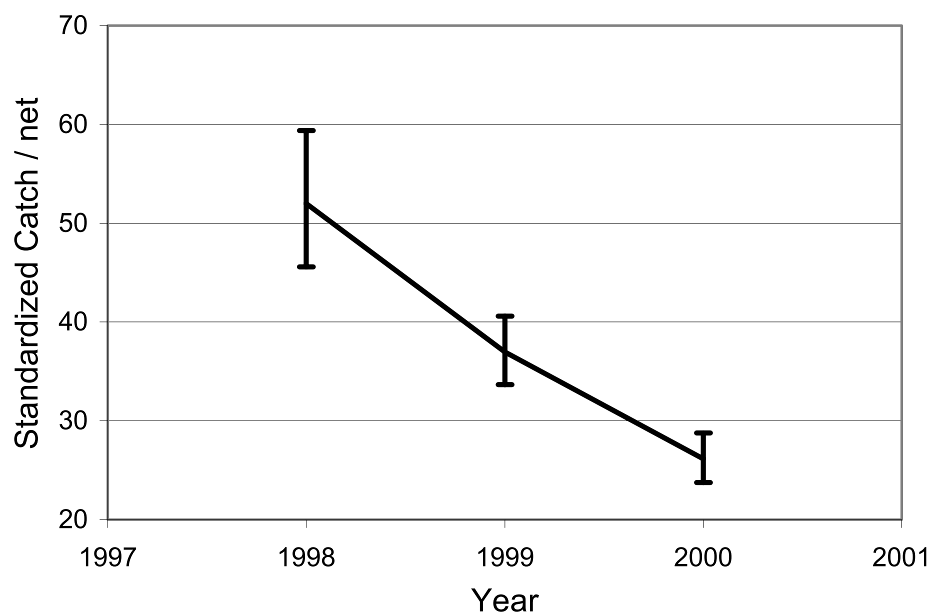

Fig. 25. Standardized catch rates from the gillnet fisheries for cod by vessels <35 feet in 3KL combined during the 1998 and 2000 index fisheries and the 1999 commercial fishery.

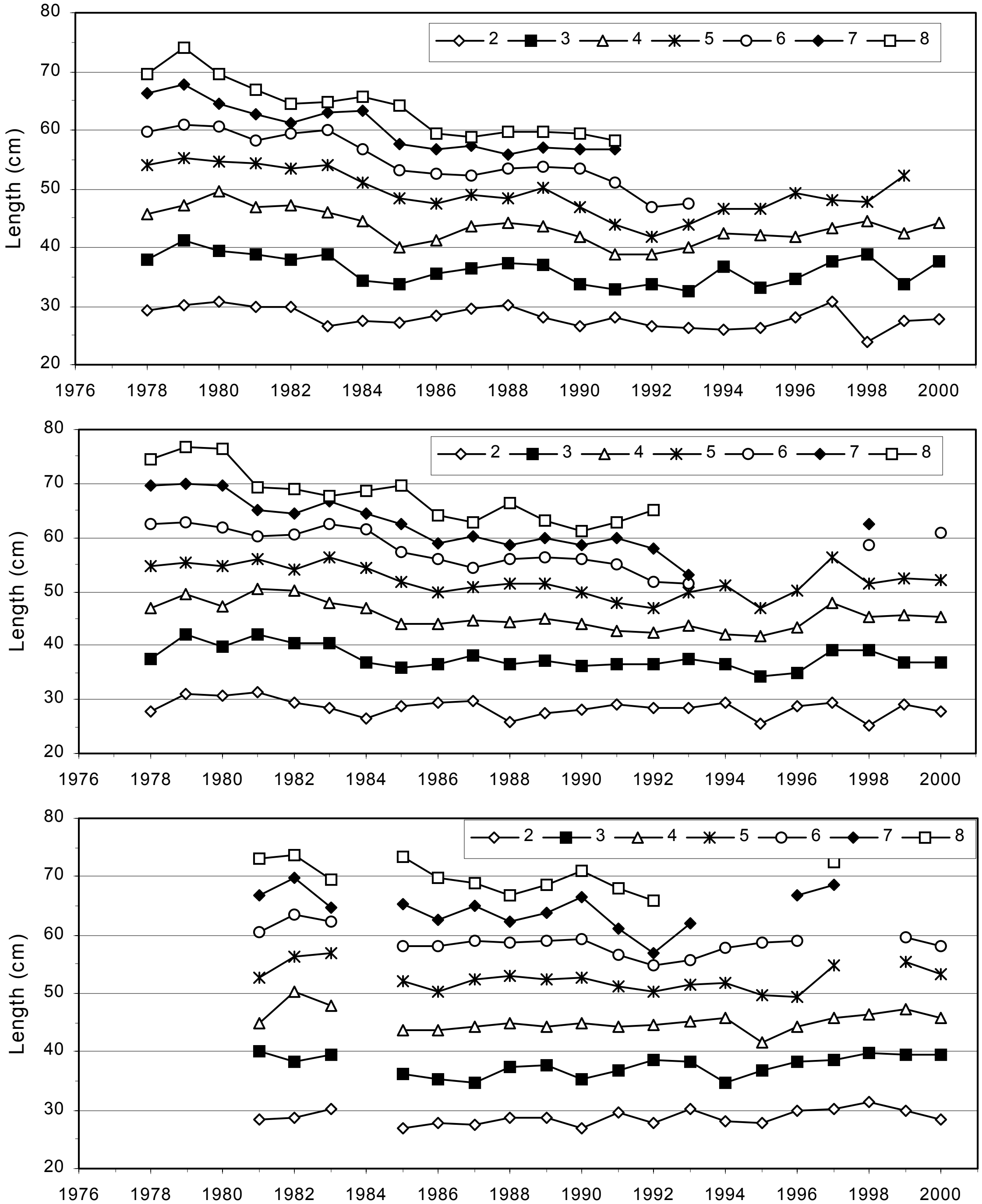

Fig. 26. Mean lengths at ages 2-8 of cod in Divisions 2J, 3K and 3L in 1978-2000, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

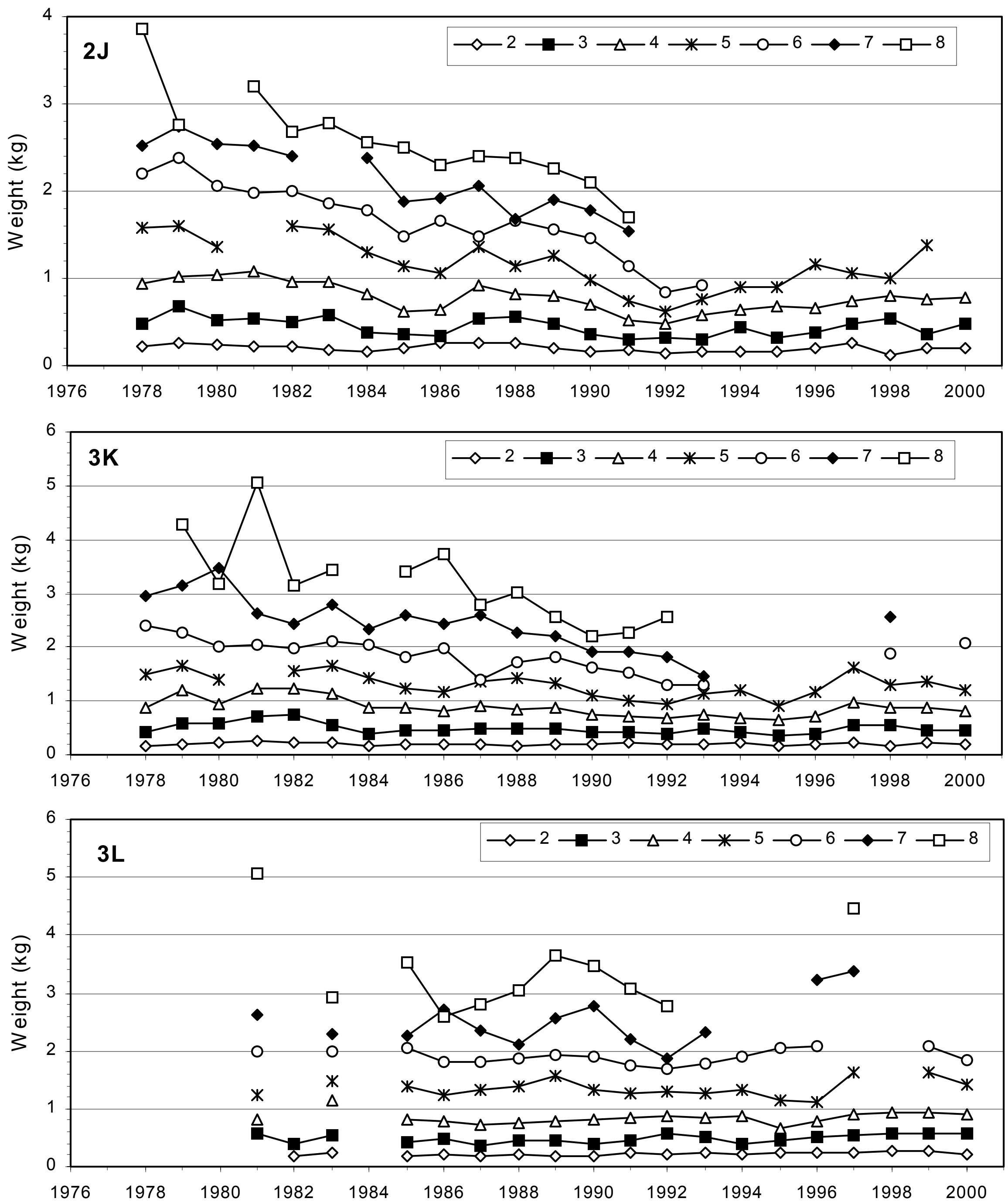

Fig. 27. Mean weights at ages 2-8 of cod in Divisions 2J, 3K and 3L in 1978-2000, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

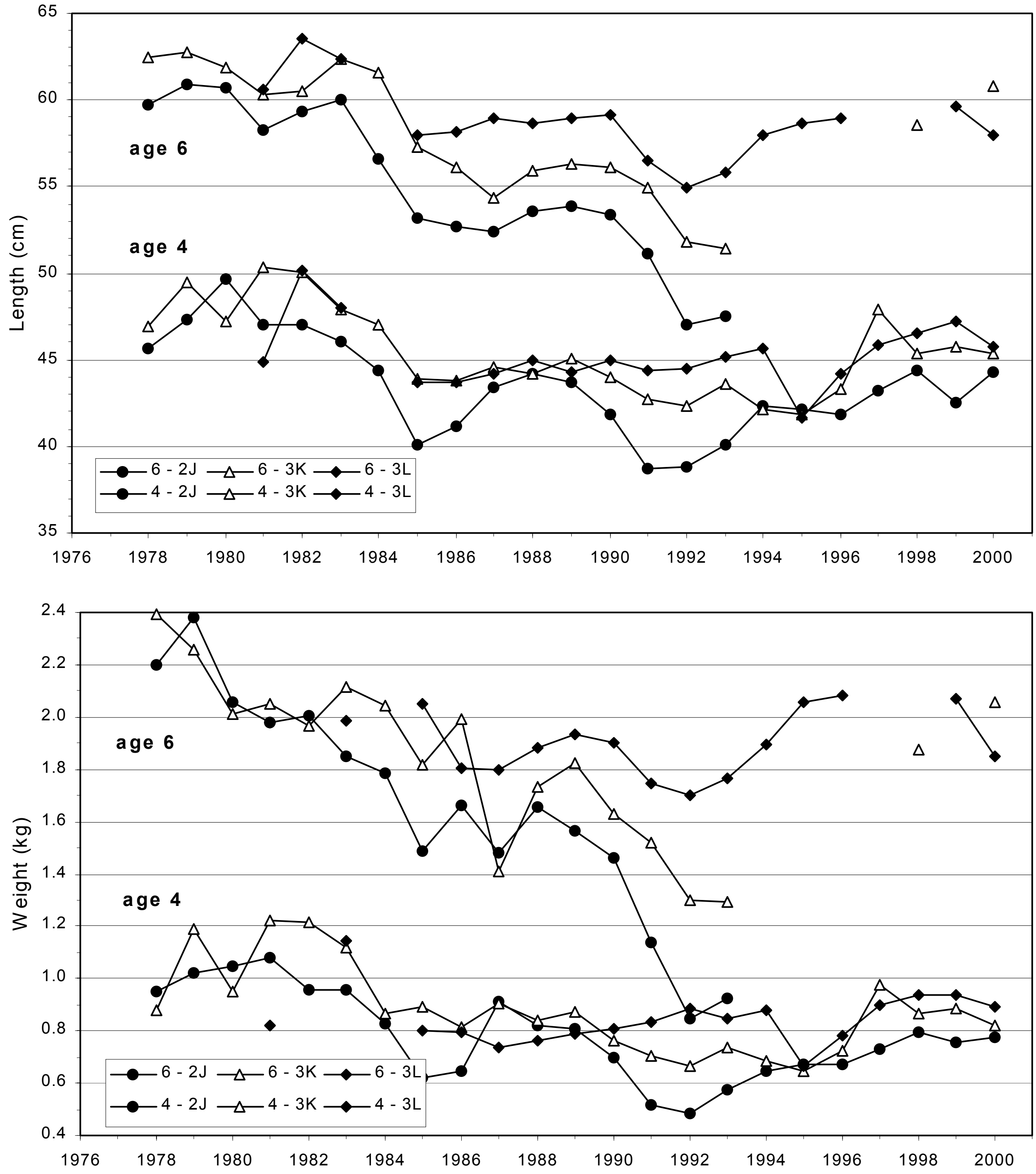

Fig. 28. Mean lengths and weights at ages 4 and 6 of cod in Divisions 2J, 3K and 3L in 1978-2000, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

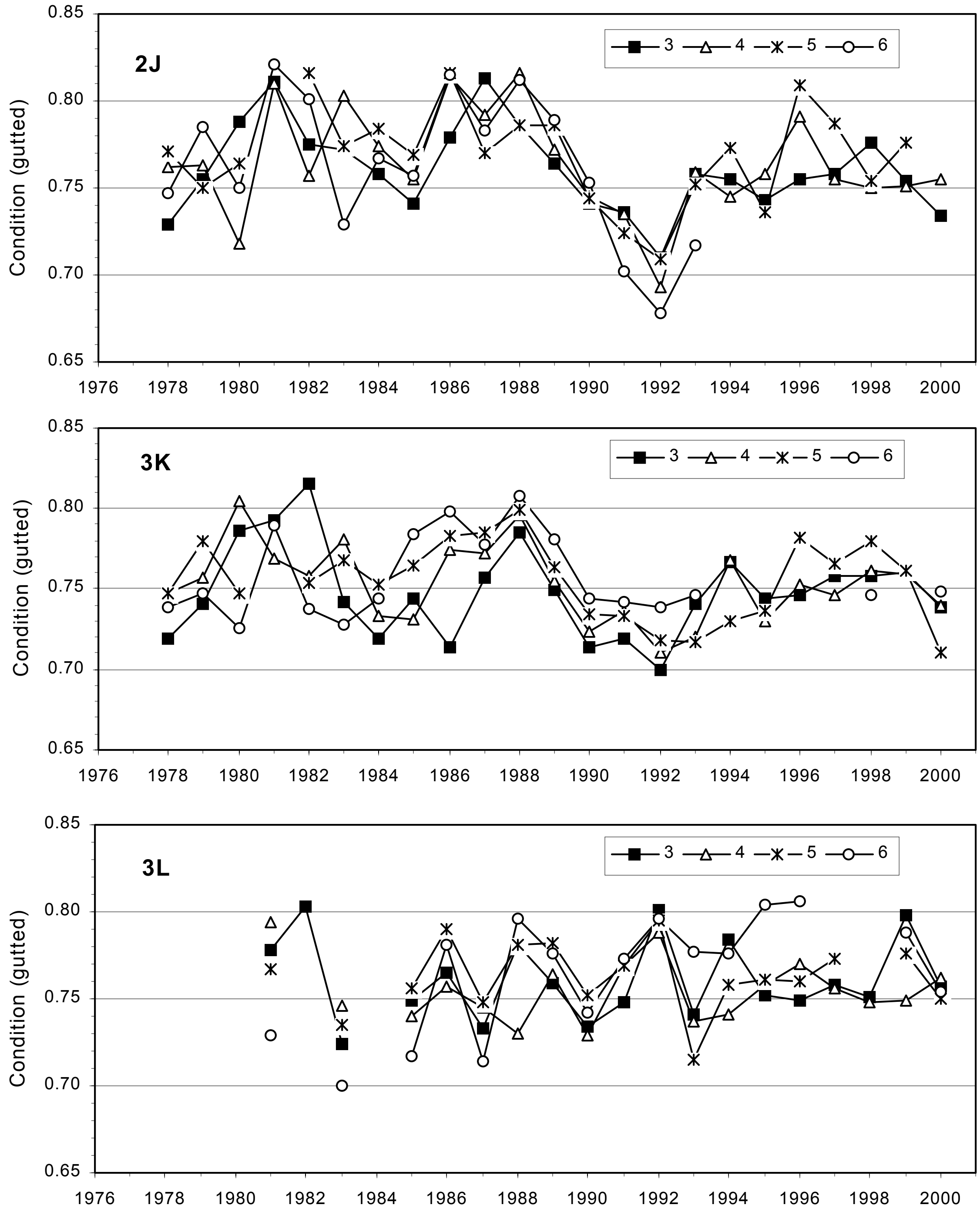

Fig. 29. Mean Fulton's condition (gutted weight) at ages 3-6 of cod in Divisions 2J, 3K and 3L in 1978-2000, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

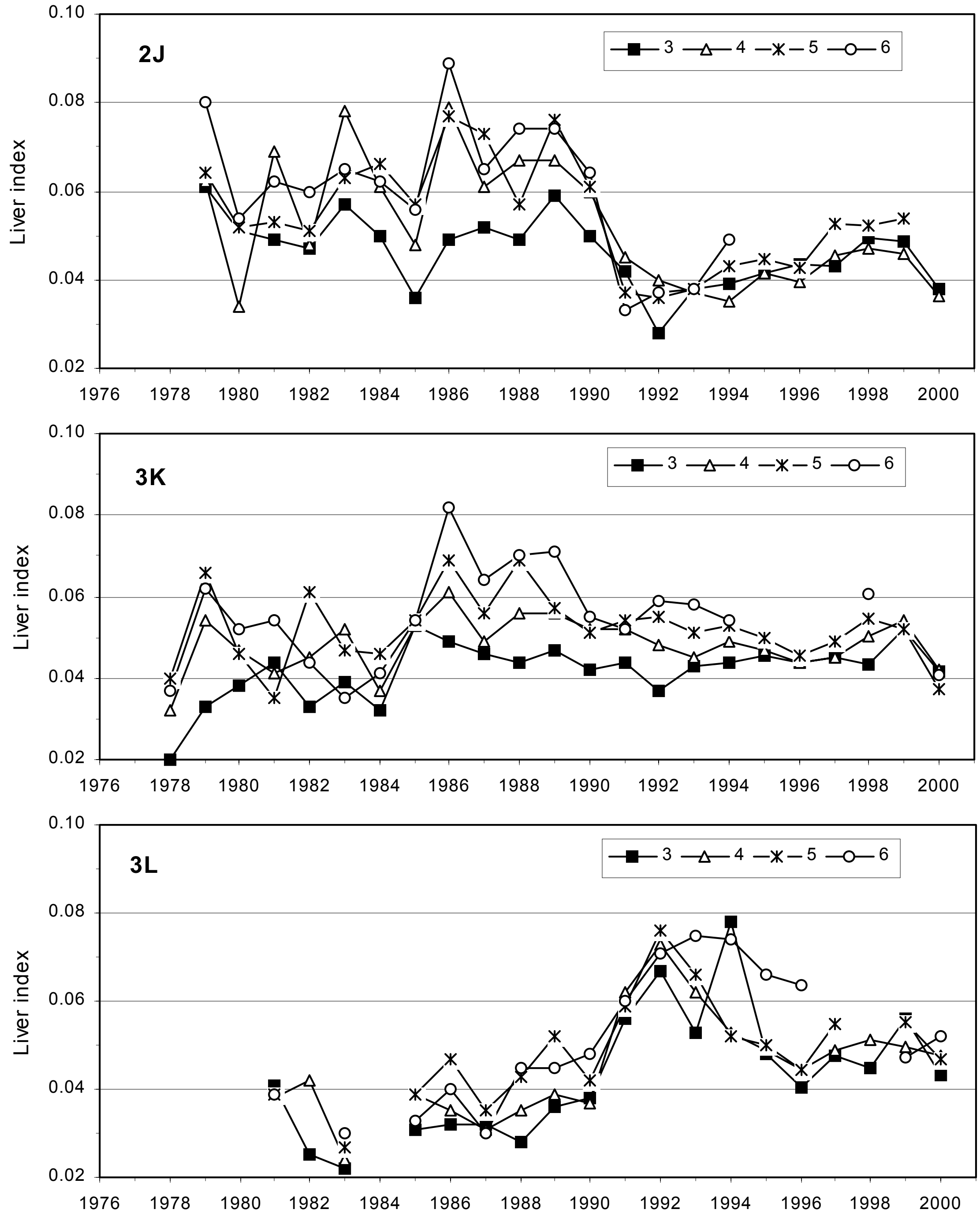

Fig. 30. Mean liver index at ages 3-6 of cod in Divisions 2J, 3K and 3L in 1978-2000, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish in 1995-1997 are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

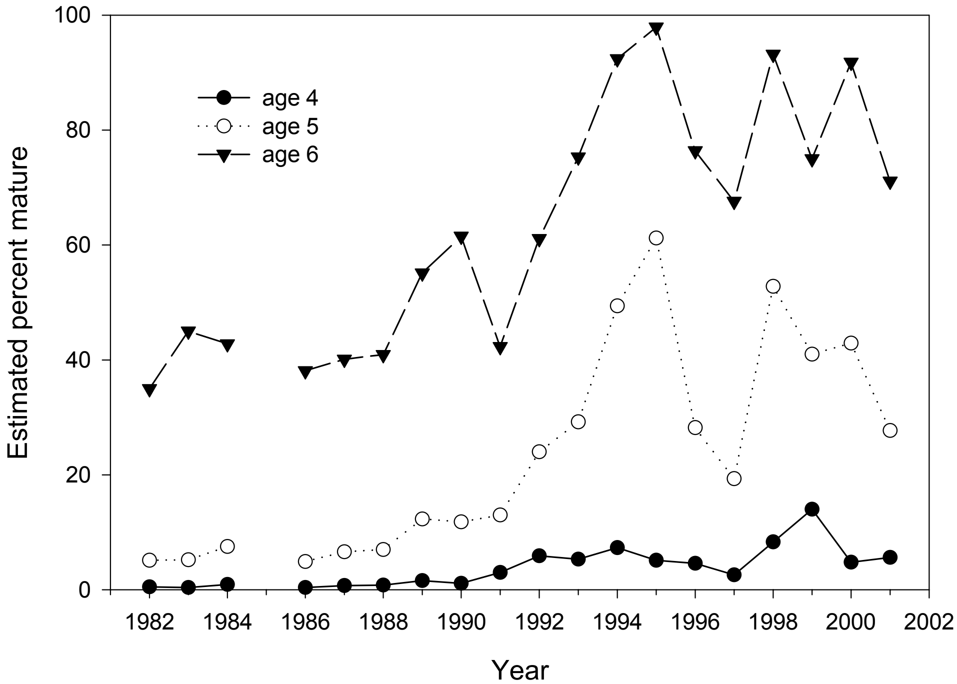

Fig. 31. Estimated percentage mature at ages 4, 5 and 6 for female cod in divisions 2J3KL combined (1982-2001). The percentage mature at age estimated from sampling during the autumn research bottom-trawl survey in year t is displayed for spawning in year t+1.

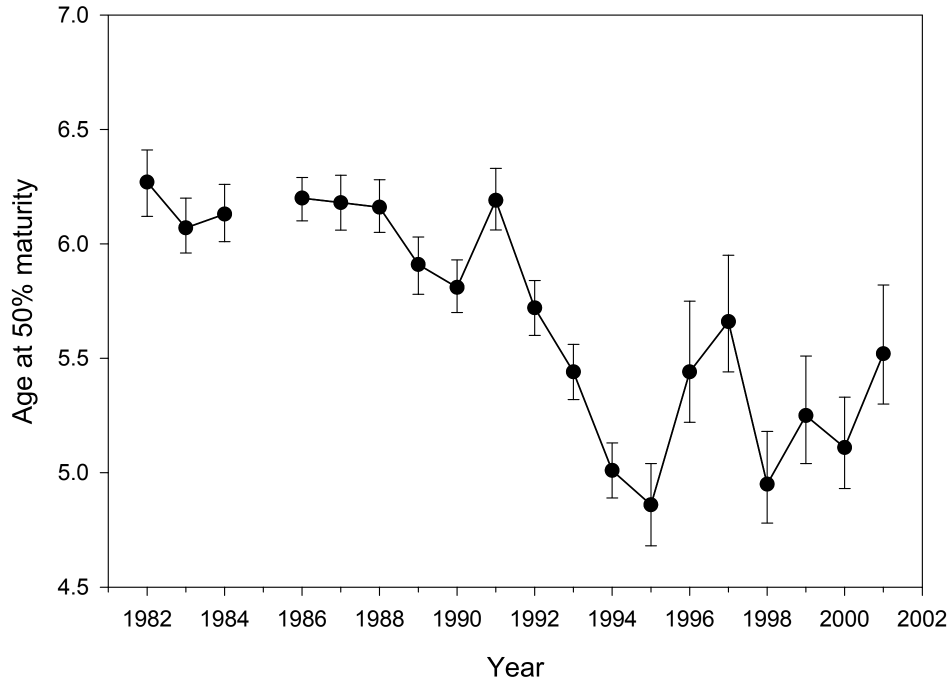

Fig. 32. Age at 50% maturity (± 95% CI) by year for female cod in divisions 2J3KL combined (1982-2001). The A50 estimated from sampling during the autumn research bottom-trawl survey in year t is displayed for spawning in year t+1.

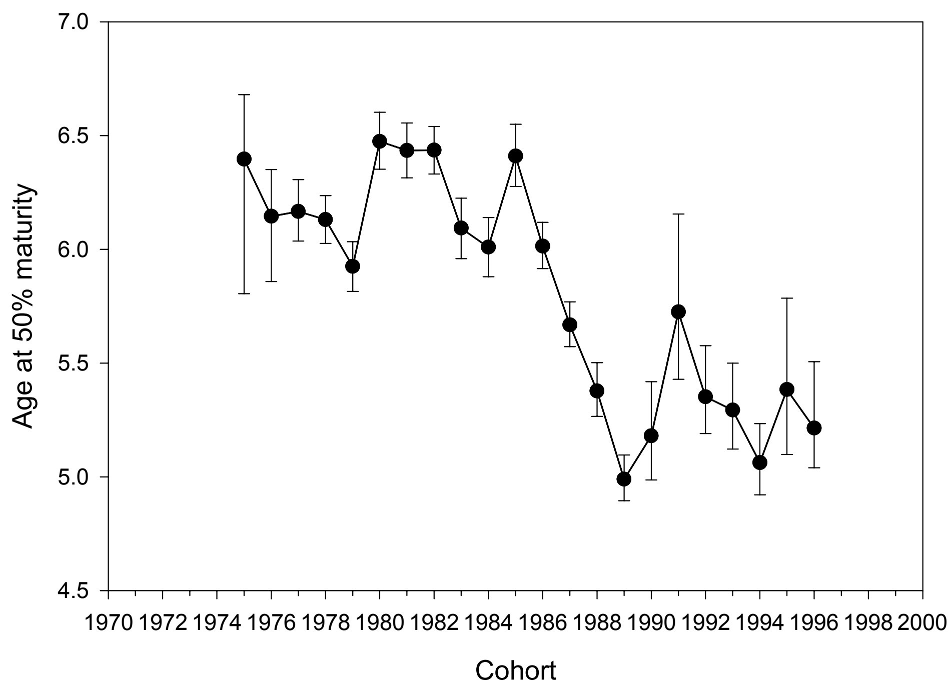

Fig. 33. Age at 50% maturity (± 95% CI) by cohort for female cod in divisions 2J3KL combined based on sampling during the autumn research bottom-trawl surveys in 1981-2000.

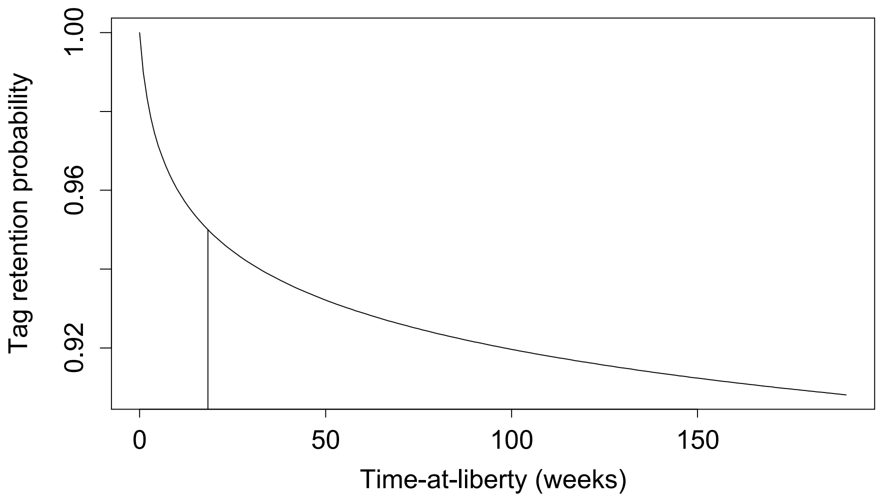

Fig. 34. Estimates of the proportion of single-tagged fish that still retain their tag, versus time-at-liberty.

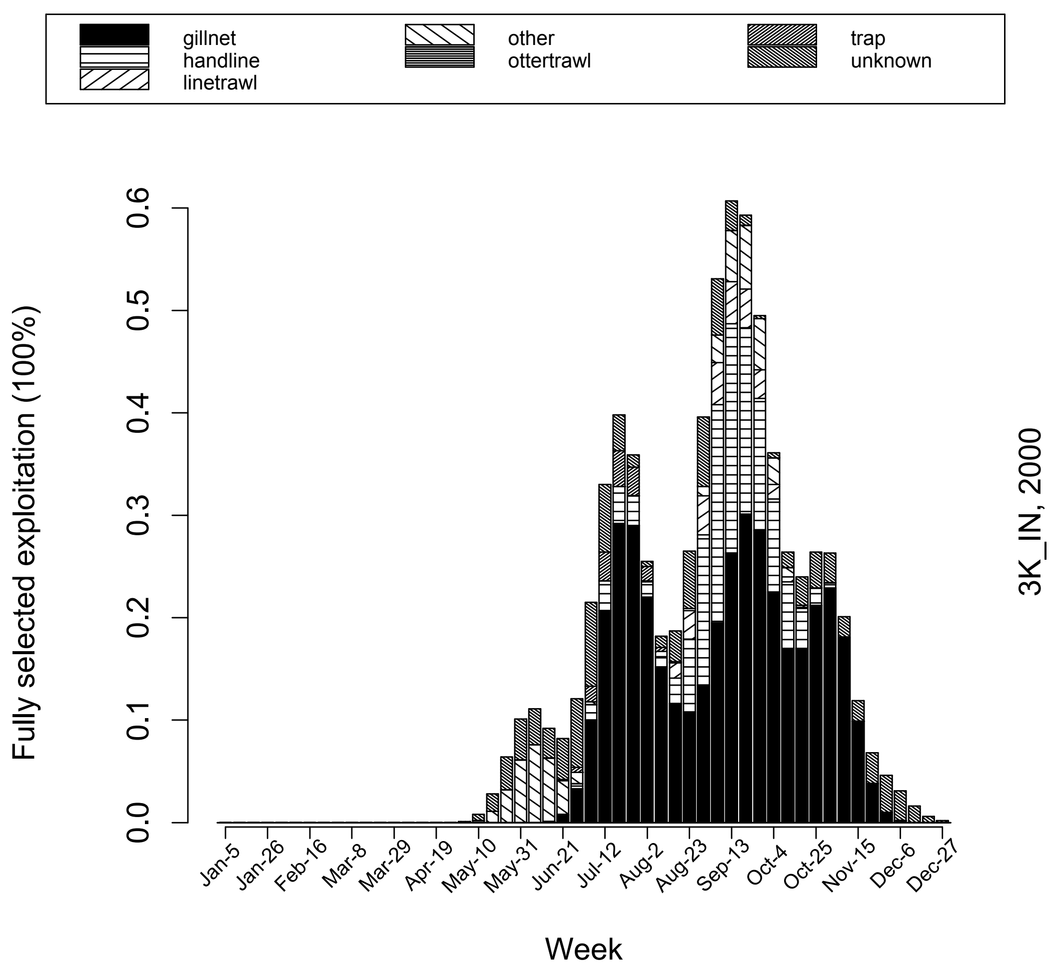

Fig. 35. Weekly estimates of the fully selected exploitation rates (%) in 2000 by gear type for 3K. The mid-week date is shown for every fourth week.

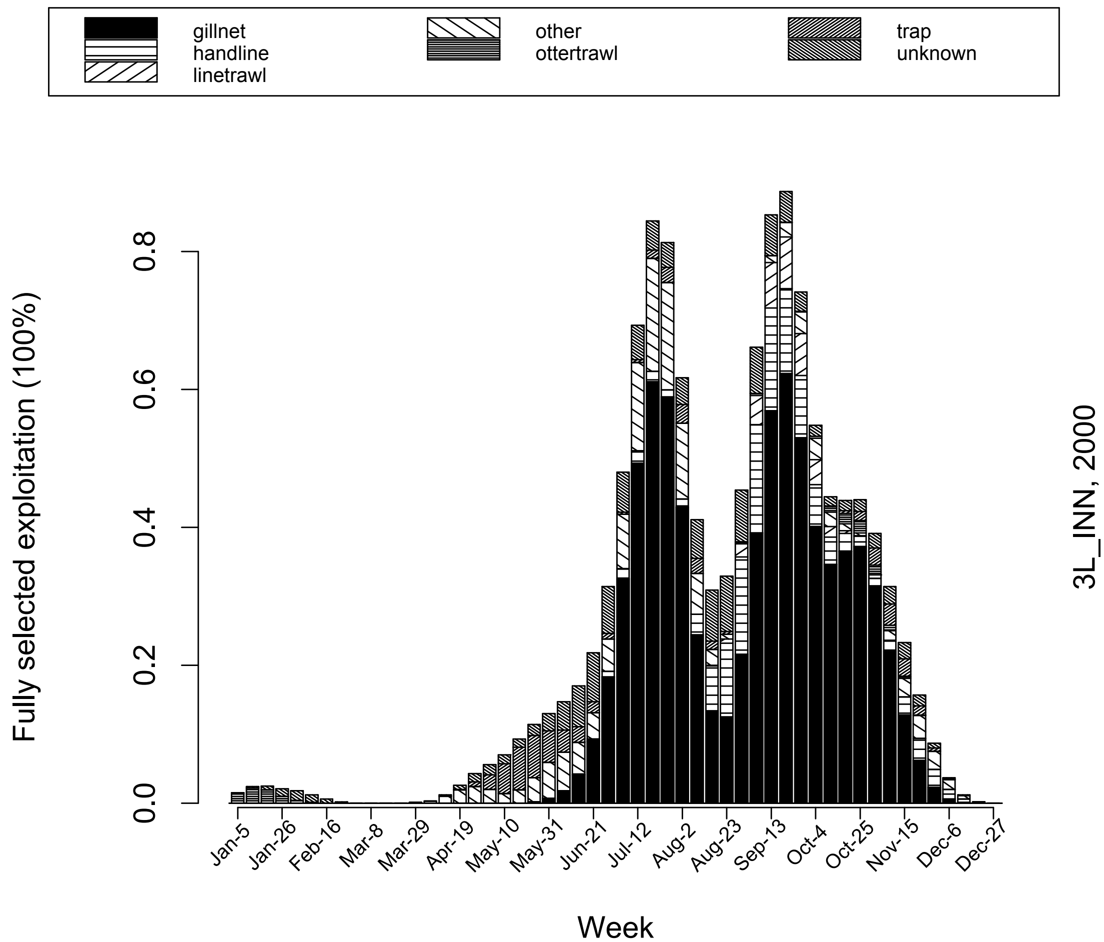

Fig. 36. Weekly estimates of the fully selected exploitation rates (%) in 2000 by gear type for northern 3L. The mid-week date is shown for every fourth week.

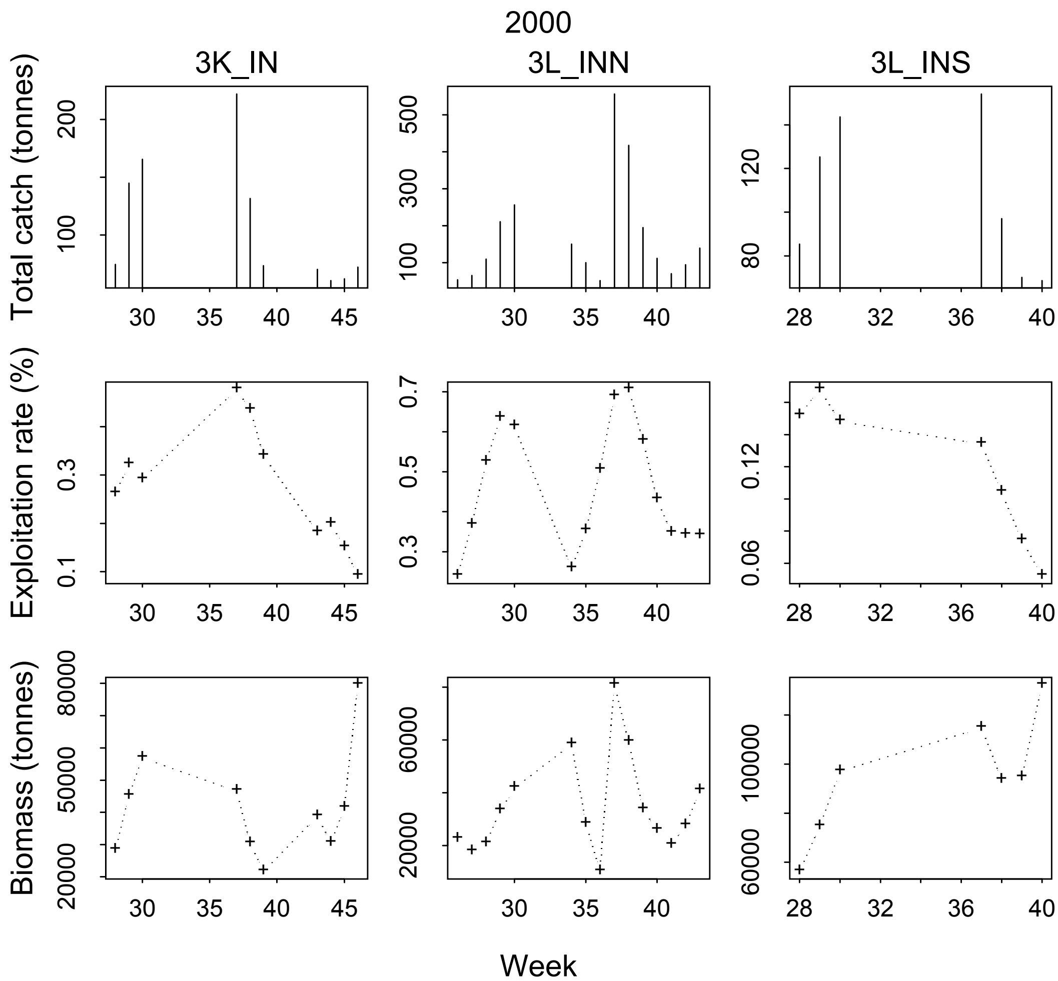

Fig. 37. Weekly total catch, exploitation, and biomass estimates for three inshore regions in 3KL. The panels in the top row show weekly landings, for weeks when the landings exceeded 50 tonnes. Exploitation and biomass estimates corresponding to these weeks are shown in the middle and bottom panels. The weeks are numbered from the beginning of the year.

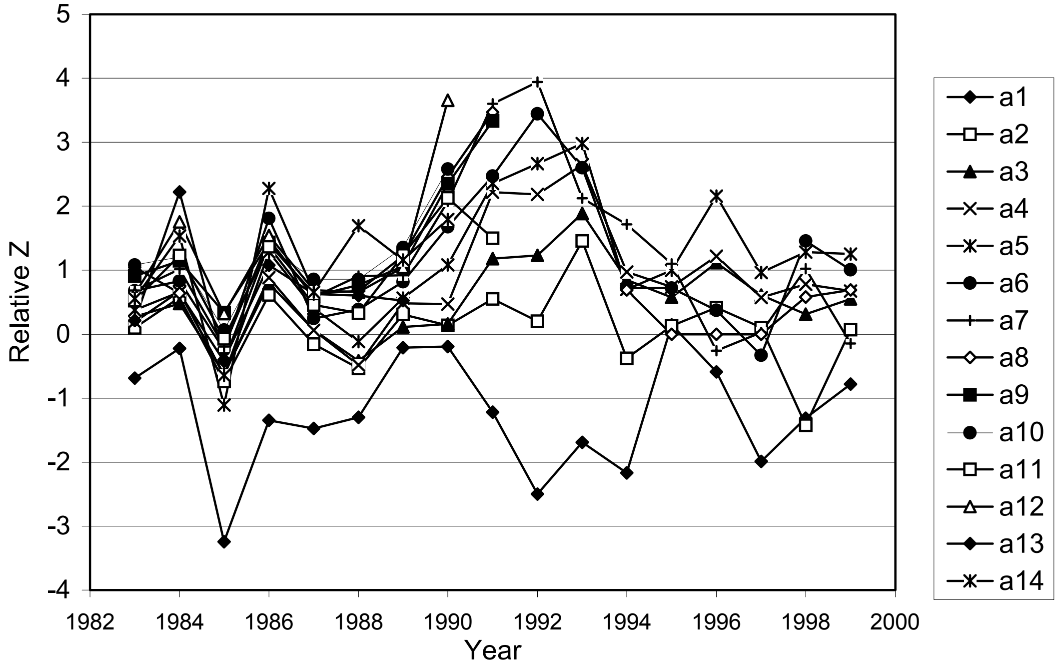

Fig. 38. Mortality rates on fish aged 1 to 14 as calculated from catch rate per tow at age during the autumn research bottom-trawl surveys in 2J3KL in 1983-2000.

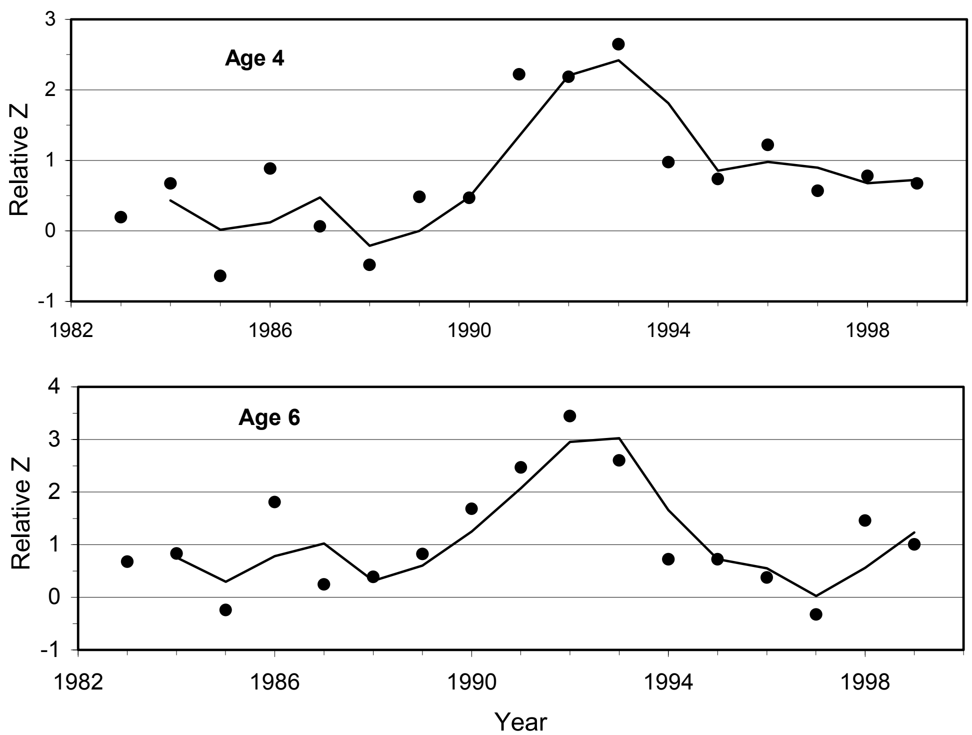

Fig. 39. Mortality rates on fish aged 4 and 6 as calculated from catch rate per tow at age during the autumn research bottom-trawl surveys in 2J3KL in 1983-2000. The smoother is a two year forward moving average.

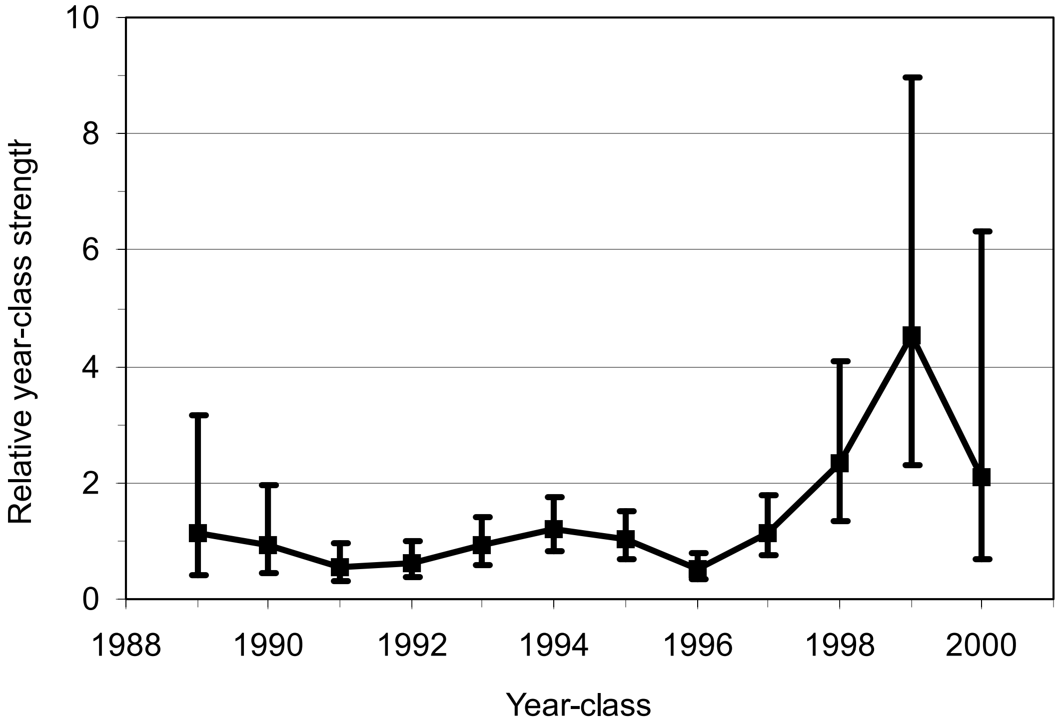

Fig. 40. Standardized year-class strength derived from modelling 30 survey/age indices (see Section 4.4.3).

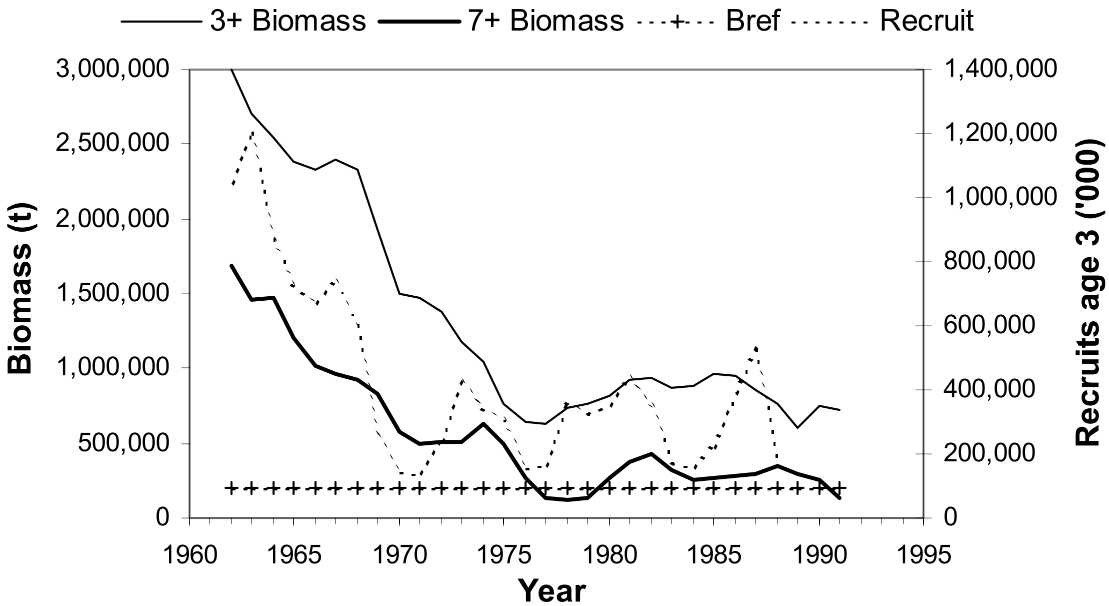

Fig. 41. Estimates of population biomass (3+), spawner biomass (7+), and recruitment (at age 3) in the 2J+3KL cod stock (from Baird et al. MS 1992).

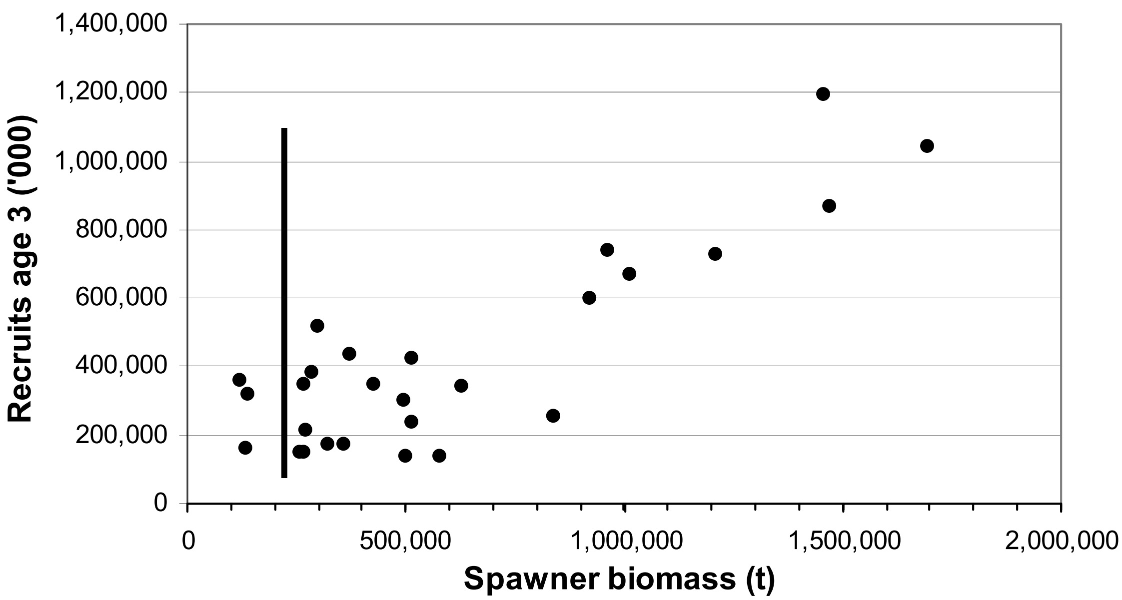

Fig. 42. Estimates of recruits (at age 3) and spawner biomass (7+) in the 2J+3KL cod stock (from Baird et al. MS 1992).

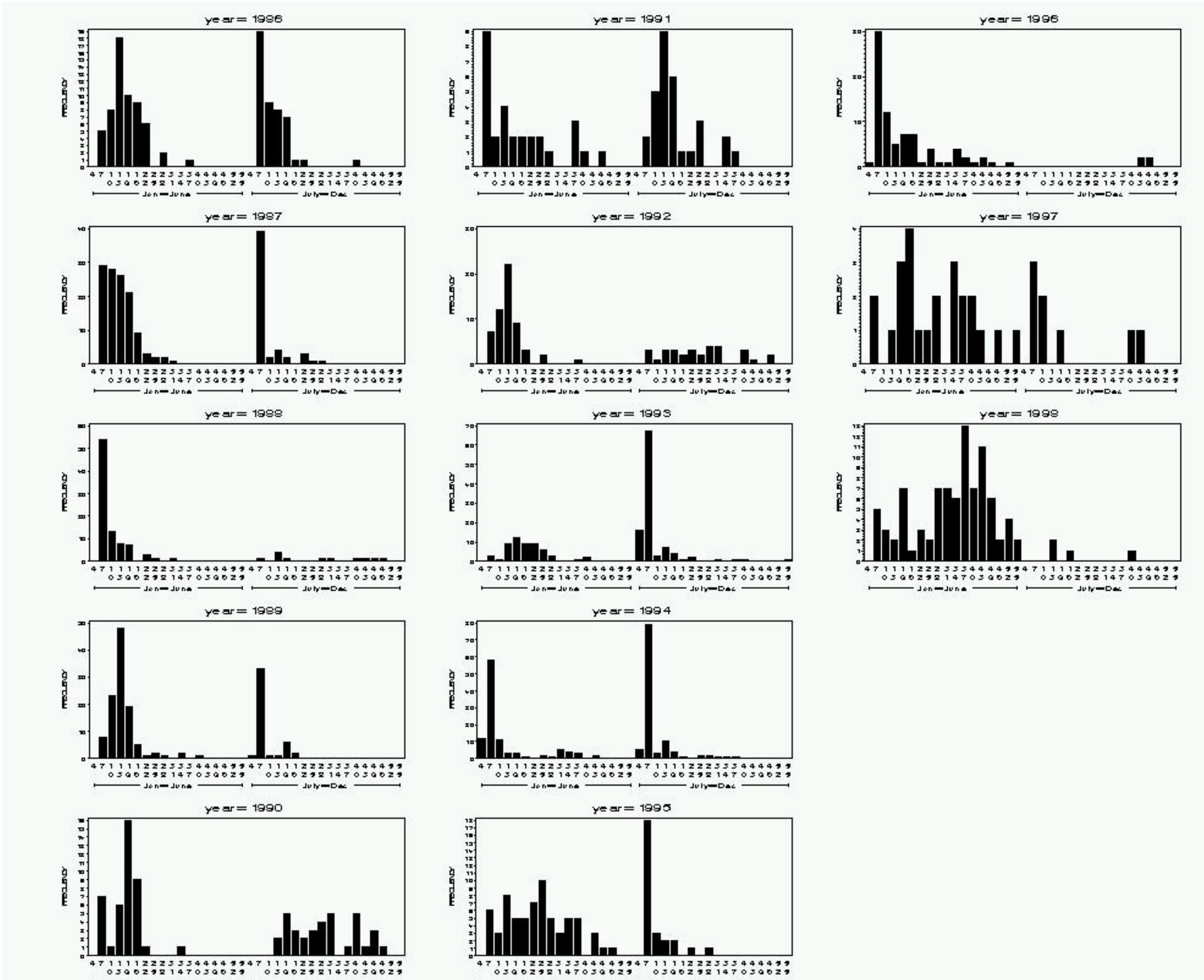

Fig. 43. Semi-annual cod length frequencies calculated from the sizes of otoliths found in harp seal stomachs in NAFO divisions 2J, 3K and 3L combined, for each year in the period 1986-1998.

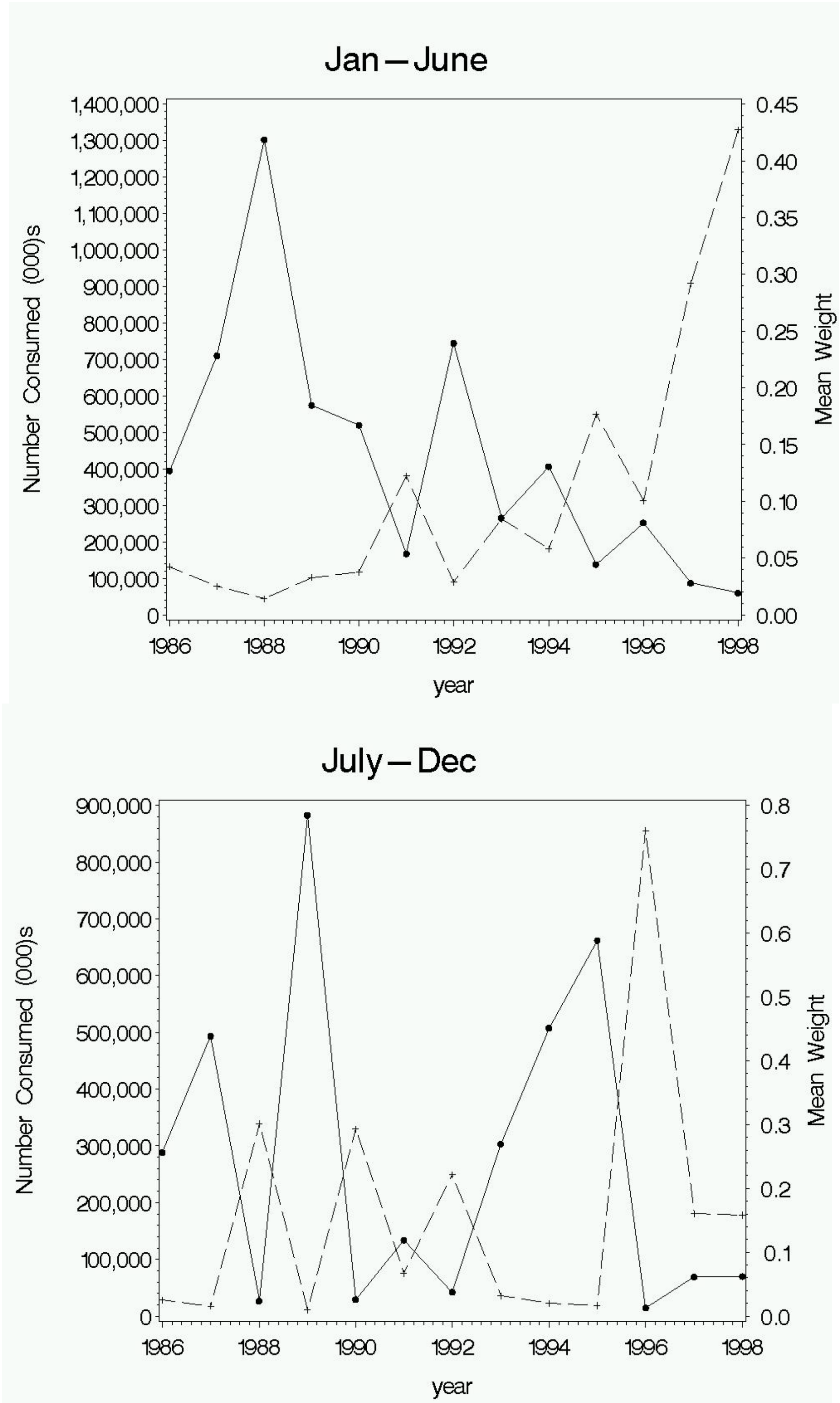

Fig. 44. Mean weights of cod consumed and the number of cod consumed by harp seals in NAFO divisions 2J, 3K and 3L combined, by half-year and year in the period 1986-1998.

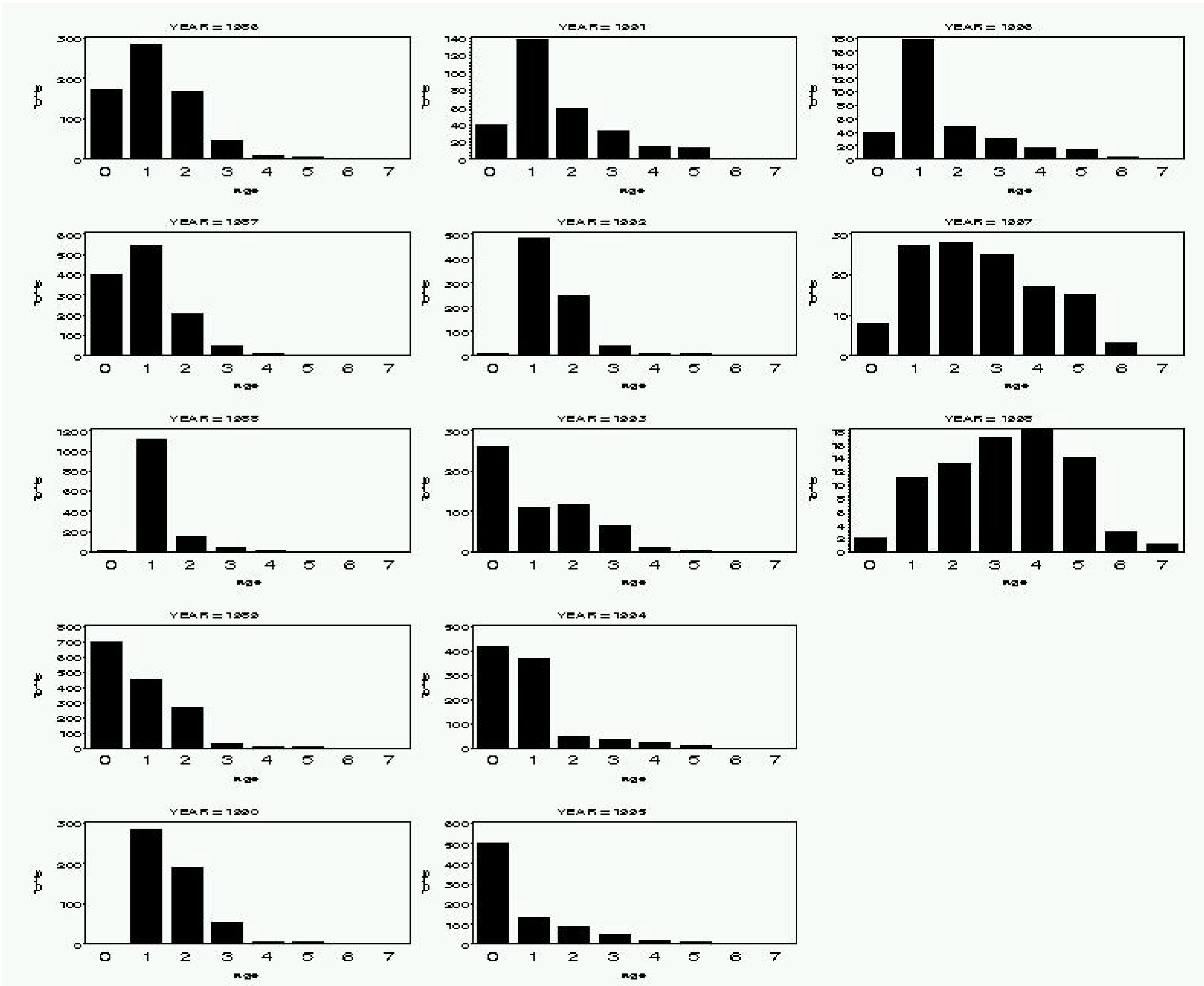

Fig. 45. Estimates of the number of cod at age consumed by harp seals each year during 1986-1998.