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

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Abstract

The status of the 2J+3KL cod stock is updated based on catch rates from the re-opened fishery in the inshore and an additional year of research bottom-trawl surveys, prerecruit surveys, acoustic surveys in specific areas, sentinel surveys and returns from tagging studies. The size of the stock as a whole and the size of incoming year-classes remain low relative to levels in the 1980s. On the basis of the current distribution of fish and new information on genetics, it was concluded that information on stock status should be provided for the inshore and offshore separately. In the offshore, biomass remains extremely low. There are very few fish larger than 50 cm and older than age 5. In the inshore, sentinel surveys and the commercial fishery have found very few fish in 2J and north of White Bay in 3K. From White Bay to the southern boundary of the stock, fish exist in sufficient density to enable moderate to high catch rates in some times and places. Catch rates in the gillnet sentinel surveys increased from 1995 to 1998 and declined by half from 1998 to 1999. The biomass calculated from tag returns and catches was estimated to be at most 55,000 t in the inshore of 3K and northern 3L. An estimate could not be produced for southern 3L because of the strong seasonal contribution of fish from 3Ps.

Résumé

L’état du stock de morue de 2J et 3KL fait l’objet d’une mise à jour fondée sur les taux de capture de la pêche côtière, qui a été réouverte, et d’une année supplémentaire de relevés de recherche au chalut de fond, de relevés des pré-recrues, de relevés acoustiques de certaines zones, de relevés par pêches sentinelles et d’études par marquage-recapture. L’effectif de l’ensemble du stock et celui des classes d’âge à venir demeurent faibles par rapport à ceux des années 1980. Il a été conclu, à partir de la répartition actuelle des poissons et de nouveaux renseignements obtenus sur leur génétique, que les renseignements relatifs à l’état du stock devraient être présentés de façon distincte pour les composantes côtière et hauturière. La biomasse hauturière demeure extrêmement faible. On note très peu de poissons de plus de 50 cm de longueur et plus vieux que 5 ans. Dans la partie côtière, les relevés par pêches sentinelles et la pêche commerciale n’ont permis de déceler que très peu de poissons en 2J et au nord de White Bay, en 3K. De la White Bay à la limite sud du stock, les poissons sont suffisamment abondants pour autoriser des taux de capture moyens ou élevés à certains moments et en certains lieux. Les taux de capture des relevés par pêches sentinelles au filet maillant ont augmenté de 1995 à 1998, mais ont chuté de moitié de 1998 à 1999. La biomasse calculée à partir des étiquettes récupérées et des captures a été estimée à près de 55 000 t dans la partie côtière de 3K et le nord de 3L. Il a été impossible d’obtenir une estimation pour la partie sud de 3L à cause d’un apport saisonnier important en provenance de 3Ps.

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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) and Hutchings and Myers (1995).

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. There was no sign of recovery in the 1995-1998 surveys.

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. MS 1992b; Kulka et al. 1995), the inshore fishery started late (Davis MS 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). The changes in the lightly exploited American plaice in Divisions 2J and 3K parallel many of the changes in cod (Bowering et al. 1997). 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. MS 1994; Lilly MS 1996a). 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), 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). Other analyses find no support for this 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 catches and the autumn research vessel index. One may class the various possibilities for the discrepancy into three groups. First, the 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) has conducted a modelling exercise that he suggests demonstrates how aggregations could cause overestimation in a random stratified survey. Second, the survey indices may not have been severely anomalous. Instead, catches were grossly underestimated because landings were under-reported and the discarding of small fish was seriously underestimated (Hutchings 1996; Myers et al. 1997a). Third, there may have been an increase in natural mortality. If the survey index reflects accurately the change in population abundance, then the increase in natural mortality must have occurred rather suddenly. It is possible that there was no single cause of the discrepancy between the catches and the research vessel index. Several factors may have contributed. Distinguishing the relative importance of these factors has proven to be difficult.

The inshore region has recently gained a greatly increased degree of prominence in the assessment of 2J+3KL cod. 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. (MS 1998a) and Lilly et al. (MS 1999), and in the many sources cited therein.

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, including 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 in 1993-1999 may be found in Bishop et al. (MS 1993; MS 1994; MS 1995a,b), Shelton et al. (MS 1996), Murphy et al. (MS 1997) and Lilly et al. (MS 1998b; MS 1999). Reports of the Canadian assessment meetings during 1993-1996 and 1999 may be found in Sinclair (1993), Shelton and Atkinson (1994), Shelton (1996), Evans (MS 1996) and Rivard (1999). NAFO deliberations are documented in NAFO Scientific Council Reports.

The 2000 assessment updated the status of the 2J+3KL cod stock to the end of 1999 based on an additional year of research bottom-trawl surveys, sentinel surveys, prerecruit surveys, acoustic surveys in specific areas, returns from tagging studies and catches from the re-opened fishery. A summary of the assessment is provided in the Stock Status Report (DFO 2000). Technical details are provided in the present document and in numerous supporting documents. The 23 additional documents anticipated at the time of writing are Anderson and Dalley (MS 2000), Beacham et al. (MS 2000a,b), Brattey (MS 2000), Cadigan and Brattey (MS 2000a,b), Colbourne (MS 2000), Dalley et al. (MS 2000), Gregory et al. (MS 2000), Inkpen and Kulka (MS 2000a,b), Jarvis and Stead (MS 2000), Lilly et al. (MS 2000), Lilly and Simpson (MS 2000), Maddock Parsons et al. (MS 2000), O'Driscoll et al. (MS 2000), Rose (MS 2000a,b), Shelton and Murphy (MS 2000), Shelton and Stansbury (MS 2000), Smedbol and Wroblewski (MS 2000), Stansbury et al. (MS 2000) and Wheeler (MS 2000). Information from these additional documents is summarized within the present paper.

2 Biology of 2J+3KL cod

2.1 Stock structure

Numerous studies have indicated the likelihood of substock structure within the northern cod complex (see Lear MS 1986 for an overview). Recent interest has focussed on whether those cod currently inshore are distinct from cod currently offshore. The cod currently offshore are assumed to be representative of those that at one time migrated from the offshore to the inshore during the late spring and summer to feed on capelin. However, it is also possible that those cod currently offshore are remnants of substocks or components that remained in the offshore throughout the year.

As summarized in the 1999 assessment document (Lilly et al. MS 1999), 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, the paucity of returns offshore from cod tagged inshore in the winter, and genetic distinction between samples of cod taken inshore and most samples taken offshore. New information on stock structure is presented in the following sections.

2.1.1 Distribution

In 1999, cod in the offshore remained broadly distributed at very low density during the autumn (see Section 5.2.2.2). In the inshore (see Section 5.4.2), acoustic studies in Bonavista Bay and Trinity Bay in autumn 1999 revealed small, scattered aggregations, with the largest quantity of fish in Smith Sound. In January 2000 a large and dense aggregation of cod was again located in Smith Sound. Such aggregations have been located in Smith Sound during most studies in winter/spring since May 1995. An exploratory survey during January 2000 in deep-water inlets from western Trinity Bay to western Notre Dame Bay found no other aggregations anywhere near the size of that in Smith Sound.

Shallow coastal waters appear to be important nursery grounds of juvenile cod from both the inshore of 3K and 3L and the offshore of 2J, 3K and 3L. Settlement to the nearshore of coastal Newfoundland occurs in two or more pulses. Genetic studies have shown that over 50% of the individuals comprising the two pulses at Newman Sound (Bonavista Bay, Division 3L) were most similar to adults that spawn in Bonavista Bay, and that many of the others were most similar to adults found offshore (especially in the area of Funk Island Bank) in the autumn (Beacham et al. MS 2000b). The autumn research bottom-trawl surveys reveal that individuals of ages 0 and 1 are 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 are mainly in those offshore areas occupied by older cod, and that individuals of age 2 are intermediate in distribution (see Section 5.2.2.3).

2.1.2 Observations from tagging studies

Tagging studies in 1999 (Brattey MS 2000) support the earlier conclusion that the inshore of 3KL is 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 during late spring and summer and returns to 3Ps during the autumn. The timing of movement and northward extent of this migrant group may vary among years. However, during 1997 to 1999 only a small number of tagged cod from 3Ps were caught north of Trinity Bay.

The tagging also provides evidence of 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, because no aggregations sufficiently large to warrant tagging have been located in the offshore in recent years and there is no fishery offshore that might capture any tagged fish that moved there from the inshore.

2.1.3 Genetics

Genetic studies were conducted to describe population structure of cod in Newfoundland and Labrador using microsatellite loci, synaptophysin (SypI) locus, and a major histocompatibility complex (Mhc) locus (Beacham et al. MS 2000a). The potential for genetic stock identification was also investigated. Variation at seven microsatellite loci (*Gmo*3, *Gmo*8, *Gmo*19, *Gmo*34, *Gmo*35, *Gmo*36, and *Gmo*37) and SypI was surveyed in approximately 5,050 cod from 19 putative populations. Variation at a class I Mhc locus was surveyed in 2,000 fish from the 19 populations. Ten populations were sampled over two or more years, and variation among populations was on average about 18 times greater than annual variation within populations. Regional structuring of the populations was apparent with inshore and offshore spawning populations forming distinct groups. The Flemish Cap population was the most distinctive of the offshore group, and the Gilbert Bay population in Labrador was the most distinctive of the inshore group. In Divisions 2J3KL, no significant genetic differentiation was observed among inshore cod sampling sites in Notre Dame Bay and Bonavista Bay. Some differentiation was observed between sites in Conception Bay and Trinity Bay, and also with other inshore sites, providing some evidence of distinct "bay" stocks of cod along the northeast coast of Newfoundland. All inshore cod samples were genetically distinct from all offshore samples of northern cod. The offshore samples were more heterogeneous, and there may be at least three distinct offshore spawning populations of northern cod.

Simulated mixed-stock fishery samples of northern cod suggested that variation at the seven microsatellite loci, the synaptophysin locus, and Mhc locus C should provide reasonably accurate estimates of stock composition (inshore vs. offshore) when the inshore component comprises at least 50% of the mixture. The technique was applied to samples of 0-group cod from the inshore of Bonavista Bay (see Section 2.1.1).

The assessment meeting focused on the recent studies by Beacham et al. (MS 2000) but, as noted in last year's assessment document (Lilly et al. MS 1999), there were other genetic studies during the 1990s. These used either microsatellite loci (Bentzen et al. 1996; Ruzzante et al. 1996, 1997, 1998; Taggart et al. 1998) or mitochondrial DNA (Pepin and Carr 1993; Carr et al. 1995). The earlier studies with microsatellites give results similar to those of Beacham et al. (MS 2000), and the authors of the earlier studies with microsatellites reach conclusions broadly similar to those of Beacham et al. (MS 2000). On the other hand, Carr and Crutcher (1998) have a very different interpretation. They say that the results of studies of mitochondrial DNA reveal that "essentially none of the genetic variance in the Northwest Atlantic is attributable to subdivision among samples" and that "re-evaluation of comparable microsatellite data supports the conclusion of extremely limited genetic differentiation among populations in the Northwest Atlantic". (The microsatellite data referred to are those of Bentzen et al. (1996), Ruzzante et al. (1996, 1997, 1998) and Taggart et al. (1998)). Carr and Crutcher (1998) also conclude "that the mtDNA and microsatellite data confirm the genetic pattern first shown by Cross and Payne (1978) of a primary separation of cod on the Flemish Cap and those elsewhere in the Northwest Atlantic, but that there is otherwise little or no genetic substructuring attributable to genetically distinct stocks in this area".

Carr and Crutcher (1998) make additional observations that are important to interpretation of the genetic results. For example, they note that in some cases, such as the north and south pools in the offshore as described by Bentzen et al. (1996), the genetically discernible groups or populations "… are not biological entities but rather *a posteriori* statistical pools". It may be noted that the three distinct offshore populations described by Beacham et al. (MS 2000) were also derived by drawing boundaries around many small broadly-scattered samples. It is not clear how many pools would be appropriate and where the boundaries among them should be drawn.

Because genetic evidence is becoming vital to the discerning of population structure within the northern cod complex and to speculation about how recovery might occur, it is essential that questions regarding the interpretation of the data be resolved.

2.1.4 Conceptual models

Smedbol and Wroblewski (MS 2000) used metapopulation concepts to propose a model of subpopulation structure within the northern cod stock complex. A prediction from their model is that as remaining spawning groups recover, currently unoccupied spawning areas will be recolonized. They conclude that limiting fishing on the remaining subpopulations would afford them the opportunity to grow, thereby increasing the possibility that they would colonize unoccupied areas and thus accelerate the recovery of the overall metapopulation.

There is compelling evidence that the 2J+3KL cod stock should not be treated as a unit stock, but there is still uncertainty regarding the number of components that existed in the past and how many exist now. There is evidence of substock structure between the inshore and the offshore. There is weaker evidence for substock structure within both the inshore and the offshore. For the present assessment, it was decided to assess the offshore and the inshore separately, but not to assess individual bays within the inshore because of difficulties associated with seasonal movement of fish into 3L from 3Ps and the mixing of fish among bays.

3 The fishery

3.1 Timing of fishery and management plan

In May 1999, the Fisheries Resource Conservation Council recommended that a TAC for 1999 be set between 6,000 and 9,000 t to allow for a limited commercial fishery including a sentinel survey component for the coastal portions of 3K and 3L only (FRCC MS 1999). The Minister of Fisheries and Oceans announced on June 23 the re-opening of a limited commercial fishery with a TAC of 9,000 t in the inshore portion of 2J3KL. The quota available for the commercial fishery was set at 8,600 t after allowances of 300 t for the sentinel survey and 100 t for bycatch.

3.1.1 Commercial fishery

Licences were made available to all Level I and Level II Professional Fish Harvesters who operate from a homeport in divisions 2J3KL and hold a groundfish licence for a vessel under 65 feet. The fishery was conducted on an IQ basis, with each eligible fisher licensed for 9,000 lbs (round weight) or 7,500 lbs (head-on gutted weight). Each fishing enterprise was 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. Gillnets and longlines could not be used at the same time. Handlines could be used in conjunction with either gear. Cod traps and jiggers were not allowed. Fishers were licensed to fish only in the Division of their homeport. Smith Sound in Trinity Bay was limited to fishers with homeports in the Sound. The inner portion of Gilbert Bay in Labrador was closed to commercial fishing. All fishing was restricted to within the 12 nm limit (headland to headland). All landings were subject to an industry-funded 100% Dockside Monitoring Program. The minimum fish size was set at 43 cm (17 inches). All licence holders were required to complete detailed logbooks supplied by DFO.

The initial announcement specified two fishing seasons: July 8 – July 31 and September 13 – October 16. The second period was subsequently opened early on September 6 and extended to November 13.

3.1.2 Recreational/food fishery

A recreational/food fishery was held during three weekends: Friday July 30 to Sunday August 1; Saturday August 28 to Monday August 30; and Saturday September 4 to Sunday September 5. (The initial announcement specified only the first two weekends. The third was added because of poor weather during the second weekend.) Fishing was by hook-and-line (hand-held or angling). Jiggers were not permitted. The individual catch limit was 10 groundfish per day. The inner portion of Gilbert Bay in Labrador was closed to recreational/food fishing.

It was estimated that 57,000 people participated and caught 98,000 fish weighing 220 tons. In comparison, during the 3-day 1998 fishery 57,000 people caught 340,000 fish weighing 696 tons.

A number of factors influenced catches during the 1999 recreational/food fishery. It was felt by many participants during the first weekend that cod had been feeding on capelin and were therefore difficult to catch. Bad weather during the two succeeding weekends resulted in a dramatic decrease in activity and prevented many participants from obtaining their daily limit.

3.1.3 Sentinel survey

Timing of the sentinel surveys varied with site (Maddock Parsons et al. MS 2000). The total landings were about 200 t.

3.2 Catch and catch at age

3.2.1 Discards

Estimates of discards are available for trawlers directing for cod and shrimp (Kulka 1997; Kulka MS 1998). These data have not been included in the following description of catch and were not included in the analyses conducted in 1998 (Lilly et al. MS 1998b). Discards were estimated to average 3,400 t between 1980 and 1992, with a peak at 9,000 t in 1986.

Inkpen and Kulka (MS 2000a) present the results of an analysis of cod discard rates in the shrimp and cod directed fisheries in NAFO divisions 2J, 3K and 3L. Fishery observer records from the shrimp fishery were examined for the years 1997 - 1999. Estimates of total discards were obtained by two methods; 1) observed discard rates were applied to landings for observed vessel classes and time periods and, 2) overall discard rates were applied to total reported landings. Results indicate that cod discards in this fishery were relatively low, with estimates of 2.3 - 3.8 t in 1997 (app. 17,700 fish), 1.7 - 2.2 t in 1998 (app. 2,700 fish), and 2.5 - 2.6 t in 1999 (app. 10,500 fish). Length frequency data from 2J showed a higher proportion of large fish (>30 cm) in 1998 than in other years.

Limited data available from the Observer Program for the 1999 2J3KL inshore directed cod fishery indicated discarding in the gillnet fishery only. A total of 198 sets were observed in this sector, with 19 showing cod discards. The total estimate of 50.4 t represents a discard rate of 0.56% of the 9000 t TAC. While length data were not available, it is assumed that the fish were reflective of commercial catch sizes with 5 ½ inch gear and therefore larger than those in the shrimp directed fishery.

3.2.2 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. MS 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 4000 t, divided among by-catch (275 t), sentinel surveys (375 t), and a new index fishery, which was itself divided into an inshore component (3000 t) and an offshore component (350 t). The reported catches were 398 t from by-catch, 388 t from sentinel surveys, 3019 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, as noted in Section 3.1, there was a quota of 9000 t in the inshore portion of 2J3KL. The quota available for the commercial fishery was set at 8600 t after allowances of 300 t for the sentinel survey and 100 t for bycatch. Reported catches were about 8050 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.

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.

Inkpen and Kulka (MS 2000b) report the landings and sampling coverage, by gear, unit area and month, for the commercial fishery in 1999. They also provide illustrations of the length frequencies of the total catch by gear, unit area and month. Length frequencies from gillnet catches measured both at sea and on land did not show any evidence of high-grading (discarding of small cod).

The catch in 1999 from all sources (commercial fishery including bycatch, sentinel survey and food/recreational fishery) is presented by gear, unit area and month in Table 3. Gillnets contributed 87% of the catch by weight, linetrawls 2% and handlines 11%. The dominance of gillnets is a new phenomenon in the inshore fishery (see Table 2 and Fig. 5). The commercial fishery was conducted on the basis of individual quotas, with participants licensed to fish only in the Division of their home port, so landings by Division reflected both the availability of fish and the number of licences in each Division. Landings increased from 2J (< 1% by weight) to 3K (43%) to 3L (57%). Unit area 3Ki (central Notre Dame Bay to Cape Freels) accounted for 27% of all landings. The months of highest catch were July and September.

3.2.3 Sampling of catch in 1999

The sentinel survey was sampled intensively. Most gear/unit area cells in the commercial fishery were well sampled during July and September, but there were some shortfalls. There was no sampling of the food/recreational fishery.

The number of fish measured in 1999 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.

3.2.4 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:

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

In terms of numbers of fish, the catch in 1999 was dominated by gillnet (81%), followed by handline (16%), linetrawl (3%) and trap (<1%) (Table 6). The proportion of the catch numbers at age varied among gears (Table 6; Fig. 6). Gillnet landings were mainly of ages 5-9, with age 7 (the 1992 year-class) dominant. Linetrawl landings were mainly from ages 3-7, with ages 4 and 5 prominent. Handline landings were mainly of ages 4-7, with ages 4 and 5 again prominent. Trap landings were mainly from ages 3-7 with age 4 most prominent. The combined catch at age strongly reflected that of the gillnets, but with a stronger contribution by ages less than age 7. Only 2% (by number) of the total catch was older than age 9 (the 1990 year-class).

The numbers at age for fish in the reported landings from 1962 to 1999 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 1999. The 1992 year-class was the most important contributor in 1998-1999.

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 1999 were at or near the highest levels in the timeseries. 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 1999 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 1999. There are clearly problems with the 1993 weights-at-age that remain to be resolved. See Lilly (MS 1998) for additional information and discussion regarding this time-series.

The biomass at age for fish in the reported landings from 1962 to 1999 is presented in Table 9.

4 Industry perspective

A perspective on several aspects of the 1999 sentinel survey and commercial fishery is available from the responses to a questionnaire sent by the Fish, Food and Allied Workers (FFAW) to the fish harvester committees representing the 53 sites where a sentinel survey was conducted by the FFAW in 1999 (Jarvis and Stead MS 2000). Ninety percent of the committees said that the sentinel survey catch rates reflected cod abundance as perceived by fish harvesters.

In response to whether commercial catch rates in 1999 were low, average or high, 41% said low, 37% said average and 22% said high. All responses 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 northern Avalon Peninsula. “High” responses came from sites in the region from the most eastern part of 3K to the Smith Sound area of western Trinity Bay and also from several areas on the southern Avalon Peninsula.

In response to whether commercial catch rates were lower, the same or higher than during the 1998 index fishery, 24% said lower, 45% said they were the same, and 31% said higher. Half of the "lower" responses came from southern 3K. Most of the "higher" responses came from 2J and northern 3K, where catch rates were "low", or the region from easternmost 3K to Smith Sound in Trinity Bay, where catch rates were "high".

In response to whether "signs" of small (up to 18 inches) fish were worse, the same or better than in 1998, 16% said worse, 34% said the same and 50% said better.

In response to whether the overall condition of cod caught during 1999 was poor, average or good, 10% said average and 90% said good.

5 Resource status

Stock status at the end of 1999 was updated from 1998 based on catch rates from the re-opened fishery and an additional year of research bottom-trawl surveys, prerecruit surveys, acoustic surveys in specific areas, sentinel surveys and returns from tagging studies.

5.1 Commercial fishery CPUE

Catch and effort data recorded in logbooks maintained by participants in both the index fishery in 1998 and the commercial fishery in 1999 were examined (Shelton and Murphy MS 2000). The mean and median catch rates were computed by year, month and location. For the study of location both unit area (Fig. 1b) and the finer spatial scale of statistical section (Fig. 1c) were examined. Units are catch in kgs per gillnet and catch in kgs per thousand hooks. Data by unit area were plotted as a monthly time series. However, a comparison of the spatial pattern for statistical sections 2 to 28 for the two years was considered to be the most informative representation (Fig. 8).

The spatial pattern was similar in the two years, with catch rates 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 (Fig. 8). No inferences about annual trends should be drawn from just two years of data, especially since the dates of fishing varied between the two years. The 1998 fishery was in the autumn only (last week of September to mid-October) whereas the 1999 fishery included both summer (July) and autumn (September to mid-November). A comparison for the weeks of overlap only has not yet been conducted.

5.2 Bottom-trawl surveys

5.2.1 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 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 1985-1999.

The autumn surveys in Divisions 2J and 3K were conducted by RV Gadus Atlantica until1994. In 1995-1999 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 (1985-1999 for spring and 1983-1999 for autumn).

In the autumn 1995 survey both ships used for the first time the Campelen 1800 shrimp trawl with rockhopper footgear, replacing the Engels 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. MS 1997). Conversion of Engels catches to Campelen equivalent catches is reported by Stansbury (MS 1996, MS 1997).

The survey stratification scheme, illustrated in Fig. 9-11, is based on depth contours (Doubleday 1981; Bishop MS 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.

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 1995-1999, set allocation was based once again on stratum area alone.

5.2.2 Autumn bottom-trawl surveys

5.2.2.1 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. This correction was not applied after 1991 because of changes in cod distribution, a change in the stratification scheme introduced in 1993 (Bishop MS 1994) and the change in vessel and trawl gear in 1995.

Estimates of abundance and biomass for the autumn surveys from 1978 (Divisions 2J and 3K) or 1981 (Division 3L) to 1994 may be found in Tables 12-19 of Shelton et al. (MS 1996). The data from 1983 to 1994 have been converted to Campelen equivalents and are presented along with the actual Campelen data from 1995-1999. Data for Division 2J are in Tables 10-12 and data for Division 3K are in Tables 13-15. Note that data for 1993-1999 are presented separately from earlier years for Divisions 2J and 3K because of the change in stratification scheme introduced in 1993 (Bishop MS 1994). Estimates for surveys in Division 3L in 1983-1987 are in Tables 16-18 of Lilly et al. (MS 1999). Estimates for strata <= 200 fathoms in Division 3L in 1988-1999 are in Tables 16-17 of this paper. Estimates for strata > 200 fathoms in Division 3L in 1990-1999 are in Table 18.

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 are not included.

Changes in abundance and biomass in the index strata are shown by Division for the years 1983-1999 in Fig. 12. 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. The abundance and biomass have remained at extremely low levels in all Divisions since 1993.

The abundance and biomass estimates for the new inshore strata in 1996-1998 (Table 19) 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 20.

The abundance and biomass for index strata, deep offshore strata and inshore strata are provided in Table 21 by Division and year for the 5 years since introduction of the Campelen trawl. Abundance in index strata declined from 1995 to 1997 and increased in 1998 and 1999. Biomass in index strata increased from 1995 to 1997, remained unchanged in 1998 and increased in 1999. The biomass in index strata in 1999 was about 28,000 t, which is about 2.4% of the average biomass of 1,200,000 t (in Campelen equivalents) in 1983-1988 (excluding 1986).

5.2.2.2 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. MS 1996; Murphy et al. MS 1997) and in weight (kg) per standard tow (Lilly 1994, MS 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. (MS 1999). The catches in 1987-1988 are presented in Fig. 13 as an example of the relatively large catches that were obtained during the 1980s. Catches in 1995-1999 are presented in Fig. 14. (Note the change in scale between Fig. 13 and Fig. 14.)

For the period 1981-1988 catches were wide-spread 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. During 1995-1999 catches were 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.

The increase in catches in Division 3L in autumn 1999 prompted the question of whether there was evidence of cod migrating into Division 3L from Divisions 3NO to the south. To help address this question, plots of the catch (number) per tow were made for Divisions 2J3KLNO combined for the years 1995-1999 (Fig. 15). There was no indication of a continuous distribution of cod from Divisions 3NO into Division 3L in 1999. However, this does not preclude the possibility that cod moved from 3NO into 3L, either over the plateau of Grand Bank or in the deeper water below the CIL along the eastern edge of the Bank.

5.2.2.3 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 in press). Catches from autumn surveys in 1995-1998 have revealed a similar pattern, with the notable exception that the 1994 year-class, which has been the strongest year-class appearing in the surveys since at least the early 1990s, was already well onto the shelf by age 1 (Lilly et al. MS 2000). More recent year-classes have been extremely weak in Division 2J, but have been found to be somewhat more abundant adjacent to the coast in Divisions 3K and 3L.

The distributions of cod of ages 0 to 5 in autumn 1999 are illustrated in Fig. 16. 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.

5.2.2.4 Autumn size composition

Population numbers at length, calculated by areal expansion of the stratified arithmetic mean catch at length (3-cm groupings) per tow, are illustrated for 1995-1999 in Fig. 17. There were very few cod longer than 50 cm in any year.

There were very few cod longer than 50 cm in any year. A strong mode at 19 cm in Divisions 2J and 3K in 1995 moved to 28-31 cm in 1996, to the upper 30s and lower 40s in 1997 and to the upper 40s by 1998. A comparison with the age samples reveals that this mode represented the 1994 year-class in 1995, but by 1997 and again in 1998 it was a combination of the 1994 and 1995 year-classes. This mode had almost disappeared by 1999. Additional modes appeared after 1997 in 3K and 3L, but not in 2J. Individuals contributing to the prominent mode at 37-40 cm in 3L in 1999 were not seen in 3L in 1998.

In all 5 years Division 3L had more large fish than Divisions 2J and 3K.

5.2.2.5 Autumn mean catch at age per tow

The divisional mean number caught at age per tow in 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. (MS 1995b). The data from 1983 to 1994 have been converted to Campelen equivalents and are presented along with the actual Campelen data from 1995-1999 in Table 22a 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 increase occurred at most ages and was most pronounced at ages 2 and 3. As in the previous 5-6 years, very few fish older than age 5 were caught in 1999.

The mean catch at age per tow was also calculated for the inshore strata in 3KL combined (Table 22b). The inshore was fished only in 1996-1998.

5.2.2.6 Autumn recruitment

The weakness of recent year-classes is emphasized when mean catch at age per tow is plotted for the 1976-1998 year-classes at ages 1-3 (Fig. 18). The 1994 year-class at age 1 was relatively large compared with actual catches of earlier year-classes, but it looks very weak compared to previous year classes following conversion to Campelen equivalent numbers. The 1992-1996 year-classes at age 3 look weak even when compared with unconverted catches of some of the year-classes from the early and late 1980s.

5.2.2.7 Autumn total mortality (Z)

Total mortality rates at age in each year, $Z_{a,y}$ were estimated from the survey data by applying the following equation to ages 1 to 14:

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

For ages not fully selected by the gear this represents only a relative measure of mortality. The increase in Z during the late 1980s is clear in the data as well as a decrease in 1994 (Fig. 19), lagging the implementation of the moratorium on Canadian fishing by one year. However, mortalities have remained high on ages 3-5 in recent years despite the belief that fishing mortality is now negligible. Ages older than 5 are not represented with any abundance in recent survey data. The reason for mortality levels on these age classes in excess of the commonly assumed natural mortality rate of 0.2 is not understood and will have a negative impact on stock recovery in the offshore.

5.2.2.8 Autumn size-at-age and condition

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. The research survey data (Tables 23, 24; Figs. 20, 21) 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. 22, 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 and weights-at-age in the early 1990s appears to have been reversed, but sample sizes at ages greater than age 4 have been very small in recent years (Lilly MS 1998), so the accuracy of these estimates is poor.

Condition, as measured by both gutted body weight (Table 25; Fig. 23) and liver weight (Table 26: Fig. 24) relative to fish length, declined in Division 2J in the early 1990s. Gutted condition has since returned to approximately normal whereas the liver index has improved but not fully recovered. In Division 3K gutted condition declined and has since improved whereas liver index has changed little. In Division 3L gutted condition has remained relatively unchanged over time whereas liver index increased considerably in the early 1990s and has since declined. The historic trends in condition indices are complex and poorly understood (Lilly MS 1996b, MS 1997).

5.2.2.9 Autumn maturity

The observed proportions mature at age for female and male cod in divisions 2J3KL combined from 1982 to 2000 based on sampling conducted during autumn bottom-trawl surveys in 1981 to 1999 are shown in Tables 27 and 28. 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, are also given. The model estimates for A50 are illustrated in Fig. 25 (bottom panel). In the early portion of the time series from 1972 until the mid to late 1980s the A50's were higher and fluctuated irregularly between 5.8 and 6.2 for females and 4.8 to 5.3 for males. From the mid to late 1980s until the present the A50's declined in both sexes and are currently at or close to their lowest values in the time series. The values of A50 for the most recent year are 5.11 for females and 4.38 for males. A time series of estimated proportions mature at age for females aged 4-6 shows that approximately 80% of 6 yr olds are mature in recent years compared to only 40% in the 1980s (Fig. 25, top panel). The most recent portion of the time series of A50 (Fig. 25, bottom panel) shows considerable year to year variability, but suggests that the declining trend may have halted. However, there are no indications that age at 50 % maturity is increasing and current values remain close to the lowest observed in the time series.

5.2.3 Spring bottom-trawl surveys

5.2.3.1 Spring 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. (MS 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. (MS 2000). The data from 1988 to 1999 for the index strata (depths <= 366 m or 200 fathoms) are provided in Tables 29-30 and Fig. 26 in the present document. The indices declined very rapidly from 1990 to 1994 and have remained very low in subsequent surveys. Fishing in waters deeper than 200 fathoms started on a regular basis in 1991 (Table 31). In some years a large portion of the total estimated abundance and biomass was caught outside the index strata in the deeper water.

5.2.3.2 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 (Fig. 27). Because the catches were becoming very small by the mid-1990s, the catches for 1992-1999 (Fig. 28) are displayed with an expanded 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 northeastern and northern 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. Since 1995 the cod in 3NO appear to be further onto the bank at the time of the surveys than they were in the early 1990s. In 1999 there is 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.

5.3 Recruitment surveys and observations

5.3.1 Pelagic 0-group surveys

Pelagic juvenile fish surveys, designed to provide an index of the abundance of 0-group cod prior to settling, were conducted in offshore and inshore waters of 2J3KL in August-September 1994-1999 (Dalley et al. MS 2000). The index for all of 2J3KL declined from 1994 to 1996, increased somewhat in 1997 and 1998, and increased greatly in 1999 to the highest level in the timeseries. Most of the increase in 1999 occurred in the inshore, but there was also an increase on the northern Grand Bank. Catches continued to be very low in the offshore of 2J and 3K.

5.3.2 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. MS 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. MS 1999, MS 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. MS 2000).

5.3.3 New recruitment index

A new recruitment index was derived from catch rates of juvenile (ages 0-3) cod during the following studies: experimental squid traps; experimental fixed-station bottom-trawling (FS BT) with a Campelen trawl, both inshore and offshore; beach seine; pelagic 0-group monitoring with an IYGPT trawl, both inshore and offshore; sentinel survey linetrawl (LT); sentinel survey 5.5 inch gillnet (GN); sentinel survey 3.25 inch gillnet (GN); and stratified-random bottom-trawl (SR BT) monitoring with a Campelen trawl, both inshore and offshore (Shelton and Stansbury MS 2000). The years during which each series was operational and the ages of cod caught and considered during this analysis are:

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	0-2	1992-1997
IYGPT inshore	0	1994-1999
IYGPT offshore	0	1994-1999
Sentinel LT	3	1995-1999
Sentinel GN 5.5	3	1995-1999
Sentinel GN 3.25	2-3	1996-1999
SR BT inshore	1-3	1996-1998
SR BT offshore	0-3	1995-1999

The total number of survey/age indices considered in the analysis was 28. 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 beach seine data are from Methven et al. (MS 1998); the IYGPT trawl data are from Anderson et al. (2000); the sentinel data are from Stansbury et al. (MS 2000); and the stratified-random bottom-trawl data, both offshore and inshore, are from Section 5.2.2.5 of this paper.

An iterative reweighting multiplicative model was fitted to survey at age indices to removes survey and age effects and thereby reveal the yearclass strength signal:

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

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 yearclass 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 indices weightings were 1/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 to provide a single index of yearclass strength (Fig. 29) because the inshore appears to be an important nursery area for cod populations spawning in both the inshore and the offshore.

The index declines from 1989 to 1991, increases to 1994, declines to 1996, and then increases to 1999. The ultimate strength of the 1998 and 1999 year-classes is yet to be determined. Their present strength is known only imprecisely. 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 that was relatively strong in sentinel and commercial catches. It is likely that the spawning biomass in both the inshore and offshore will decline in the next few years even in the absence of a fishery because of what appears to be a particularly poor 1996 year class and an only marginally better 1995 year class. If the apparently higher 1998 and 1999 year-classes survive then spawner biomass may begin to increase when they mature.

5.4 Acoustic surveys and observations

5.4.1 Offshore (mainly Hawke Saddle)

Offshore acoustic studies were conducted in Hawke Channel in 2J in June 1994-1996 and 1998-1999 and in January 1998-2000 (Rose MS 2000b). The biomass detected during June surveys decreased by half from 1994 to 1995 and continued to decline in succeeding years. The 1999 estimate, which was approximately 16% of the 1994 estimate, may be low because survey coverage was incomplete.

5.4.2 Inshore (mainly Smith Sound)

Inshore 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 their abundance but also on where the cod are in their annual cycle of movements. Fish overwinter in dense aggregations in deep water in the Sound and perhaps spawn there in the spring. They then move into shallow water along the coast in western Trinity Bay and Bonavista Bay from late spring to early autumn and return to the Sound in late autumn or early winter. Acoustic surveys by Rose (MS 2000a) provided biomass estimates of 13,000 t in May 1995, 14,000 t in June 1998, 15,000 t in January 1999 and 1000 t in June 1999. Two acoustic surveys in January 2000 provided an average biomass of about 22,000 t. Sampling by bottom-trawling during January 2000 showed the 1990 and 1992 year-classes to be present in relatively large numbers and the 1995, 1996 and 1997 year-classes to be well represented. 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 MS 1997; Porter et al. MS 1998; Wheeler MS 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. MS 1998; Wheeler MS 2000).

An exploratory acoustic study of deep-water inlets from western Trinity Bay to western Notre Dame Bay in January 2000 found no other aggregations anywhere near the size of that found in Smith Sound at that time (G. Rose, Memorial University of Newfoundland, St. John's, NF, pers. comm.).

Acoustic surveys directed at herring in autumn 1996 and 1999 both yielded cod biomass estimates of 5,000 t for Bonavista and Trinity bays combined (Wheeler and Miller MS 1997; Wheeler MS 2000). For several reasons, these estimates are considered to be relative indices. In 1996 more cod were detected in Bonavista Bay than in Trinity Bay, whereas in 1999 there were more in Trinity Bay. During both surveys cod were primarily in shallow water (< 75 m). Peak densities were at about 45 m in 1996 and 20 m in 1999.

An acoustic study in southern Bonavista Bay in November-December 1999 did not encounter any large concentrations of cod (Anderson and Dalley MS 2000).

5.5 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 1995-1999. The primary goal of these surveys was to obtain information on catch rates on traditional 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. Analyses are available for data collected in 1995-1997 (Lilly MS 1997; Lilly et al. MS 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 5.5.2).

5.5.1 Site-by-site descriptions

Maddock Parsons et al. (MS 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. With respect to annual variability, gillnet catch rates declined in 1999 from levels observed in 1998, which were generally the highest since the inception of the surveys. Linetrawl catch rates were similar in 1999 to those in 1998 but lower than the highest catches observed in 1997. Trap catches were down in all areas in 1999, with only one trap site having a noteworthy catch. The data have also been grouped by Division. Catch rates in 2J have remained very low since 1995 in all gears fished. In 1999, gillnet catch rates were lower in 3K than in 3L but linetrawl catch rates were similar in the 2 Divisions.

Information is also presented on relative length frequencies (number at length divided by amount of gear) by sentinel survey site, gear and year. These data have also been grouped by division.

5.5.2 Standardized CPUE

The sentinel program has been running in NAFO Division 2J, 3K and 3L since 1995. To date there are five complete years of catch and effort data from 60 sites. Length frequencies and weight analysis have been sampled by quarter in all sites. Methods developed in the last assessment (Lilly et al. MS 1999) were extended in the present assessment (Stansbury et al. MS 2000) to obtain an age disaggregated index of standardized relative abundance for gillnets and linetrawls. The catch from 2J3KL are divided into cells defined by Gear type (gillnet 5 ½ inch, gillnet 3 ¼ inch and line trawl), Division (2J, 3K, 3L), Statistical unit area (i.e. 3Ki, 3Lh etc.), Year (1995-99) 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 3 ¼ gillnets. Length frequencies and age length keys are combined within cells. Numbers of fish at length were assigned an age using an age length key. Because there are little to no discards in the sentinel fishery and the fish harvesters measure the length of all of the fish for line trawl and gillnet sets, obtaining catch numbers-at-age is relatively straight forward (see Stansbury et al. (MS 2000) for details).

The catch-at-age and catch per unit effort (CPUE) 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. Zero catches were generated for ages not observed in a set. Sets with effort and no catch are valid entries in the model. Ages in the model ranged from 3 to 10 for 5 ½ gillnet, 2 to 10 for 3 ¼ inch gillnet and 3 to 9 for linetrawl. A generalized linear model (McCullagh and Nelder 1989) was applied to the catch and effort data for each gear and survey method.

$$E(C_{msay}) = x_{msay} effect$$

where C =catch in numbers for month *m*, site *s*, age *a* and year *y*
x = log (amount of effort)
effect = month(site)+age(year) which is month nested in site and age nested in year.

Site/month combinations where no fish were landed in all years where deleted from the analysis. The model was fitted using the SAS procedure GENMOD assuming a Poisson distribution for catches and a log link function with an offset equal to the log of the amount of gear. No intercept was fitted in the model. 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 linear scale to give the relative index at age for each year.

Gillnet catch rates increased from 1995 to 1998 but declined from 1998 to 1999 (Fig. 30). Linetrawl catch rates showed relatively little change from 1995 to 1996, increased in 1997, and declined again in 1998 and 1999.

The catch rates at age (Fig. 31) indicated 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.

5.6 Mark-recapture experiments (tagging)

An intensive tagging study was initiated in 3Ps in 1996 to provide information on the movements of cod and to assist in the estimation of population size. Some tagging was also conducted in 2J3KL, but the effort was relatively small because there was no commercial fishery that could recapture the fish. An extensive and intensive tagging programme was started in the spring of 1999 when it became clear that there would be a commercial fishery later that year.

5.6.1 Tag return rates

During 1 April - 3 December 1999, a total of 8,825 cod (>45 cm fork length) were tagged with single, double, or high-reward t-bar anchor tags and released in Divisions 3KL at various inshore locations from Notre Dame Bay to St. Mary's Bay (Brattey MS 2000). A total of 791 (9.0%) were reported as recaptured during 1999 from recreational, sentinel, directed commercial and by-catch fisheries. The percentage of tagged cod released prior to the fishery and reported as recaptured varied among areas, ranging from 28.6% (n=1420) in 3Ki (Fogo-Twillingate area) to 4.8% (n=1046) in Trinity Bay. Substantial recoveries (7.2%) of cod tagged in various regions in southern 3L (Conception Bay southward) included many autumn recaptures from neighbouring Placentia Bay (Subdivision 3Ps) where there was a directed cod fishery with landings during the last quarter of 1999 in excess of 7,500 t.

For further analysis of the tag return data, the inshore was divided into three geographic areas: 3K, northern 3L (Bonavista and Trinity bays) and southern 3L. The returns from tags applied during 1999 were highest for fish tagged in 3K (26%), lowest for fish tagged in northern 3L (7%) and intermediate in southern 3L (11%). As noted above, many of the recoveries of the tags applied in southern 3L occurred in 3Ps. It is presumed that these fish had migrated into 3L from 3Ps during the spring.

5.6.2 Exploitation rates and population estimates

Information from recaptures of cod tagged in 3KL during 1997-1999 were used to estimate length-and gear-based exploitation rates for the commercial fishery in 1999 (Cadigan and Brattey MS 2000a). The model incorporated methods to estimate tagging mortality, tag loss, tag reporting rates and growth. (The incorporation of a prediction of growth in length between the time of release and the time of recapture was a new refinement (Cadigan and Brattey MS 2000b). The prediction was based on the application of the von Bertalanffy growth model to those tag return data in which the length at recapture was known. The von Bertalanffy model was modified to accommodate seasonal variation in growth.) The model was used to estimate weekly exploitation rates, but inferences about exploitation focused on an aggregation of data for each of the two periods of the 1999 fishery: the full period of the July opening and the first 5 weeks of the September-November opening.

It was emphasized that the migration of cod usually leads to underestimation of exploitation rates derived from tag returns. The present estimates were based only on tags returned from fish caught in the same geographic area in which they were tagged and released. Thus, they represent the fraction of the tagged population exploited by the fishery if there was no migration. If some fish move out of the area, then the size of the tagged population would be less than the number of tagged fish released (even after discounting for tag loss, natural mortality and previous fishing mortality), so the actual exploitation by the fishery would be underestimated. Nevertheless, it is thought that the results are reasonably accurate for 3K and the northern part of 3L where migration was low. Exploitation rates for the first opening were estimated to have been at least 19.4% in 3K and 2.3% in northern 3L. Exploitation rates for the second opening were estimated to have been at least 13.5% in 3K and 3.8% in northern 3L.

When combined with the catches recorded for each area and time period, these exploitation rates suggest biomasses of at most 8,900 t in 3K and 49,000 t in northern 3L during July, and 11,000 t in 3K and 42,000 t in northern 3L during September-October.

Reliable estimates of exploitation and biomass could not be produced for southern 3L because of the smaller numbers of fish tagged and extensive movements of fish between this region and 3Ps.

6 Other considerations

6.1 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 MS 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 2J3KL cod.

6.2 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 (DFO 1999; Lilly and Simpson MS 2000).

The trend in biomass of capelin has been uncertain since the late 1980s (DFO 1999). Recent acoustic studies have detected some aggregations of capelin in the inshore but few offshore compared to the 1980s and early 1990s (O'Driscoll et al. MS 2000).

There are concerns that the capelin stock may not be sufficiently large in the offshore to support a recovery of offshore cod. Other prey items exist in the offshore, but capelin was historically the most important prey in the diet of 2J3KL 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 MS 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).

Additional concerns relate to the potential for recolonization of the offshore. It is possible that the tendency for cod to move from the inshore to the offshore and from south to north may be greater if capelin biomass increases both offshore and to the north (O'Driscoll et al. MS 2000).

6.3 Predators

A wide variety of predators are known to consume cod, mainly during the cod's juvenile stages (Pálsson 1994). 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), but the predator that has attracted the most interest and concern in recent years, because of both its abundance and large size, is the harp seal.

The contribution of cod to the diet of harp seals is small, but because the total prey consumption by the harp seal population is large, the quantity of cod estimated to be consumed is also large. The most recent estimate is about 50,000 t in 1998. The data and methods used to derive this estimate, and an accounting of some of the uncertainties involved, may be found in Lilly et al. (MS 1999) and references therein.

In recent winters, particularly those of 1997-1998 and 1998-1999, there were many reports of large cod being eaten by harp seals in coastal waters, particularly in eastern Notre Dame Bay and southwestern Bonavista Bay (Lilly et al. MS 1999). This "belly-feeding", in which a bite is taken from the abdomen and the liver and stomach removed, leaving the rest of the body untouched, has not been incorporated into the estimates of consumption. There were few reported occurrences of such predation during 1999-2000 prior to the end of March, but there was a major event in southwestern Bonavista Bay in early April (after the assessment meeting had concluded).

The effect of the large harp seal population on the recovery of the northern cod stock remains uncertain. Estimates of harp seal population size available for this assessment were projections from the last pup count carried out several years ago. The current size of the population will be estimated this year and will include data from the 1999 pup census, allowing a reappraisal of the possible role of harp seals in the lack of recovery of the northern cod stock.

7 Outlook

An analytical assessment was not attempted. The inability to reconcile reported catches and the research vessel index in the late 1980s and early 1990s has not been resolved. If this were the only problem, then there would be value in proceeding with sequential population analysis, as had been done in the 1998 assessment (Lilly et al. MS 1998b), in order to conduct a tentative risk analysis. It was felt, however, that the research vessel bottom-trawl index, the only long-standing fishery-independent index available for this stock, may no longer be representative of the stock as a whole. It is thought that the index is adequately reflecting the status of the stock in the offshore, which constitutes the vast bulk of the stock area, but is not reflecting the status of cod found on traditional inshore fishing grounds (depths less than 50-60 m) from White Bay to St. Mary’s Bay.

It is nevertheless clear that the size of the northern cod stock as a whole remains low relative to levels in the 1980s. There is no recovery of spawner biomass in the offshore and there is no evidence that the inshore spawner biomass increased from 1998 to 1999.

Rebuilding in the offshore can come about through resurgence from remnants that continue to exist on the shelf and offshore banks, or through a movement of fish to the offshore of 2J3KL from elsewhere such as the inshore. An increase in the inshore component may be possible through good recruitment, growth and low levels of fishing mortality. However, the capacity for the inshore to sustain a larger biomass of fish than that which currently exists is unknown.

Year-class strength appears to have declined from 1994 to 1996 and to have increased since, although there is considerable uncertainty associated with estimates for recent year classes. It is therefore likely that the spawning biomass in both the inshore and offshore will decline in the next few years even in the absence of a fishery. If the apparently larger 1998 and 1999 year-classes survive then spawner biomass may begin to increase when they mature.

It is certain that the inshore fishery will not return to its former prominence until such time as a substantial biomass of cod builds up in the offshore and these fish undertake a summer feeding migration to the inshore. Management options for the inshore should therefore be evaluated in terms of the risk both of detrimental effects on the inshore component and of hindering the recovery of the offshore component.

Management options for 2000 might include a TAC increase, a status quo TAC, a limited index fishery for scientific purposes or a moratorium on all cod-directed fishing. With a precautionary approach in mind, the risks that were evaluated included: causing a decline in the spawner biomass of the inshore component, hindering recovery of the spawner biomass in the offshore, exceeding acceptable exploitation rates, and eliminating small sub-components.

There is some risk that spawner biomass in the inshore will decrease even with no fishing because year-classes subsequent to the 1992 year-class appear weak. The 1994 year-class, which was relatively strong in the 0-group surveys, has not been prominent in either sentinel or commercial catches.

The risk to the recovery of the offshore with respect to any fishery in the inshore cannot be determined and will depend in part on whether recovery in the offshore is through resurgence of offshore fish or through inshore fish moving offshore. The latter is more likely to occur if the spawner biomass in the inshore is allowed to increase. Any inshore fishery, although based primarily on the inshore component, may also remove any offshore fish that might continue the historic summer feeding migration to the inshore.

The 9,000 t TAC led to exploitation rates well above a 20% reference level in 3K in 1999 and this is unacceptable under a precautionary approach. If the inshore cod presently inhabit only a limited fraction of their potential range then under a precautionary approach exploitation rates should be low enough to allow it to expand.

Lower exploitation rates occurred in northern 3L in 1999, consistent with other information on the distribution and abundance of fish.

Reliable estimates of exploitation rate could not be produced for southern 3L in 1999 because of the strong seasonal contribution of fish from 3Ps. If this migration is less in any year, then even a small fishery could pose unacceptable risks to resident inshore southern 3L fish and to any portion of the offshore remnant that might continue to migrate inshore in the summer.

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Table 1. Landings (t) of cod from NAFO Divisions 2J3KL for the period 1959-1999.

	2J				3K				3L				2J3KL			
	Offshore mobile gear		Fixed gear		Offshore moblie 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	1501 [10]	0
1997 [1]	0	0	3	3	0	0	159	159	4		339	343	505	0	505	0
1998 [1]	0	0	16	16	0	0	1993	1993	1		2490	2491	4501	0	4501	4000
1999 [1]	0	0	36	36	0	0	3644	3644			4792	4792	8472	0	8472	9000

[1] Provisional catches.

[2] Includes French catch and other foreign catch as estimated by Canadian surveillance.

[3] Figure is 4000 t less than Canadian statistics as this quantity is considered 3NO catch misreported as 3L

[4] Derived from reported catch and Canadian surveillance estimate of foreign catch.

[5] Includes 5000 t catch from the recreational fishery after the moritorium was declared.

[6] Canadian surveillance estimate of foreign catch .

[7] Includes 5053 t for the recreational fishery additional to that recorded by Canadian statistics.

[8] 1300 t is from the food fishery; the remainder is bycatch

[9] Includes 163 t caught in the sentinel survey and 168 t caught as bycatch.

[10] Comprised of a sentinel survey catch of 397 t, a food fishery catch of 962 t and bycatch of 142 t. However, 103 t of sentinel catch remains to be allocated by division and gear.

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	24	1081	245	644	1994	31	1377	284	798	2490	4501
1999 [1]	0	21	3	12	36	4	3030	106	503	3644	4	4310	60	419	4792	8472

[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) from all sources (commercial fishery including bycatch, sentinel survey and food/recreational fishery), by gear, unit area and month.

MONTH	1	4	5	6	7	8	9	10	11	12	total
Gillnet											
2JA					10.2						10.2
2JM					6.3	0.5	3.8	0.4			11.0
3KA			0.1	0.1	6.7	1.2	7.6	2.2			17.9
3KD				0.6	82.0	4.8	51.9	16.0	5.9		161.1
3KG									1.4		1.4
3KH			0.1	3.5	654.9	3.6	177.1	89.9	54.7	0.0	983.8
3KI	0.2		1.6	14.5	928.9	12.3	706.9	143.0	58.0	0.5	1866.0
3LA			2.7	0.3	433.8	17.9	674.5	109.0	10.3		1248.4
3LB	0.5	2.4	0.5	1.9	692.2	10.0	491.9	340.4	30.7		1570.5
3LC						0.5	4.3	0.1			4.9
3LD							0.0	0.0	0.2		0.2
3LF				3.6	480.6	6.4	106.8	57.0	6.2		660.6
3LG							0.3	0.2			0.5
3LJ				12.1	166.0	8.1	288.9	80.6	6.5		562.2
3LQ			0.2	1.2	77.0	8.2	83.3	63.6	13.6	15.3	262.4
Total	0.7	2.4	5.2	37.7	3538.7	73.4	2597.2	902.5	187.4	15.8	7361.1
Linetrawl											
2JM					0.1		1.4	1.5			3.0
3KA							1.4	1.1			2.5
3KD							5.1	5.5	0.9		11.5
3KE											0.0
3KH						0.7	6.5	11.7	2.6		21.5
3KI					3.2	1.0	48.8	13.5	4.3		70.8
3LA					0.4	0.9	17.7	8.6	1.2		28.9
3LB							4.7	1.5	0.2		6.4
3LF							2.9	6.6	2.8		12.2
3LJ						0.1	0.2	3.6	1.7		5.6
3LQ							4.9	1.5			6.4
Total					3.7	2.7	93.7	55.1	13.7		168.9
Handline											
2JA						0.1	0.1				0.2
2JM					2.3	0.2	7.6	1.5			11.6
3KA						0.3	2.0	1.1			3.4
3KD						3.6	22.2	4.8	1.4		32.0
3KH					0.2	29.7	41.3	28.1	2.1		101.4
3KI					37.7	43.9	200.4	77.1	7.1		366.2
3LA					5.2	10.4	118.6	25.4	4.4		164.0
3LB					1.5	5.5	72.3	13.0	5.7		98.0
3LF						3.3	10.3	16.6	1.8		32.0
3LJ					2.8	10.8	51.7	36.6	9.3		111.1
3LQ					0.0	4.4	7.9	1.6			13.9
Total					49.7	112.2	534.3	205.8	31.8		933.8
Trap											
3KD							1.0				1.0
3KH						0.7					0.7
3KI				0.6	1.3	0.7					2.6
3LA					2.3						2.3
3LB					0.9						0.9
3LJ					0.1						0.1
3LQ					0.7						0.7
Total				0.6	5.3	1.4	1.0				8.2
Total	0.7	2.4	5.2	38.3	3597.4	189.6	3226.3	1163.4	232.9	15.8	8472.0

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

MONTH	1	4	5	6	7	8	9	10	11	12	total
Sentinel survey 5.5 inch gillnet											
2JM			2			146	307				455
3KA				29	2	620	163	4			818
3KD				77	825	1981	595	68	15		3561
3KH				1496	1262	1344	462	235	264		5063
3KI			436	4096	2028	5127	2354	399	1533		15973
3LA					4843	5450	1318		1237		12848
3LB				581	2133	3401	2738	437	140		9430
3LF				1364	4716	1866	666				8612
3LJ				5674	6933	3176	760	175	36		16754
3LQ				544	5135	3142	1286	56			10163
Total			438	13861	27877	26253	10649	1374	3225		83677
Sentinel survey 3.25 inch gillnet											
2JM					29	286	529				844
3KD				5	19	275	232	126	20		677
3KH					34	74	60	66	178		412
3KI				37	71	251	317	63	907		1646
3LA					174	472	64				710
3LB				61	182	237	374	97			951
3LF				11	213	143	25				392
3LJ				106	210	114	55				485
3LQ					194	32	25				251
Total				220	1126	1884	1681	352	1105		6368
Commercial gillnet											
3KG							375	49			424
3KH					688		910	29			1627
3KI					2453		3755				6208
3LA					395	129	2619				3143
3LB					1826		2671				4497
3LF					3698		921				4619
3LJ					777		1971				2748
3LQ								354			354
Total					9837	129	13222	432			23620
Gillnet (total)											
2JM			2		29	432	836				1299
3KA				29	2	620	163	4			818
3KD				82	844	2256	827	194	35		4238
3KG							375	49			424
3KH				1496	1984	1418	1432	330	442		7102
3KI			436	4133	4552	5378	6426	462	2440		23827
3LA					5412	6051	4001		1237		16701
3LB				642	4141	3638	5783	534	140		14878
3LF				1375	8627	2009	1612				13623
3LJ				5780	7920	3290	2786	175	36		19987
3LQ				544	5329	3174	1311	410			10768
Total			438	14081	38840	28266	25552	2158	4330		113665

(cont'd)

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

MONTH	1	4	5	6	7	8	9	10	11	12	total
Gillnet (total)			438	14081	38840	28266	25552	2158	4330		113665
Sentinel survey linetrawl											
3KD							4	8			12
3KH						319	639	309			1267
3KI						527	620	545	124		1816
3LA						515	436	117	389		1457
3LJ						48	103	10			161
3LQ							454				454
Total						1409	2256	989	513		5167
Sentinel survey handline											
2JM					6	23					29
3KH								128			128
3LF							259				259
3LJ					833	2011	1096				3940
Total					839	2034	1355	128			4356
Trap											
3KD							985				985
3KH						485					485
3KI				317	1251	692					2260
3LA					1481						1481
3LB					660						660
3LJ					101						101
3LQ					296						296
Total				317	3789	1177	985				6268
Commercial linetrawl											
3KD							87				87
3KH							258				258
3KI							823				823
3LA							147				147
3LB											
3LJ											0
3LQ											0
Total						0	1315	0	0		1315
Commercial handline											
2JM								7			7
3KD							334	426			
3KI					66		1078	29			
3KH							1205				1205
3LA							620				
3LB							2880				
3LF							703				703
3LJ					217		1315	345			1877
Total					283	0	8135	807			9225
Total (all gears)			438	14398	43751	32886	39598	4082	4843	0	139996

Table 5. Number of fish aged from sampling of the sentinel surveys and the commercial fishery, by gear, unit area and quarter. Quarter 3 is June – August and Quarter 4 is September – December.

Unit Area	Quarter 3	Quarter 4	Total
Gillnet			
2JM	97	188	285
3KA	30	55	85
3KD	258	241	499
3KH	403	431	834
3KI	665	730	1395
3LA	408	416	824
3LB	461	271	732
3LF	761	237	998
3LJ	352	228	580
3LQ	98	107	205
Total	3533	2904	6437
Linetrawl			
3KD		84	84
3KH	16	114	130
3KI		235	235
3LA		47	47
3LB		38	38
3LF		88	88
Total	16	606	622
Handline			
2JM	15	32	47
3KD		107	107
3KH		140	140
3KI	28	247	275
3LA		191	191
3LB		533	533
3LF		171	171
3LJ	22	230	252
Total	65	1651	1716
Trap			
3KA		19	19
3KD	39	16	55
3KH			
3KI	71		71
3LA	79		79
3LB	40		40
Total	229	35	264
Total	3843	5196	9039

Table 6. Estimated average weight (kg), length (cm) and number (plus standard error and coefficient of variation) of the 1999 catch at age, for all gears combined and for individual gears.

AGE	WEIGHT (kg.)	LENGTH (cm.)	NUMBER (000'S)	STD ERR.	CV
All gears combined					
1			0.0		
2	0.32	33.65	7.1	0.72	0.10
3	0.59	40.63	69.8	2.55	0.04
4	1.05	49.00	237.7	5.91	0.02
5	1.62	56.49	638.3	13.67	0.02
6	2.12	61.74	795.4	18.29	0.02
7	2.51	65.21	1157.1	20.06	0.02
8	2.96	68.56	370.2	12.80	0.03
9	3.66	73.25	253.0	9.70	0.04
10	4.70	79.30	52.3	3.62	0.07
11	5.17	81.38	12.6	1.62	0.13
12	5.57	83.37	2.6	0.54	0.21
13	6.23	87.37	0.3	0.14	0.54
14	7.66	93.61	0.1	0.07	
Gillnet					
1			0.0		
2	0.32	33.68	4.5		
3	0.52	39.14	34.7	1.65	0.05
4	1.14	50.03	65.5	3.86	0.06
5	1.75	58.13	415.9	12.86	0.03
6	2.15	62.10	699.4	18.10	0.03
7	2.51	65.22	1077.2	19.96	0.02
8	2.94	68.47	339.9	12.76	0.04
9	3.63	73.03	228.9	9.66	0.04
10	4.68	79.16	46.6	3.60	0.08
11	5.12	81.09	11.7	1.61	0.14
12	5.56	83.34	2.4	0.54	0.23
13	6.32	87.78	0.2	0.14	0.75
14	7.71	93.82			
Linetrawl					
1			0.0		
2	0.31	33.06	2.1	0.31	0.15
3	0.56	39.88	10.8	0.55	0.05
4	0.96	47.72	23.7	0.74	0.03
5	1.36	53.41	28.8	0.71	0.02
6	1.94	59.81	12.8	0.43	0.03
7	2.72	66.75	12.0	0.38	0.03
8	3.30	71.00	5.5	0.27	0.05
9	4.08	76.02	4.0	0.22	0.06
10	4.76	80.24	0.9	0.11	0.12
11	6.13	86.83	0.1		
12	3.86	73.90	0.1	0.03	
13	4.85	81.17	0.0	0.01	
14	6.22	88.00	0.0		

(cont'd)

Table 6 (cont'd). Estimated average weight (kg), length (cm) and number (plus standard error and coefficient of variation) of the 1999 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	0.39	35.84	0.5	0.12	0.24
3	0.70	43.15	23.7	1.85	0.08
4	1.03	48.81	146.2	4.41	0.03
5	1.36	53.44	192.2	4.57	0.02
6	1.87	59.05	82.4	2.53	0.03
7	2.48	64.69	67.2	1.95	0.03
8	3.09	69.38	24.6	1.06	0.04
9	3.99	75.26	19.9	0.88	0.04
10	4.86	80.46	4.8	0.34	0.07
11	5.82	84.59	0.8	0.14	0.17
12	6.26	87.43	0.1	0.04	
13	6.21	87.24	0.1	0.04	
14	6.22	88.00	0.0	0.00	
Trap					
1			0.0		
2			0.0		
3	0.57	40.19	0.6	0.08	0.15
4	0.81	45.09	2.3	0.14	0.06
5	1.19	51.10	1.5	0.13	0.09
6	1.75	57.92	0.8	0.07	0.10
7	2.26	62.44	0.7	0.06	0.10
8	2.72	66.74	0.2	0.03	0.15
9	3.39	71.69	0.2	0.03	0.14
10	4.36	78.19	0.0	0.01	0.33
11			0.0		
12			0.0		
13			0.0		
14			0.0		

Table 7. Catch numbers (thousands) at age for cod in 2J3KL in 1962-1999.

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
2	25	8	58	35	0	0	0	0	1	0	3	7
3	2779	1696	7693	3111	430	940	105	7	40	8	96	70
4	14651	17639	40557	31654	3860	4993	379	30	237	23	229	238
5	20184	21150	36410	53805	14535	3343	575	71	297	54	395	638
6	47917	25212	22695	29553	12211	1940	177	55	341	56	689	795
7	45725	38708	16390	9064	4526	700	74	20	129	84	384	1157
8	18608	28499	17940	6164	1372	147	22	11	23	21	237	370
9	9026	8696	9156	4745	376	21	2	3	5	3	74	253
10	4337	3640	2865	1696	199	0	0	0	3	2	10	52
11	774	1695	1084	641	104	0	0	0	0	0	5	13
12	422	572	478	250	18	0	0	0	0	0	2	3
13	366	244	103	88	9	0	0	0	0	0	1	0
14	223	180	98	39	4	0	0	0	0	0	0	0
15	100	94	36	21	0	0	0	0	0	0	0	0
16	32	43	25	9	0	0	0	0	0	0	0	0
17	5	4	8	3	0	0	0	0	0	0	0	0
18	10	9	7	2	0	0	0	0	0	0	0	0
19	5	0	1	2	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

Table 8. Catch weights-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	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
2	0.29	0.26	0.29	0.17				0.21	0.40	0.32	0.29	0.32
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
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
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
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
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
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
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
10	3.04	3.02	3.06	3.14	2.24			2.93	3.19	4.30	4.18	4.70
11	4.37	3.96	3.58	3.80	2.68			4.51	5.44	4.23	4.01	5.17
12	5.49	5.41	4.68	4.96	4.95			2.01	4.35	6.33	3.87	5.57
13	6.55	7.50	6.23	5.49	5.34				7.63	6.22	6.42	6.23
14	8.60	9.24	8.51	7.61	7.02				4.46			7.66
15	9.76	10.05	9.78	11.58								
16	9.73	9.34	12.58	11.01								
17	12.58	15.74	15.45	12.82								
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
2	7	2	17	6	0	0	0	0	0	0	1	2
3	1362	814	3231	1120	125	536	42	3	29	4	60	41
4	10695	13053	27984	19309	2239	3545	258	24	234	19	214	249
5	21799	21785	38595	52191	11773	3243	564	107	385	81	596	1032
6	66125	36305	34043	41670	14531	2425	250	107	647	112	1477	1687
7	76361	70836	31797	17040	7830	1113	137	45	306	205	952	2908
8	41124	58993	39827	13992	2813	1235	45	27	63	61	714	1094
9	22655	22957	22341	12479	1000	194	6	8	18	11	248	927
10	13184	10993	8767	5325	446	0	0	0	11	8	40	246
11	3382	6712	3881	2436	279	0	0	0	1	2	22	65
12	2317	3095	2237	1240	89	0	0	0	0	1	7	15
13	2397	1830	642	483	48	0	0	0	0	0	6	2
14	1918	1663	834	297	28	0	0	0	0	0	0	1
15	976	945	352	243	0	0	0	0	0	0	0	0
16	311	402	315	99	0	0	0	0	0	0	0	0
17	63	63	124	38	0	0	0	0	0	0	0	0
18	160	168	95	26	0	0	0	0	0	0	0	0
19	83	0	17	26	0	0	0	0	0	0	0	0
20	55	18	0	0	0	0	0	0	0	0	0	0
total	264975	250632	215096	168021	41200	12290	1301	321	1694	504	4338	8269

Table 10. 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** T	0	0	325
	236	122	0	0	0	34	0	0	**nf** T	0	0	0
751-1000		517	0	0	0	34	0	0	0 T	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 11. Estimates of cod biomass (t) 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	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 12a. Estimates of cod abundance (thousands) from surveys in Division 2J in 1993-1999, in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-1999.

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
Mean survey date			07-Nov-93	17-Nov-94	28-Dec-95	30-Oct-96	27-Oct-97	27-Oct-98	13-Nov-99
101-200	201	633	0	0	nf	0	0	44	44
	205	1594	63	219	nf	110	110	32	37
	206	1870	547	0	0	184	257	294	110
	207	2246	2128	2699	350	588	138	751	666
	237	733	151	0	273	134	0	34	0
	238	778	nf	0	nf	107	36	0	0
201-300	202	621	0	0	49	0	0	0	0
	209	680	374	514	327	249	62	243	374
	210	1035	5731	854	1424	320	214	178	854
	213	1583	871	0	2504	835	1085	871	290
	214	1341	1771	338	323	959	406	418	221
	215	1302	1719	358	90	2373	1381	498	788
	228	2196	436	0	949	2068	1347	2001	868
	234	530	0	0	nf	73	142	36	32
301-400	203	487	0	301	0	335	234	67	100
	208	588	0	162	768	566	0	40	40
	211	251	414	322	708	483	0	192	383
	216	360	0	173	927	715	99	74	275
	222	450	279	846	495	543	1021	272	371
	229	536	590	295	627	946	205	74	442
401-500	204	288	0	0	16	20	0	0	14
	217	241	66	55	561	63	0	166	33
	223	158	0	0	880	91	54	19	0
	227	598	795	0	370	1207	41	247	0
	235	414	1044	1006	541	101	85	85	0
	240	133	9	0	123	9	18	0	128
total strata fished <= 500 meters			16989	8145	12305	13081	6936	6636	6074
1STD strata fished <= 500 meters			4595	2584	1822	1968	1000	919	958
501-750	212	557	77	128	69	136	77	0	0
	218	362	0	50	1660	75	0	0	0
	224	228	0	0	596	0	0	0	42
	230	185	0	34	13	0	0	0	13
	239	120	17	17	0	8	7	0	0
751-1000	219	283	0	0	0	0	0	0	0
	231	186	0	0	0	0	0	0	0
	236	193	0	0	12	0	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
total all strata fished			17082	8373	14654	13300	7020	6636	6129
1 STD all strata fished			4596	2588	2057	1973	1003	919	959

Table 12b. Estimates of cod biomass (t) from surveys in Division 2J in 1993-1999, in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-1999.

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

Table 13. 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 14. 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 15a. Estimates of cod abundance (thousands) from surveys in Division 3K in 1993-1999, in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-1999.

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

Table 15b. Estimates of cod biomass (t) from surveys in Division 2J in 1993-1999, in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-1999.

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

Table 16. Estimates of cod abundance (thousands) from surveys in Division 3L in 1988-1999 in depths <= 200 fathoms. The 1988-1994 data are in Campelen equivalent units and the 1995-1999 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
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
31-50	350	2071	13276	10854	5911	5359	1140	1804	122	1045	285	570	773	1587
	363	1780	23286	43993	52247	3702	13036	408	367	365	82	1306	481	367
	371	1121	4472	193	7556	411	1079	103	0	31	0	0	0	39
	372	2460	16269	32627	141824	3774	2919	299	0	353	414	42	1114	1269
	384	1120	1489	986	41791	1061	146	154	0	0	0	0	0	385
51-100	328	1519	8806	1224	2090	279	1114	488	139	0	334	376	334	1226
	341	1574	1245	298	1985	505	217	1516	0	36	289	54	223	1256
	342	585	429	80	2052	161	54	0	80	40	121	40	80	724
	343	525	650	24	1372	481	722	72	96	36	0	68	0	361
	348	2120	3995	6189	6389	1896	3208	**nf**	219	250	393	167	194	767
	349	2114	7302	1745	4736	3722	58	1939	208	122	166	344	162	955
	364	2817	10048	1656	13595	291	388	1421	323	43	116	525	0	775
	365	1041	1690	573	895	1575	286	95	95	215	207	191	0	0
	370	1320	623	121	1888	121	484	666	0	73	0	91	0	0
	385	2356	25	29	1713	389	648	0	0	0	36	0	41	41
	390	1481	3107	2183	1290	0	136	0	0	34	0	0	0	204
101-150	344	1494	4874	4580	9454	3186	5446	2363	771	530	2950	914	715	1548
	347	983	10628	4571	30560	609	676	439	34	199	391	541	406	316
	366	1394	66130	17888	9812	19359	44544	2972	115	230	236	652	443	345
	369	961	12241	1005	2809	12559	1884	227	0	78	0	220	39	1332
	386	983	4895	6464	7099	135	766	135	0	0	45	0	0	45
	389	821	13270	10023	2936	10842	0	0	0	38	0	38	0	151
	391	282	427	1028	1629	233	129	116	0	0	0	19	0	97
151-200	345	1432	11285	5881	11977	4432	985	1510	542	2780	433	302	653	2863
	346	865	27058	9073	14517	37387	33292	1417	136	754	379	1269	297	881
	368	334	5008	1861	11555	27437	30338	15627	88	299	128	459	368	980
	387	718	1753	1350	3325	2963	2864	2601	779	66	44	1514	132	527
	388	361	1813	5761	1962	1556	579	414	177	99	0	135	0	5313
	392	145	289	40	598	259	20	27	0	19	18	20	0	928
total strata fished <= 200 fathoms			256383	172299	395569	144684	147159	36813	4292	7732	7066	9859	6454	25281
ADJUSTED			256383	172300	395567	144684	147158	36813	4291	7735	7067	9859	6454	25281
upper			312134	235628	525307	181155	215462	65605	6233	12328	12052	15027	8524	95232
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
1 STD strata fished <= 200 fathon			26946	30742	58945	17534	33948	12486	951	1993	1939	1862	1010	5504

[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 17. Estimates of cod biomass (t) from surveys in Division 3L in 1988-1999 in depths <= 200 fathoms. The 1988-1994 data are in Campelen equivalent units and the 1995-1999 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
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
31-50	350	2071	16885	10769	6602	6434	1877	1522	179	1276	362	1355	997	1342
	363	1780	30177	33959	35121	4266	7504	344	211	506	224	2895	152	80
	371	1121	7746	457	9110	481	893	91	0	10	0	0	0	26
	372	2460	19194	29816	177108	3164	1896	287	0	54	557	29	431	608
	384	1120	1681	223	61815	674	127	67	0	0	0	0	0	212
51-100	328	1519	3397	1101	415	185	1748	166	248	0	537	1014	144	195
	341	1574	1273	198	1237	920	253	289	0	2	248	16	290	1043
	342	585	583	114	1029	383	123	0	36	22	184	66	5	164
	343	525	661	90	653	132	459	79	34	18	0	45	0	69
	348	2120	3906	4158	2995	1666	1504	**nf**	322	181	326	144	191	144
	349	2114	8207	2690	3630	5454	66	1755	54	88	117	327	357	531
	364	2817	7216	1681	6851	915	526	873	302	1	95	353	0	331
	365	1041	1961	797	509	2814	347	54	114	129	147	72	0	0
	370	1320	1128	224	1159	189	673	171	0	72	0	41	0	0
	385	2356	303	110	1620	300	735	0	0	0	11	0	57	13
	390	1481	516	294	283	0	81	0	0	13	0	0	0	81
101-150	344	1494	2746	2435	5079	809	3003	988	382	233	2214	221	409	802
	347	983	9386	5239	18473	369	181	351	20	99	324	259	407	81
	366	1394	76378	18189	8194	15225	40824	2426	116	121	87	264	223	58
	369	961	12361	3266	3223	13072	937	180	0	174	0	170	4	1048
	386	983	6410	7472	10209	124	366	194	0	0	20	0	0	26
	389	821	2951	5134	3838	3388	0	0	0	12	0	35	0	58
	391	282	76	158	577	74	18	53	0	0	0	21	0	178
151-200	345	1432	14557	7883	7575	1775	736	957	245	1441	370	76	512	1301
	346	865	33516	14619	13512	27945	29383	702	91	459	243	466	287	414
	368	334	7539	4904	13883	26629	29646	10776	80	129	48	181	240	954
	387	718	2623	1146	9129	3515	2018	1984	321	25	19	851	99	284
	388	361	1067	3506	1564	740	390	268	119	35	0	78	0	3080
	392	145	110	55	276	117	9	19	0	15	7	10	0	489
total strata fished <= 200 fathoms			274553	160688	405668	121761	126323	24594	2873	5114	6140	8991	4804	13611
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
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
1 STD strata fished <= 200 fathoms			30073	21690	81110	15570	33260	8723	502	1187	1587	2212	1028	3336

[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 18. Estimates of cod abundance (thousands) and biomass (t) from surveys in Division 3L in 1990-1999 in depths <= 200 fathoms. The 1990-1994 data are in Campelen equivalent units and the 1995-1999 data are in actual Campelen units.

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

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 19. Estimates of cod abundance (thousands) and biomass (t) from surveys in inshore strata of divisions 3K and 3L in 1996-1998. 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 196-199 TELEOST 40-42 1996	WT 217 TELEOST 55-57 1997	WT 233 1998
Mean survey date			14-Nov-96	18-Nov-97	02-Dec-98	14-Nov-96	18-Nov-97	02-Dec-98
			abundance			biomass		
101-200	608	798	915	1061	1647	201	142	113
	612	445	510	92	367	111	3	18
	616	250	103	52	206	4	0	5
201-300	609	342	436	329	155	108	64	30
	611 [3]	600	122	578	169	25	129	9
	615	251	0	17	104	0	0	61
301-400	610	256	31	405	493	3	117	50
	614	263	16	0	18	2	0	33
401-500	613	30	0	0	12	0	0	1
total inshore strata			2133	2534	3171	454	455	320
total offshore			18622	8450	15896	5588	4020	7521
total all strata fished			20756	10984	19067	6039	4475	7843
STD all strata fished			2209	1380	2040	491	525	1030

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	Teleost 41 WT 196-198 1996	WT 213-217 TELEOST 57-58 1997	WT 233 1998
Mean survey date			02-Nov-96	27-Nov-97	28-Nov-98	02-Nov-96	27-Nov-97	28-Nov-98
			abundance			biomass		
16-30	784	268	1161	977	203	80	40	3
31-50	785	465	3998	1279	352	6627	1786	109
51-100	786	84	12	97	532	2	36	54
	787	613	42	84	4005	135	61	105
	788 [1]	252	2409	323	144	177	232	92
	790	89	55	444	61	56	222	24
	793	72	599	119	64	155	56	24
	794	216	609	97	104	84	122	31
	797	98	20	27	101	11	13	24
	799	72	857	30	39	410	19	9
101-150	795	164	11	64	163	5	50	58
	791 [2]	227		200	94		154	53
101-200	789 [1]	81	0	0	0	0	0	0
	791 [2]	308	191			114		
	798	100	14	0	34	47	0	11
151-200	796	175	0	23	12	0	8	2
	800 [2]	81		6	49		2	60
201-300	792	50	0	0	3	0	0	3
total inshore strata			9978	3770	5960	7903	2801	662
total offshore			7066	11004	6628	6140	10200	5039
total all strata fished			17044	14774	12588	14044	13000	5701
STD all strata fished			3932	2113	5126	6198	2778	-195

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 20. Summary of estimates of cod abundance (thousands) and biomass (t) for all strata fished in 1983-1999. Data from 1983-1994 are in Campelen equivalent units and data from 1995-1999 are in actual Campelen units.

DIVISION	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total abundance all strata fished																	
2J	1,124,317	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
3K	447748	451517	208952	891302	284648	457191	1307523	972029	649529	61886	37265	9612	23954	20756	10984	19067	29433
3L	428505	995804	464291	358606	325352	256383	172299	396008	145682	148719	47809	4678	8013	17044	14774	12588	25514
2J3KL	2,000,570	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
Total biomass all strata fished																	
2J	722,491	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
3K	374,634	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
3L	278,412	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
2J3KL	1,375,537	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
Percent abundance																	
2J	56	34	48	50	40	42	30	16	31	13	17	37	31	26	21	17	10
3K	22	21	16	36	28	37	61	60	56	26	36	42	51	41	34	50	48
3L	21	45	36	14	32	21	8	24	13	61	47	21	17	33	45	33	42
Percent biomass																	
2J	53	40	45	49	46	55	30	11	18	7	10	27	23	18	17	25	9
3K	27	26	20	37	28	20	59	54	69	20	29	42	37	25	21	44	43
3L	20	34	35	15	26	25	11	34	13	72	61	30	40	58	62	32	48

Table 21. Summary of estimates of cod abundance (thousands) and biomass (t) for divisions 2J, 3K and 3L separately and combined in 1995-1999. Strata are aggregated into index strata, those strata deeper than the index strata and seaward of them, and those strata inshore of the index strata. There are no inshore strata in Division 2J.

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

Table 22a. 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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

3K

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
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
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	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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

(cont'd)

Table 22a (cont'd). 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.

3L

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

2J3KL

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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	4.84

Table 22b. Autumn bottom-trawl mean catch (number) per tow at age in inshore strata in 3KL in 1996-1998. 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. Each 3KL catch at age index is the mean of the divisional means, weighted by the divisional survey areas.

Age	1996	1997	1998
1	6.01	2.02	0.36
2	3.64	1.80	3.08
3	1.62	1.11	1.29
4	1.21	0.78	0.43
5	0.78	0.46	0.25
6	1.02	0.06	0.08
7	0.54	0.11	0.07
8	0.26	0.05	0.02
9	0.24	0.05	0.03
10	0.05	0.00	0.00
Unknown	0.03	0.83	0.00
Total	15.37	6.44	5.59

Table 23. Mean length (cm) at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-1999. Highlighted entries are based on fewer than 5 aged fish. 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
1																		19.9	19.8		22.9	21.5
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
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
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
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
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
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
1																		18.6	19.2	21.6	19.2	20.5
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
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
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
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
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
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
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
1															16.8	17.7	19.7	18.4	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
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
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
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
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
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
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
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
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 24. Mean weight (kg) at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-1999. 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
1																		19.9	19.8		22.9	21.5
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
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
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
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
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**
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
1																		18.6	19.2	21.6	19.2	20.5
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
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
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
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
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**
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**
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
1															16.8	17.7	19.7	18.4	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
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
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
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
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
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**
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**
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**
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 25. Mean Fulton's condition (gutted weight) at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-1997. 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
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
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
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
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
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**
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
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
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
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
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
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**
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**
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
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
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
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
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
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
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**
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**
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**
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 26. Mean liver index at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-1999. 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.

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
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
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
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
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
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**
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
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
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
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
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
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**
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**
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
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
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
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
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
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
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**
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**
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**
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 27. Observed proportion mature at age of female cod in divisions 2J3KL (1982-1999). 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.

AGE	1982	1983	1984	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	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
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
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
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
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
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	.
9	1	1	1	1	0.98	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
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
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
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
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
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
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
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
n	1028	1354	1202	1260	1037	1146	1386	1422	1361	1045	697	489	139	389	501	339	351	496

Table 28. Observed proportion mature at age of male cod in divisions 2J3KL (1982-1999). 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.

AGE	1982	1983	1984	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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	0.02	0	0.05	0	0.06	0	0.06	0.11	0.16	0	0.06
4	0.14	0.24	0.15	0.05	0.21	0.05	0.08	0.25	0.25	0.48	0.48	0.40	0.70	0.37	0.50	0.71	0.70	0.31
5	0.58	0.56	0.72	0.59	0.47	0.61	0.66	0.66	0.57	0.88	0.83	0.94	0.95	0.73	0.76	0.82	0.95	0.74
6	0.96	0.85	0.95	0.86	0.86	0.86	0.95	0.95	0.72	0.93	1	1	0.96	1	1.00	1	1	1
7	0.99	1	1	0.97	0.93	0.97	0.98	0.99	0.98	0.98	1	1	1	1	1	1	1	1
8	0.99	1	1	1	0.99	1	0.99	1	1	1	1	1	1	1	1	1	1	1
9	1	0.99	1	1	1	1	1	1	1	1	1	1	1	.	.	1	1	1
10	1	1	0.98	1	1	1	1	1	1	1	1	.	.	1	.	.	.	1
11	1	1	1	0.97	1	1	1	0.99	1	1	1	.	.	.	.	.	.	1
12	1	1	1	1	1	1	1	1	1	1	1	.	.	.	.	.	.	.
13	1	1	1	1	1	1	1	1	1	1	1	.	.	.	.	.	.	1
A50	4.83	4.86	4.72	5.02	5.04	5.03	4.85	4.64	4.91	4.13	4.12	4.11	3.73	4.34	4.10	3.70	3.84	4.38
L 95%	4.70	4.75	4.61	4.91	4.89	4.90	4.74	4.52	4.79	4.00	4.01	3.99	3.38	4.18	3.97	3.56	3.72	4.23
U 95%	4.97	4.98	4.84	5.12	5.19	5.15	4.96	4.75	5.04	4.25	4.24	4.22	3.94	4.52	4.26	3.84	3.94	4.56
Slope	2.29	1.80	2.26	1.96	1.66	2.15	2.60	1.96	1.50	1.94	2.45	2.84	2.44	2.04	1.86	1.98	3.70	2.09
SE	0.19	0.12	0.16	0.13	0.12	0.16	0.20	0.13	0.10	0.14	0.24	0.31	0.53	0.22	0.17	0.23	0.52	0.21
Int	-11.05	-8.74	-10.69	-9.86	-8.37	-10.82	-12.62	-9.10	-7.40	-8.01	-10.11	-11.68	-9.10	-8.86	-7.63	-7.35	-14.21	-9.14
SE	0.90	0.56	0.76	0.66	0.64	0.80	0.94	0.60	0.47	0.63	1.02	1.28	2.15	0.89	0.66	0.88	2.07	0.82
n	923	1359	1119	1187	954	1095	1205	1235	1165	843	599	375	141	410	512	351	334	511

Table 29. Estimates of cod abundance (thousands) 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.

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
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
31-50	350	2071	90559	24682	8018	748	414	32	0	0	412	122	47	1268
	363	1780	46453	21738	3918	1504	789	306	0	0	111	0	0	281
	371	1121	3115	4086	3315	32260	123	93	0	0	0	0	0	0
	372	2460	37778	17675	2852	541	34	62	0	0	217	0	42	602
	384	1120	1078	1566	193	270	0	31	0	0	102	0	0	0
51-100	328	1519	522	0	3194	1846	0	453	0	0	90	35	125	376
	341	1574	20425	7984	2436	469	0	0	736	0	340	1728	172	577
	342	585	402	5445	523	0	1314	322	188	0	0	121	80	121
	343	525	2744	8065	891	2239	1565	614	361	361	36	0	217	108
	348	2120	19062	12022	6575	73	227	109	365	510	151	65	328	231
	349	2114	14649	25115	10986	1066	711	905	0	0	424	145	73	646
	364	2817	13718	24050	4456	1902	0	97	0	0	234	49	106	201
	365	1041	15931	8306	2076	322	36	0	0	0	58	0	0	95
	370	1320	8861	18226	1219	34833	0	91	0	0	61	0	0	0
	385	2356	5736	25360	7808	17055	97	383	0	0	30	0	0	46
	390	1481	0	891	41	122	34	102	0	0	59	0	0	150
101-150	344	1494	4110	31503	4864	986	1165	514	0	822	565	300	355	509
	347	983	11981	6694	913	1690	34	304	0	0	0	34	203	336
	366	1394	8885	33414	15053	12651	415	384	0	0	245	447	141	133
	369	961	28158	13021	6134	3701	198	0	0	0	30	33	66	39
	386	983	26504	37547	32048	32544	68	54	0	0	0	30	34	265
	389	821	11181	13214	5788	9524	75	0	0	56	0	33	33	113
	391	282	1494	2819	45154	6750	0	0	0	0	0	0	0	19
151-200	345	1432	19723	29548	14232	3217	492	525	2167	197	773	972	460	1121
	346	865	11602	9965	145882	10812	1577	833	278	476	487	579	71	670
	368	334	414	4150	51551	4992	10866	1355	184	23	402	158	46	92
	387	718	2272	16336	241169	93995	23145	6288	0	560	142	1037	1635	684
	388	361	1738	1606	36947	10809	4618	2235	0	174	84	0	72	372
	392	145	2094	645	22130	4618	40	479	0	110	111	0	80	41
total strata fished <= 200 fath			411190	405673	680365	263087	48038	16569	4278	3289	5166	5888	4386	9096
ADJUSTED			411189	405673	680366	291539	48037	16571	4279	3289	5166	5888	4386	9096
upper			521077	475378	1169116	395962	105950	29261	7094	5694	6223	10529	10169	11449
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
1 STD strata fished <= 200 fath			50874	34169	176063	56184	13459	3989	1279	1043	522	1897	1345	1148

[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 1988-1999 in depths <= 200 fathoms. The 1988-1995 data are in Campelen equivalent units and the 1996-1999 data are in actual Campelen units.

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

[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.

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.

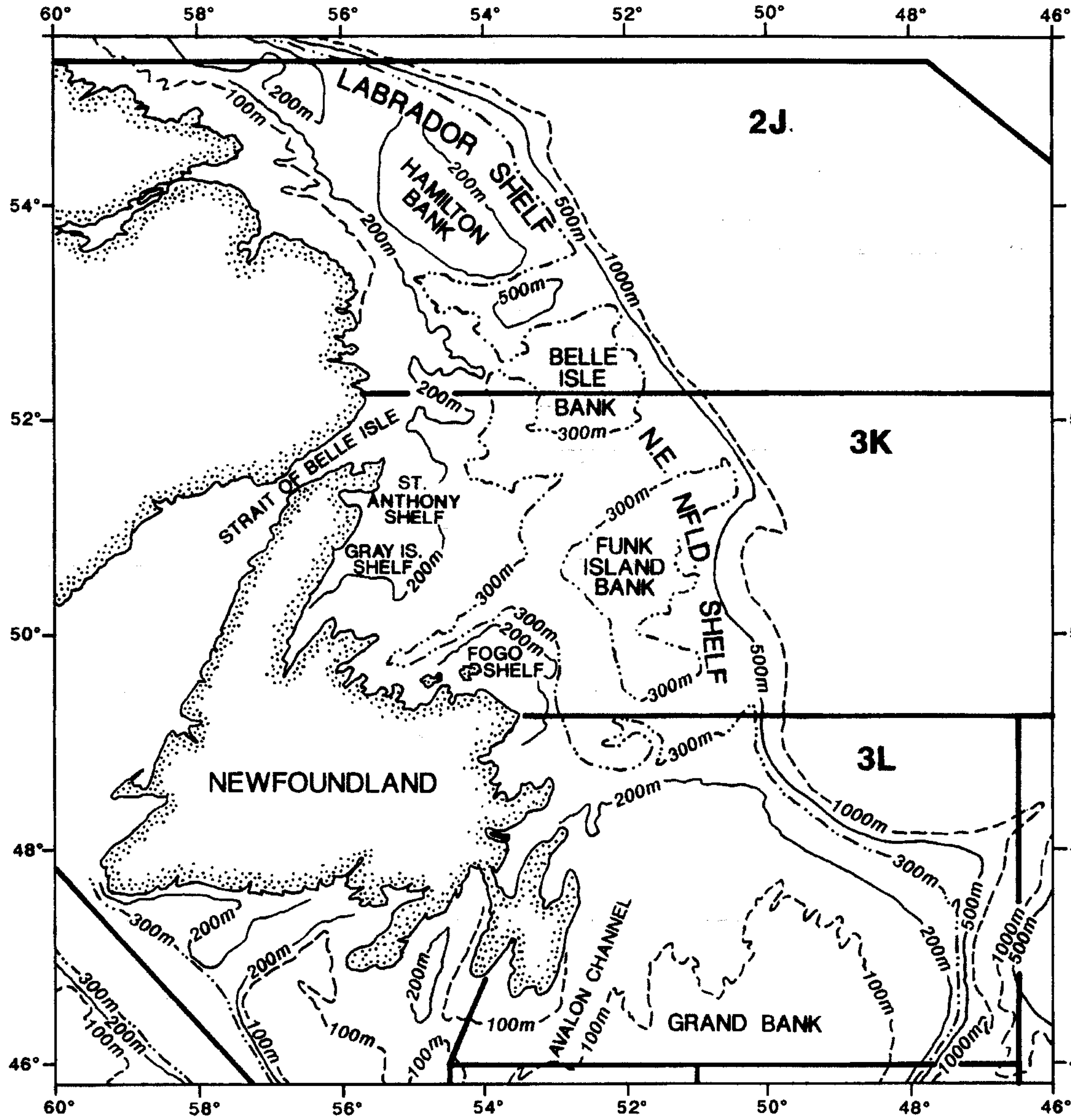


Fig. 1a. Map of the stock area, showing physiographic features and NAFO Divisions.

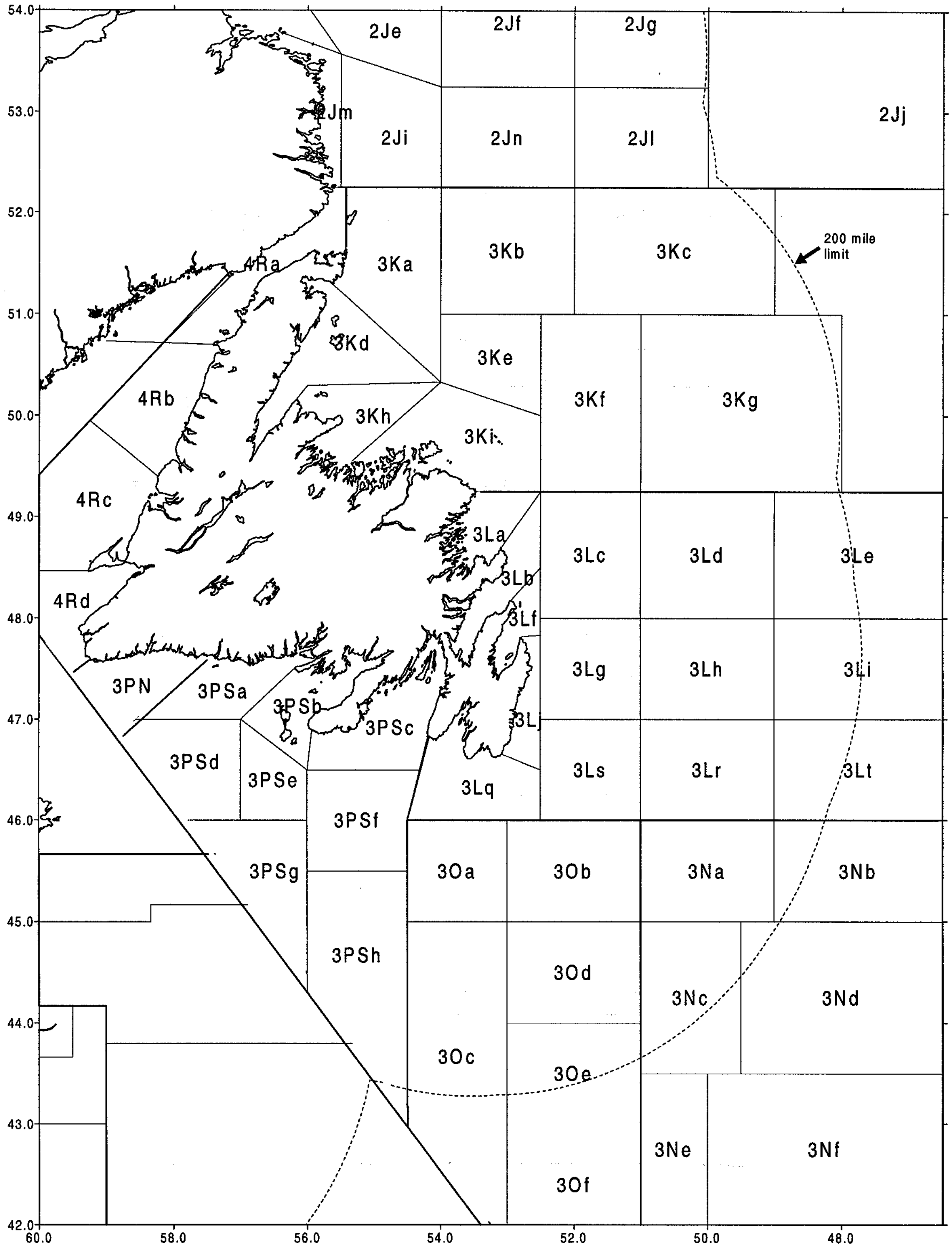


Fig. 1b. Map of the stock area, showing commercial fishery statistical unit areas.

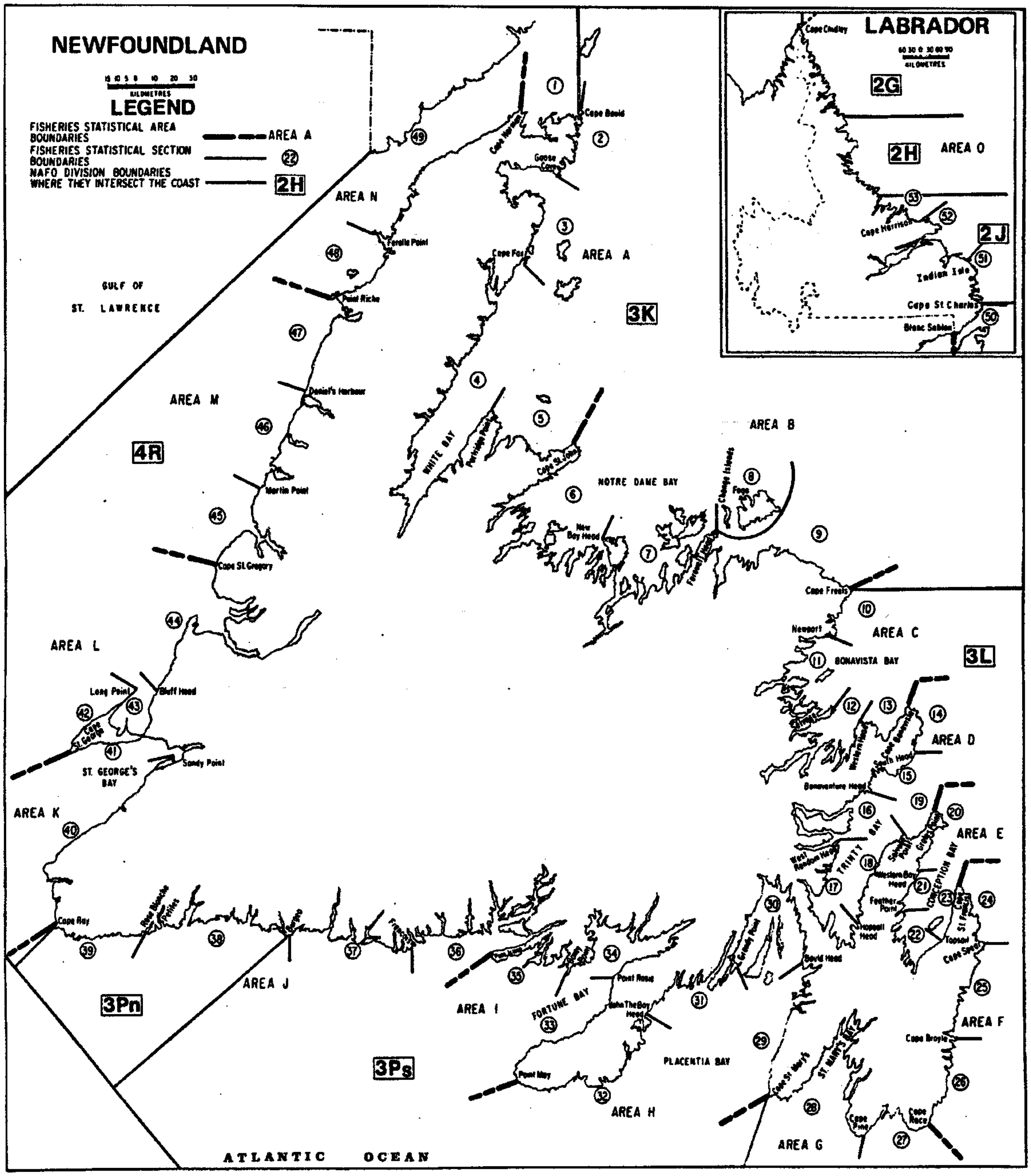


Fig. 1c. Map of the stock area, showing commercial fishery statistical sections.

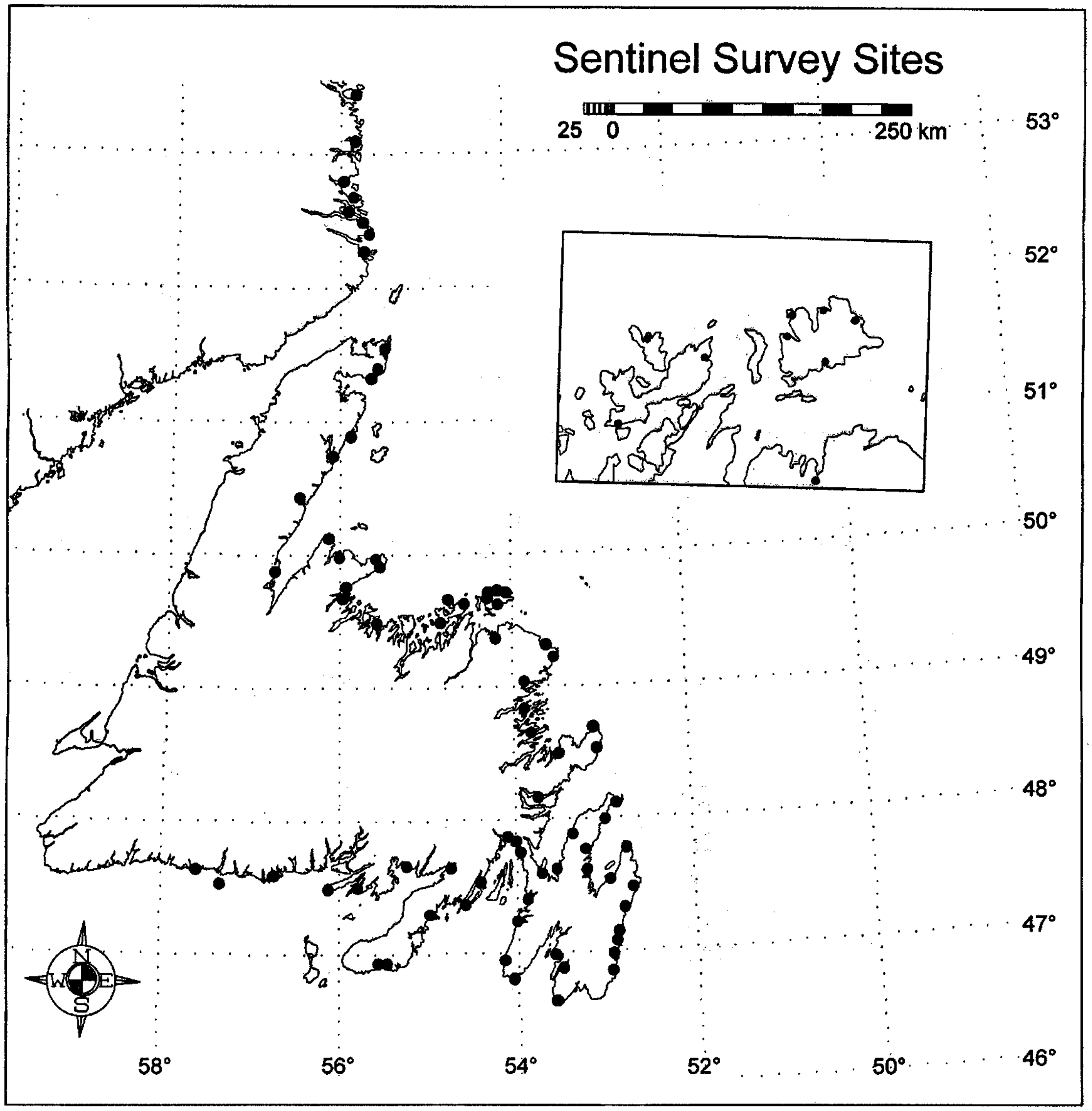


Fig. 1d. Map of the stock area, showing sentinel survey sites.

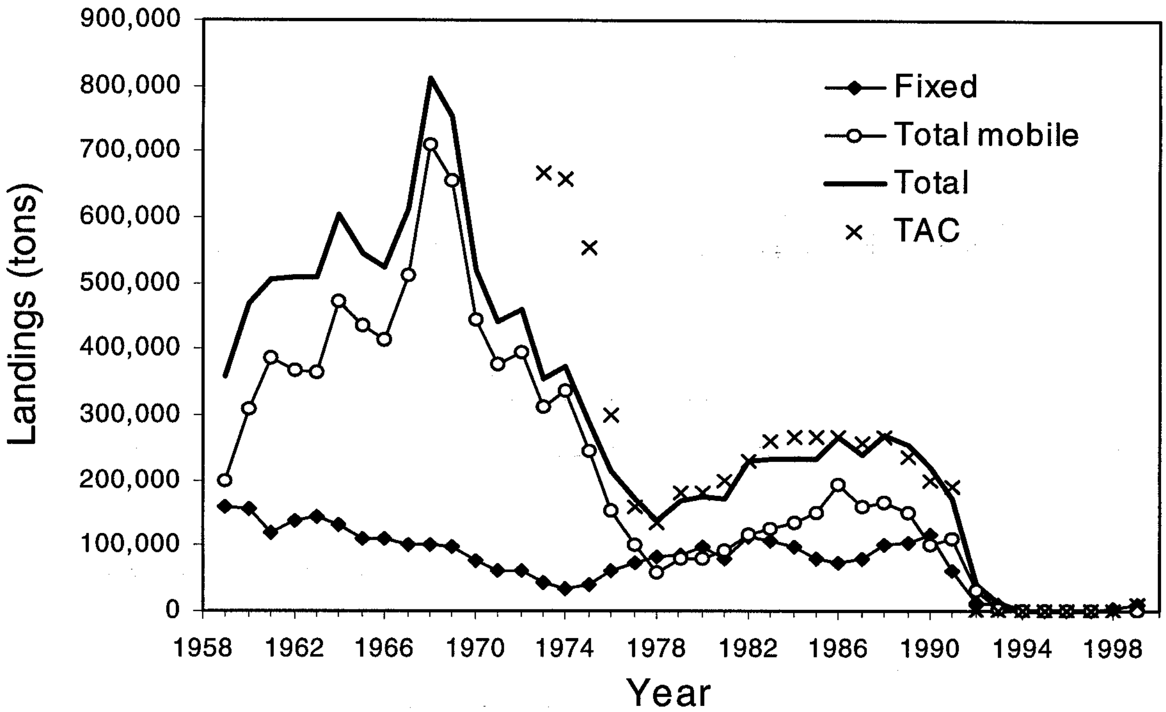


Fig. 2. Divisions 2J+3KL TAC and landings from fixed and mobile gear.

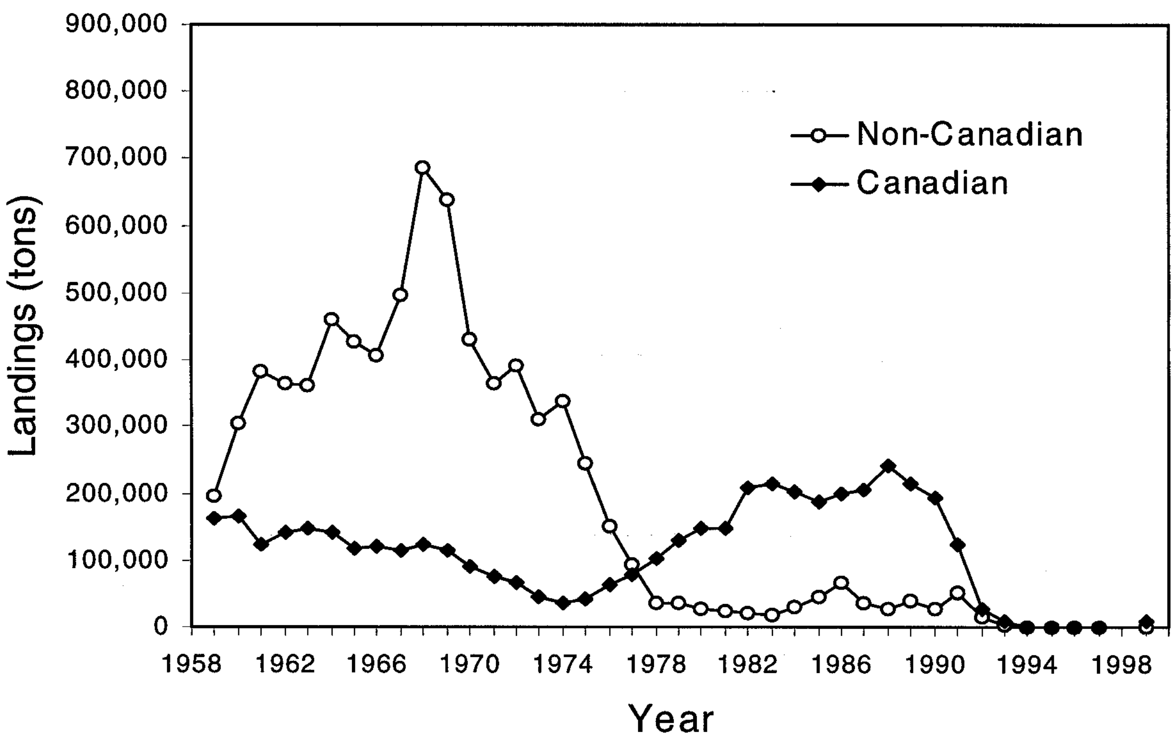


Fig. 3. Divisions 2J+3KL landings by Canadian and non-Canadian vessels.

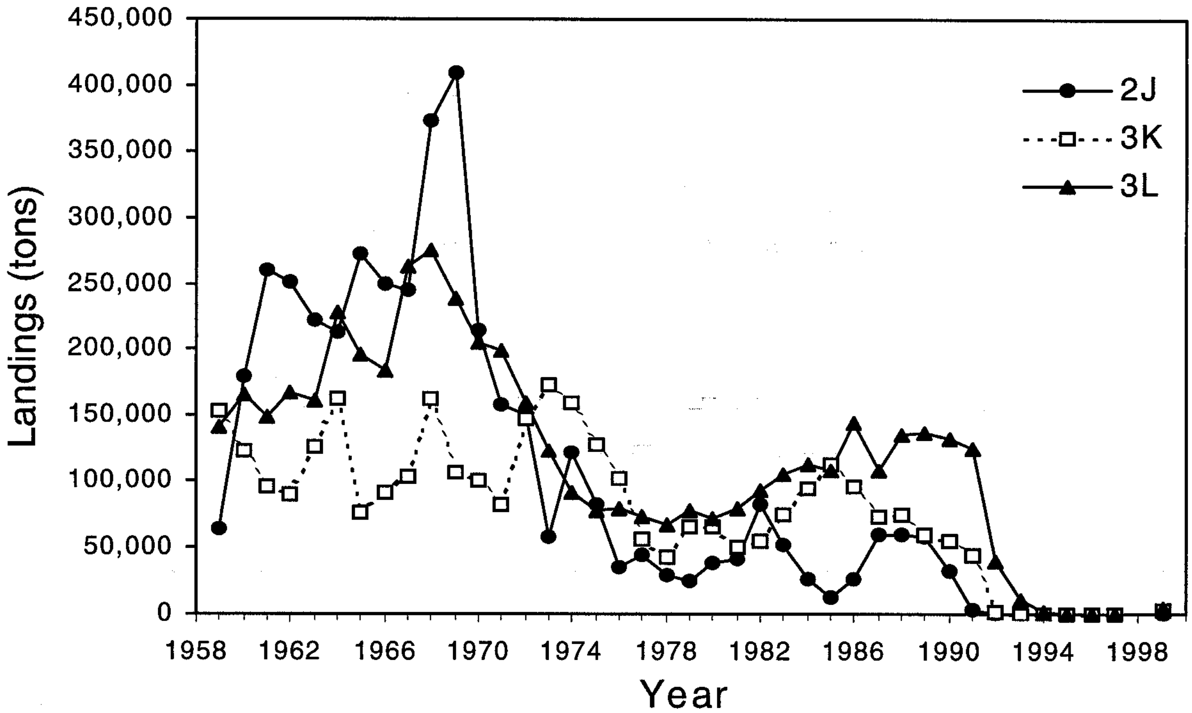


Fig. 4. Division 2J+3KL landings by Division.

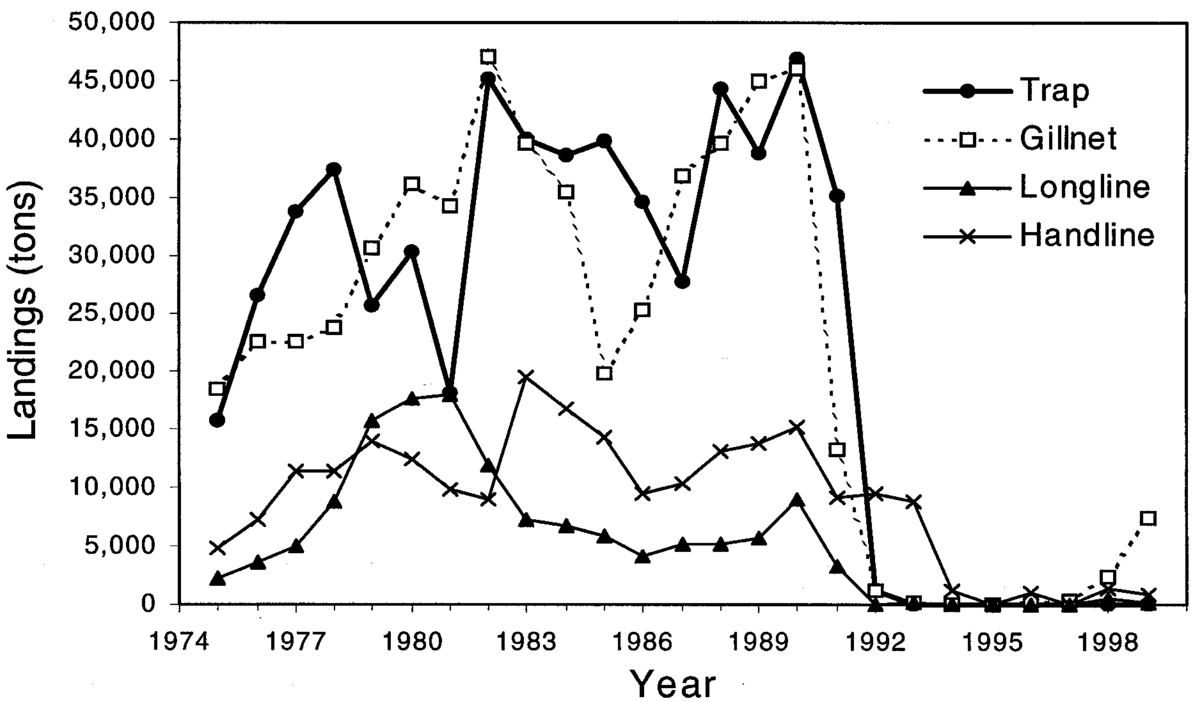


Fig. 5. Division 2J+3KL fixed gear landings by gear type.

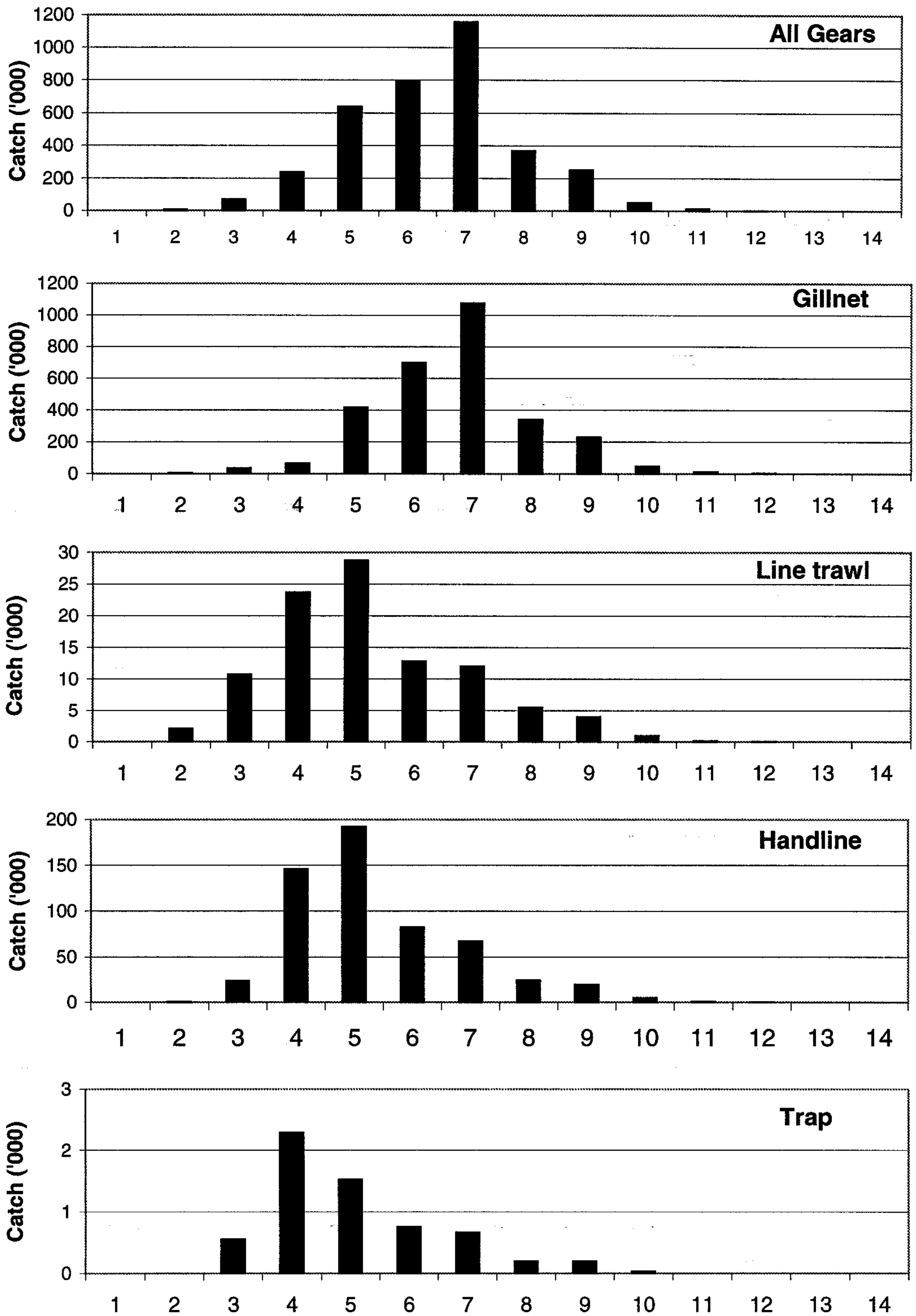


Fig. 6. The estimated catch at age for all gears combined and for individual gears in 2J3KL in 1999. All sources of catch (commercial, sentinel survey and food/recreational) are combined.

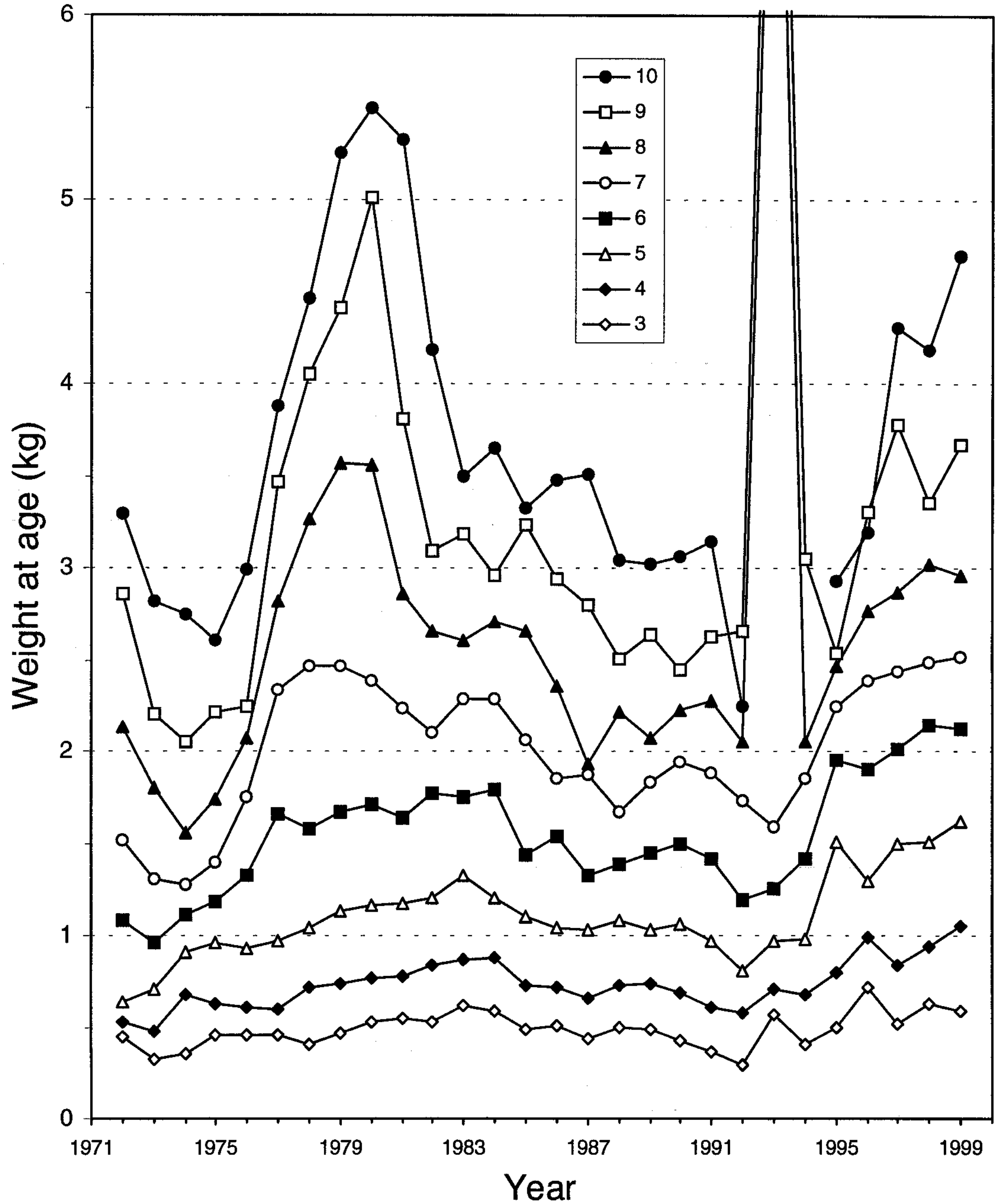


Fig. 7. Mean weights-at-age calculated from mean lengths-at-age in the catch.

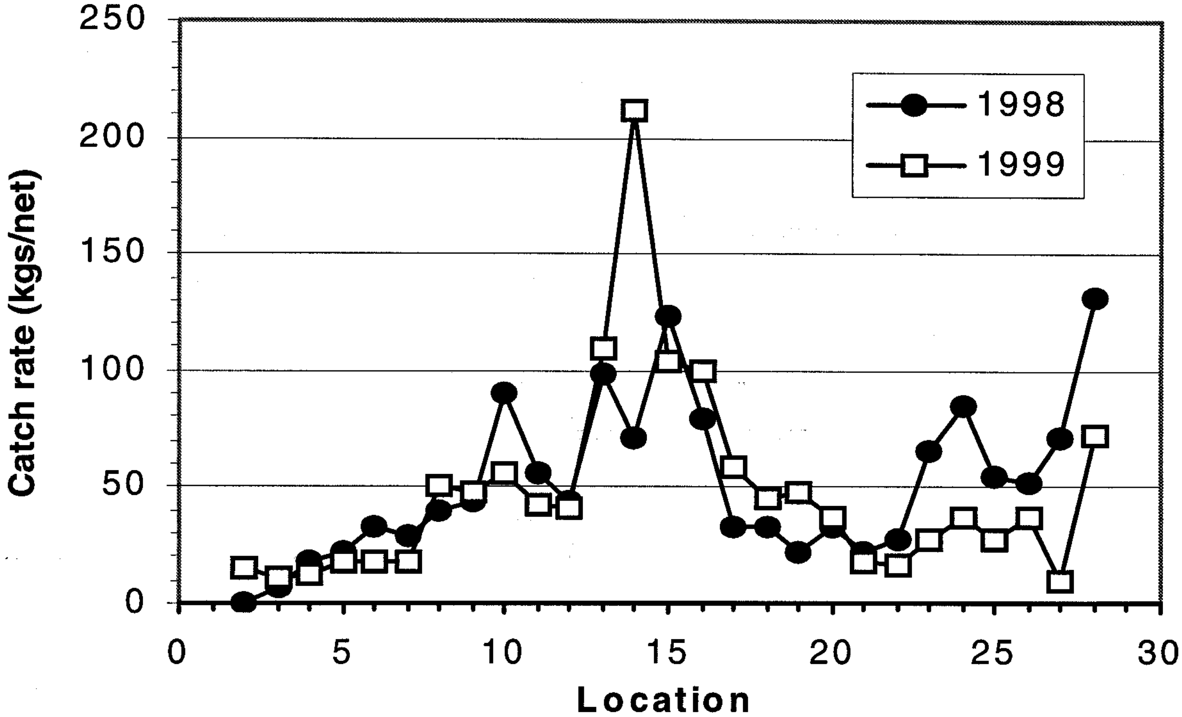


Fig. 8. Median gillnet catch rates by statistical section during the 1998 index fishery and the 1999 commercial fishery. Statistical sections are illustrated in Fig. 1c. From north to south, Section 2 starts at Cape Bauld, section 4 is White Bay, 6-7 are Notre Dame Bay, 8 is Fogo, 10-13 are Bonavista Bay, 14-19 are Trinity Bay, 20-23 are Conception Bay, 24-26 are the eastern Avalon Peninsula, and 28 is St. Mary's Bay.

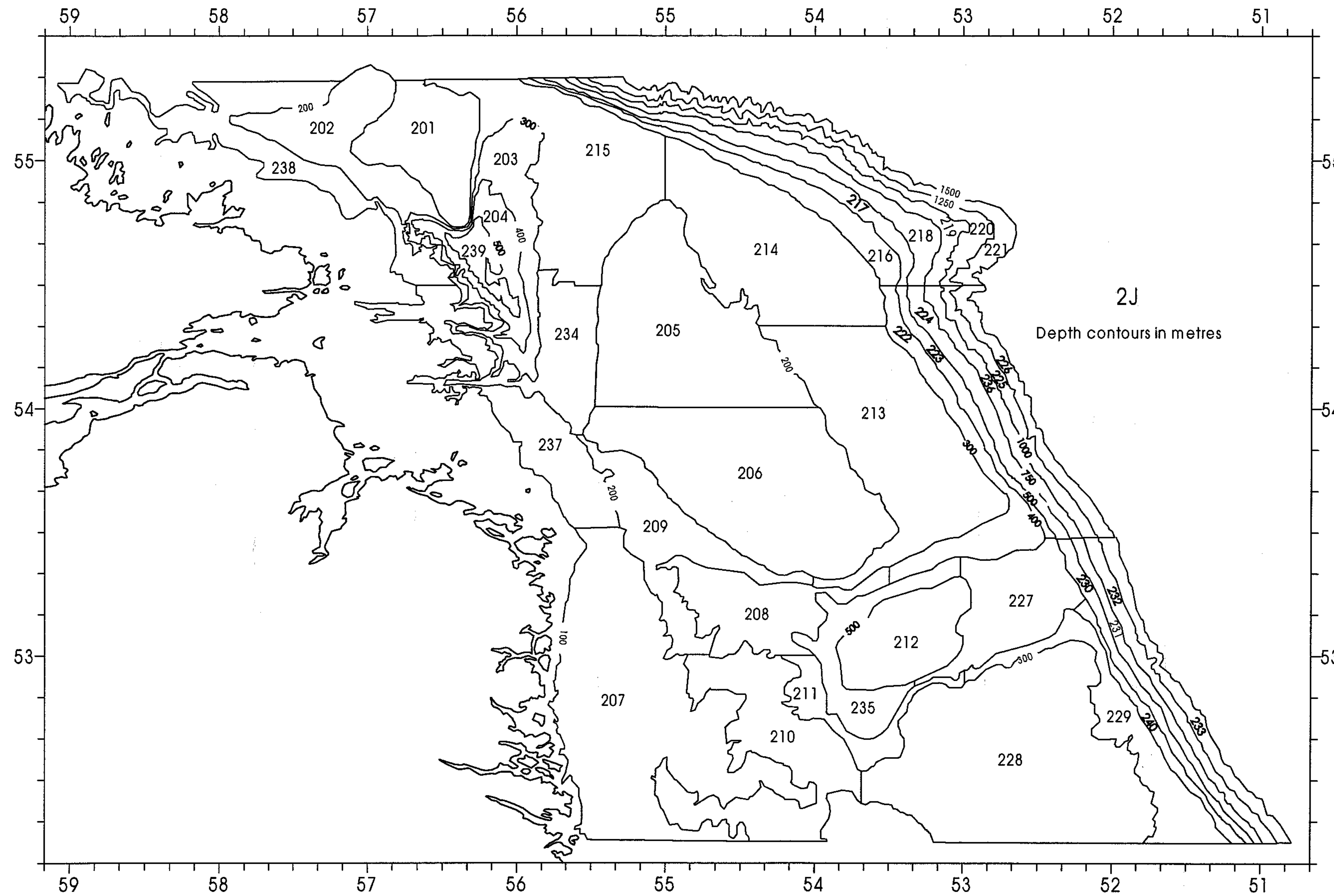


Fig. 9. Strata used for research bottom-trawl surveys in Division 2J.

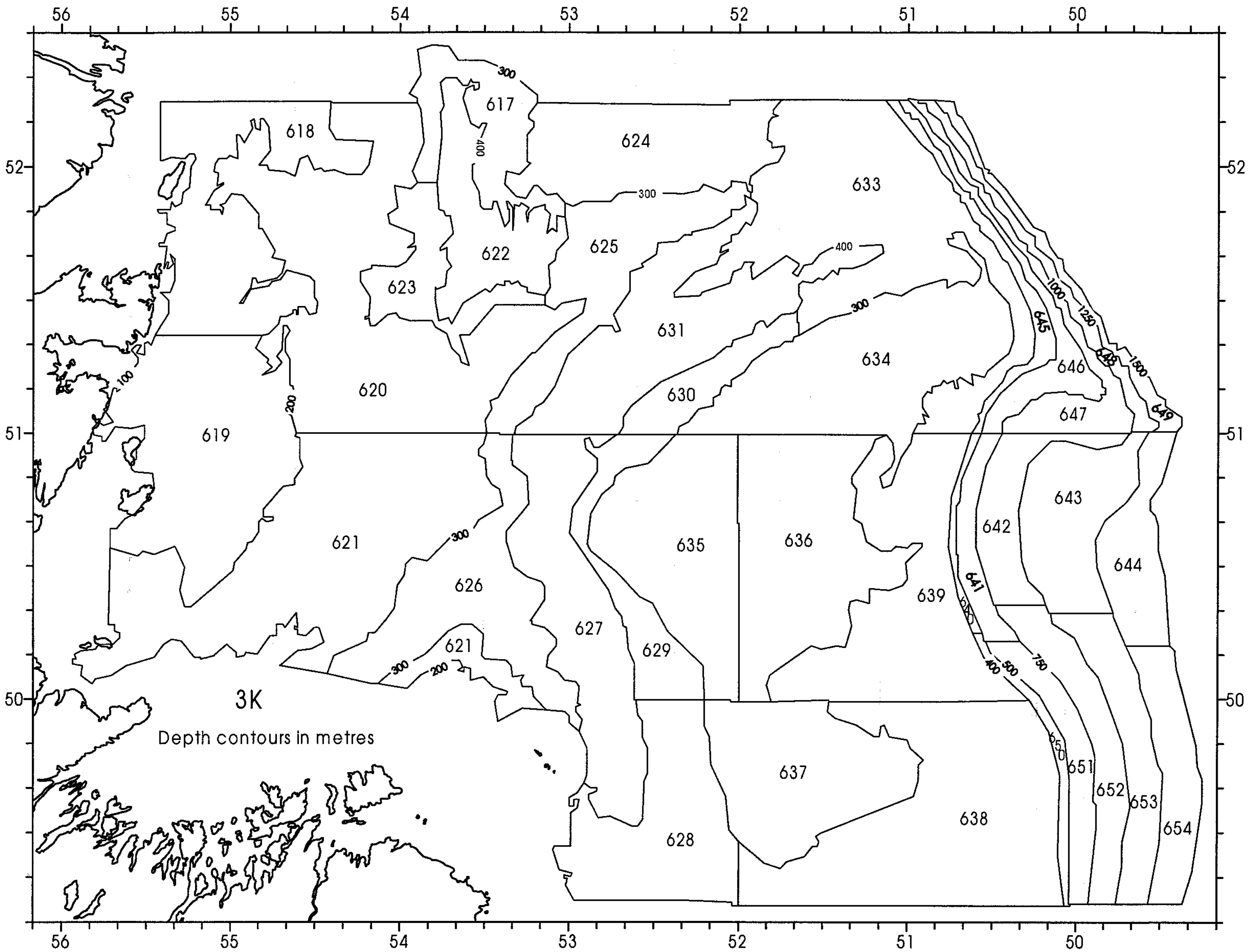


Fig. 10. Strata used for research bottom-trawl surveys in Division 3K.

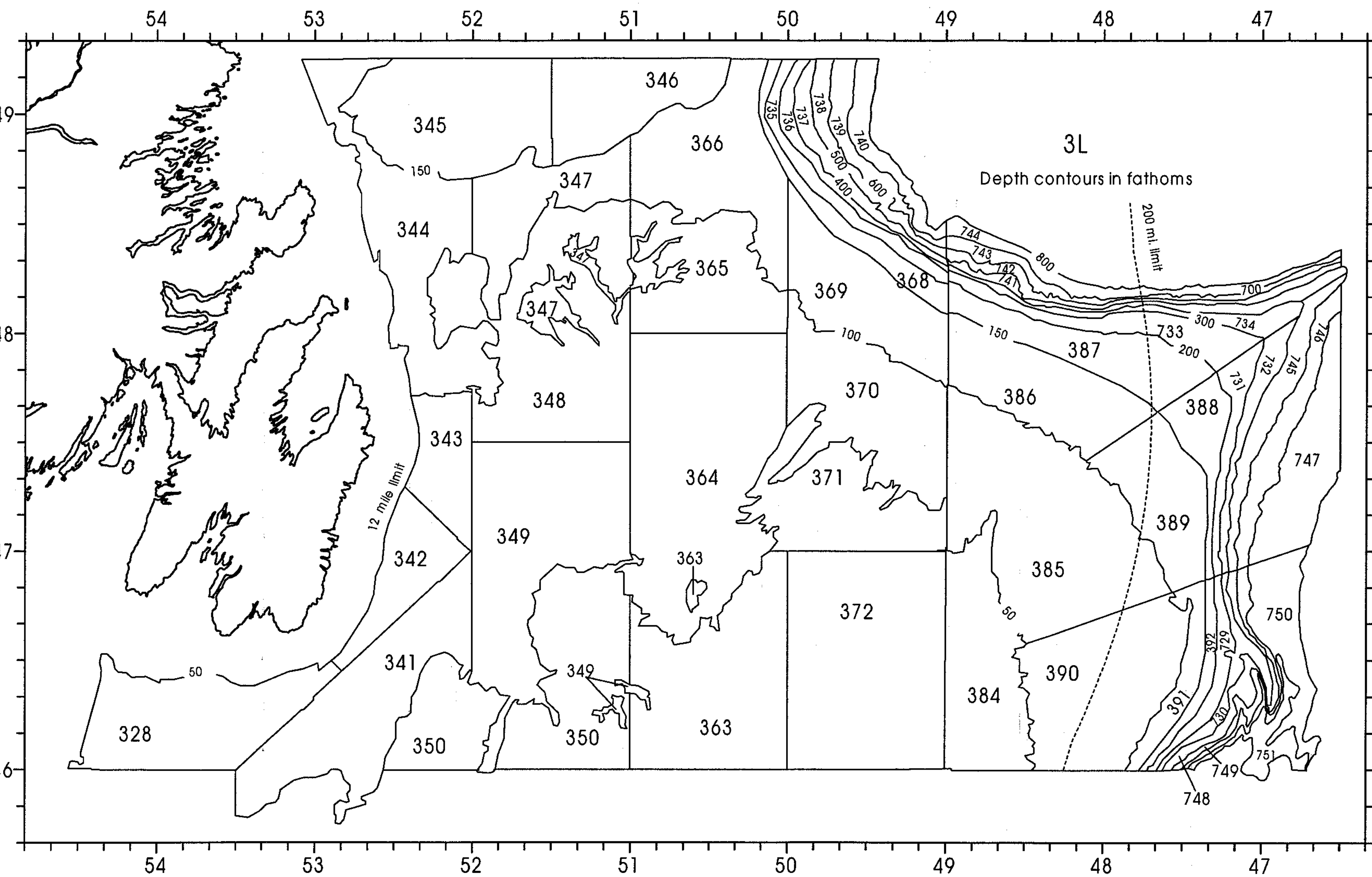


Fig. 11. Strata used for research bottom-trawl surveys in Division 3L.

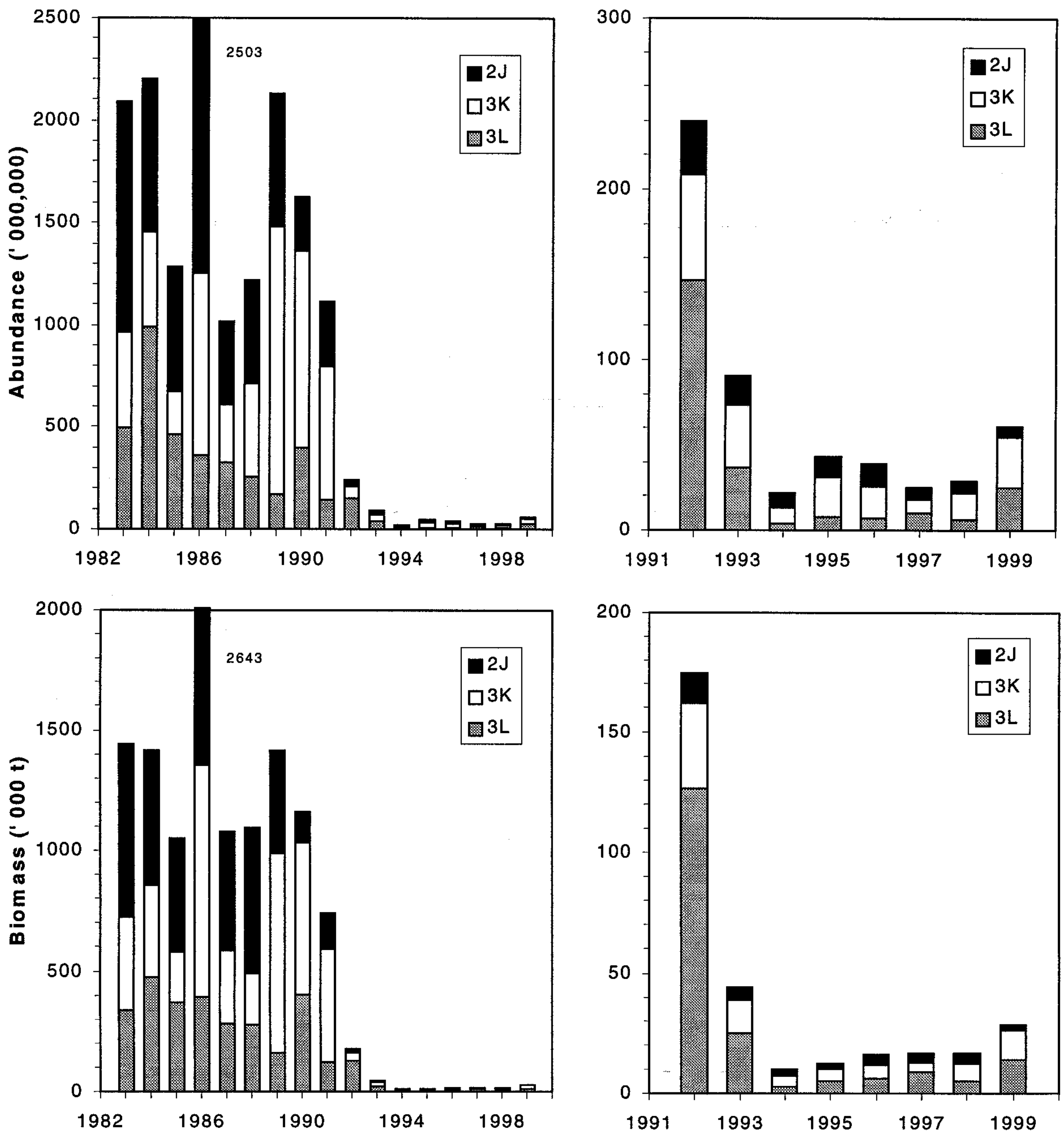


Fig. 12. Indices of abundance and biomass of cod from autumn bottom-trawl surveys in divisions 2J3KL. The estimates for 1983-1994 are Campelen equivalents.

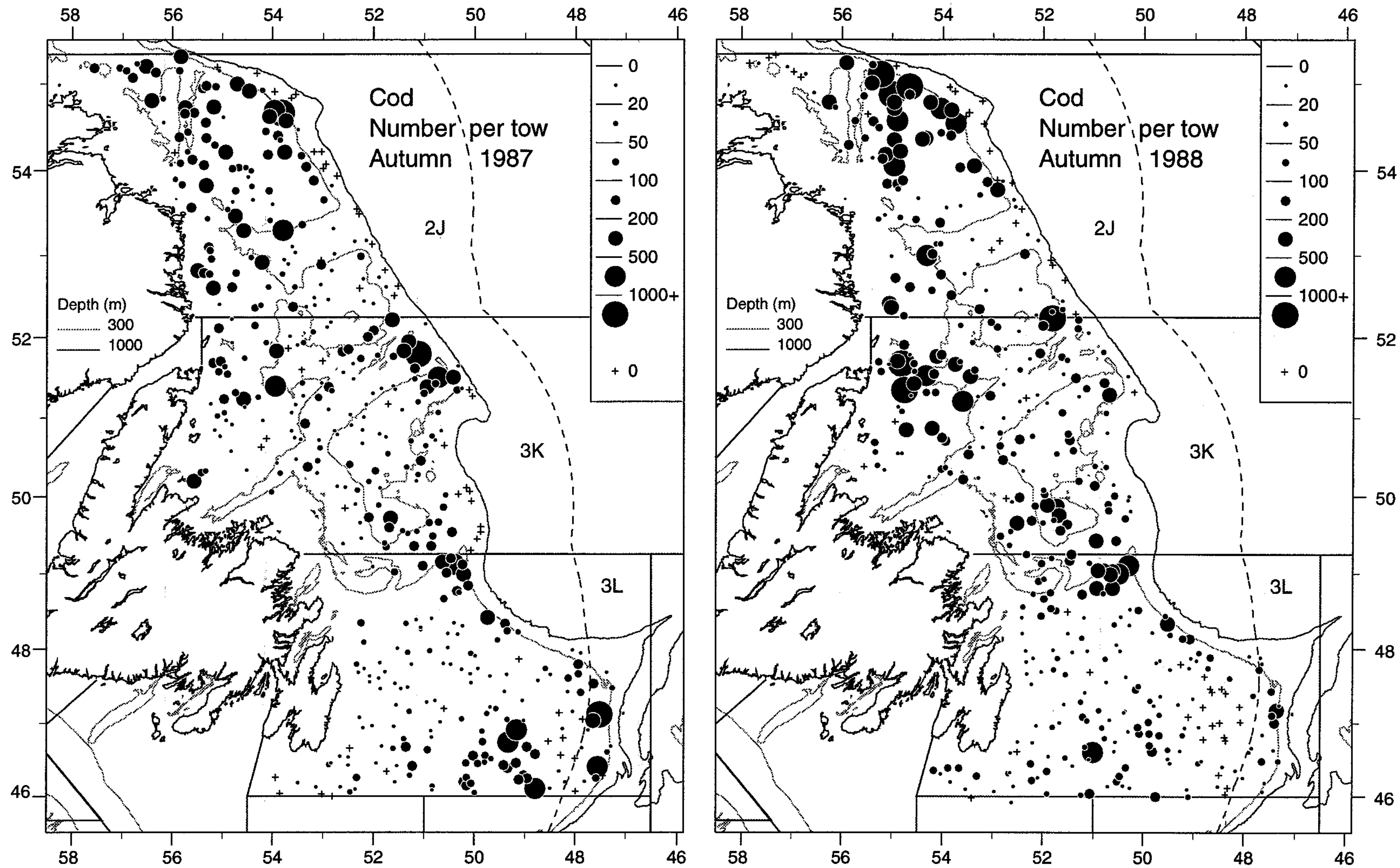


Fig. 13. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L 1987-1988.

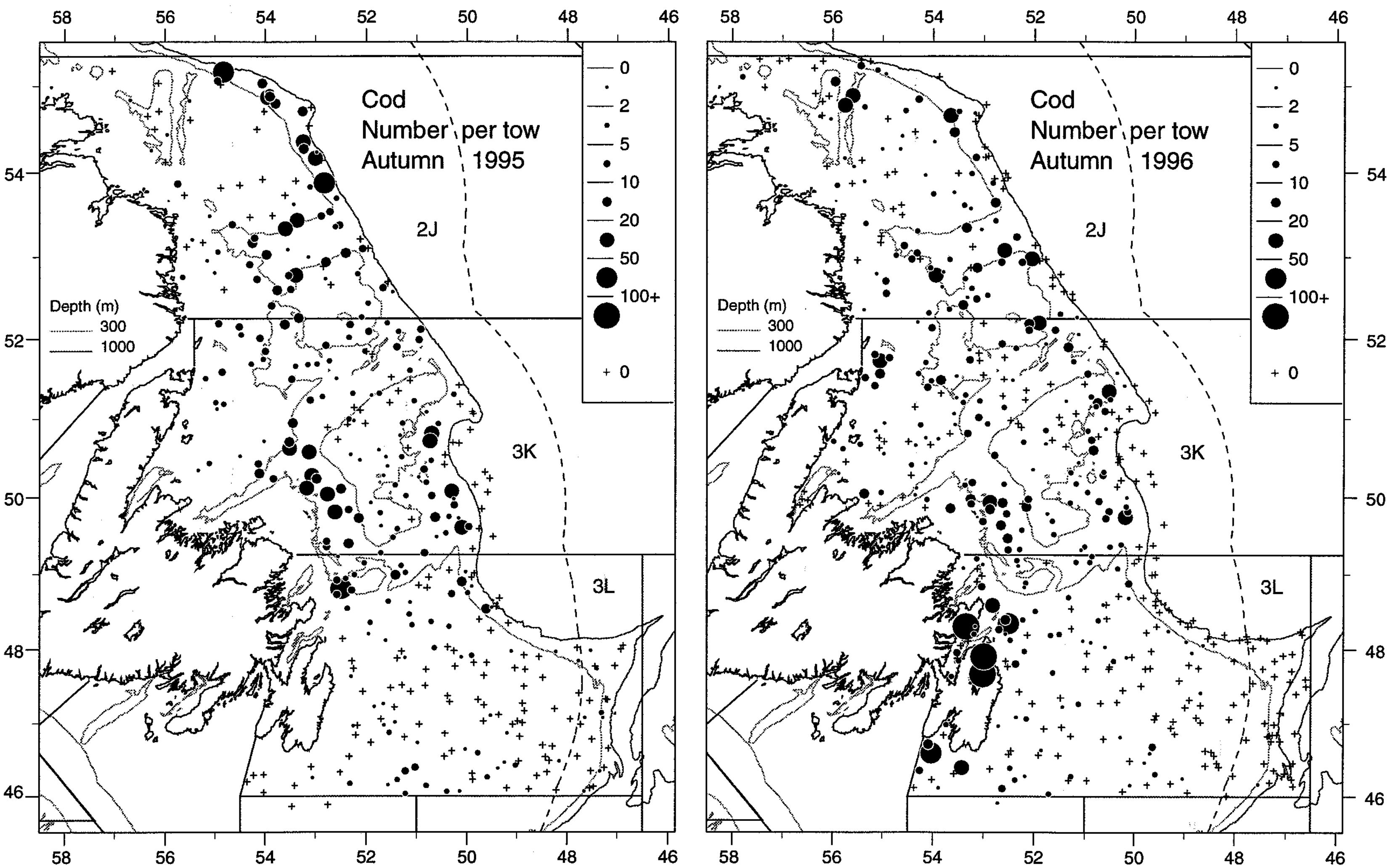


Fig. 14a. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L 1995-1996.

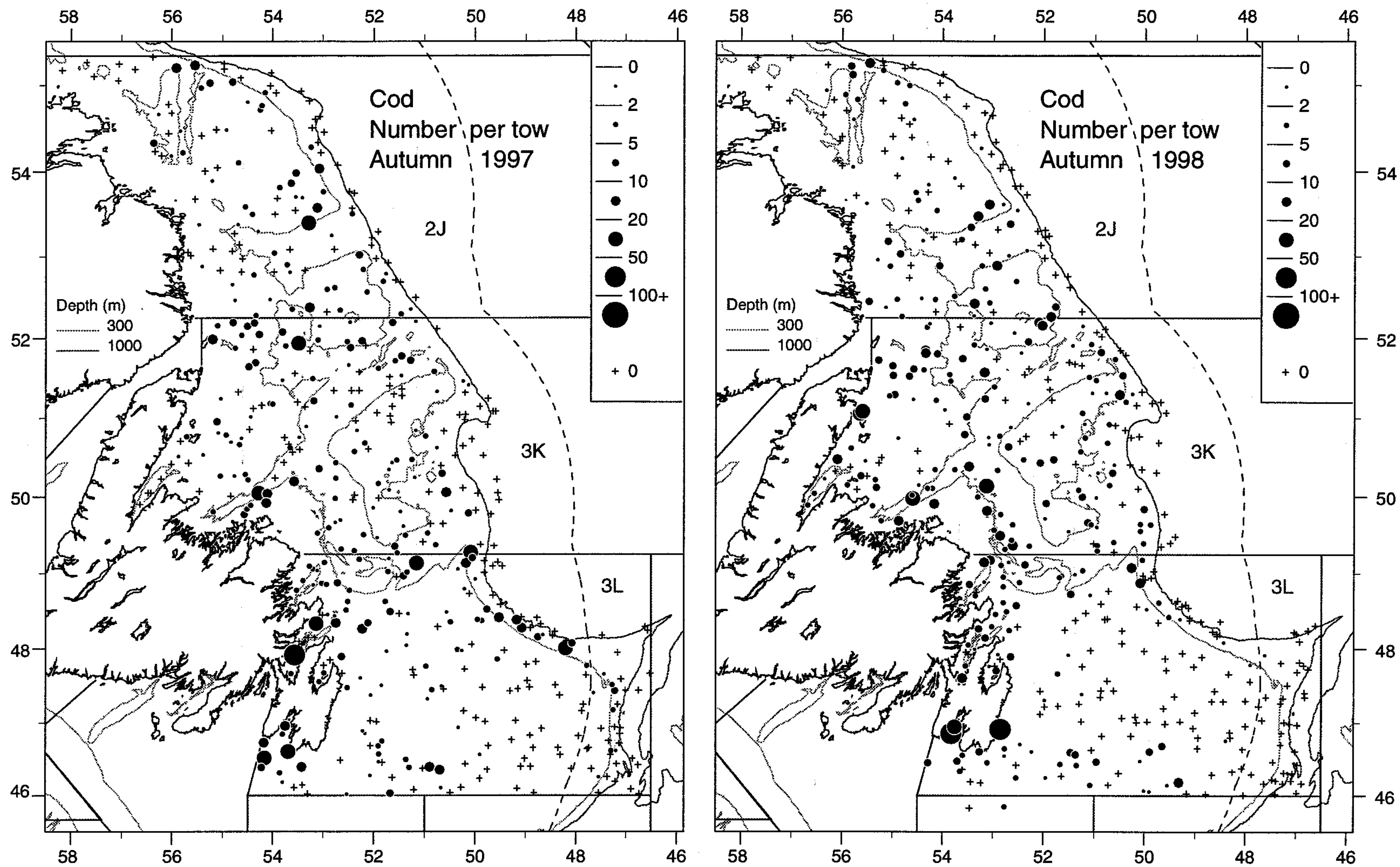


Fig. 14b. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L 1997-1998.

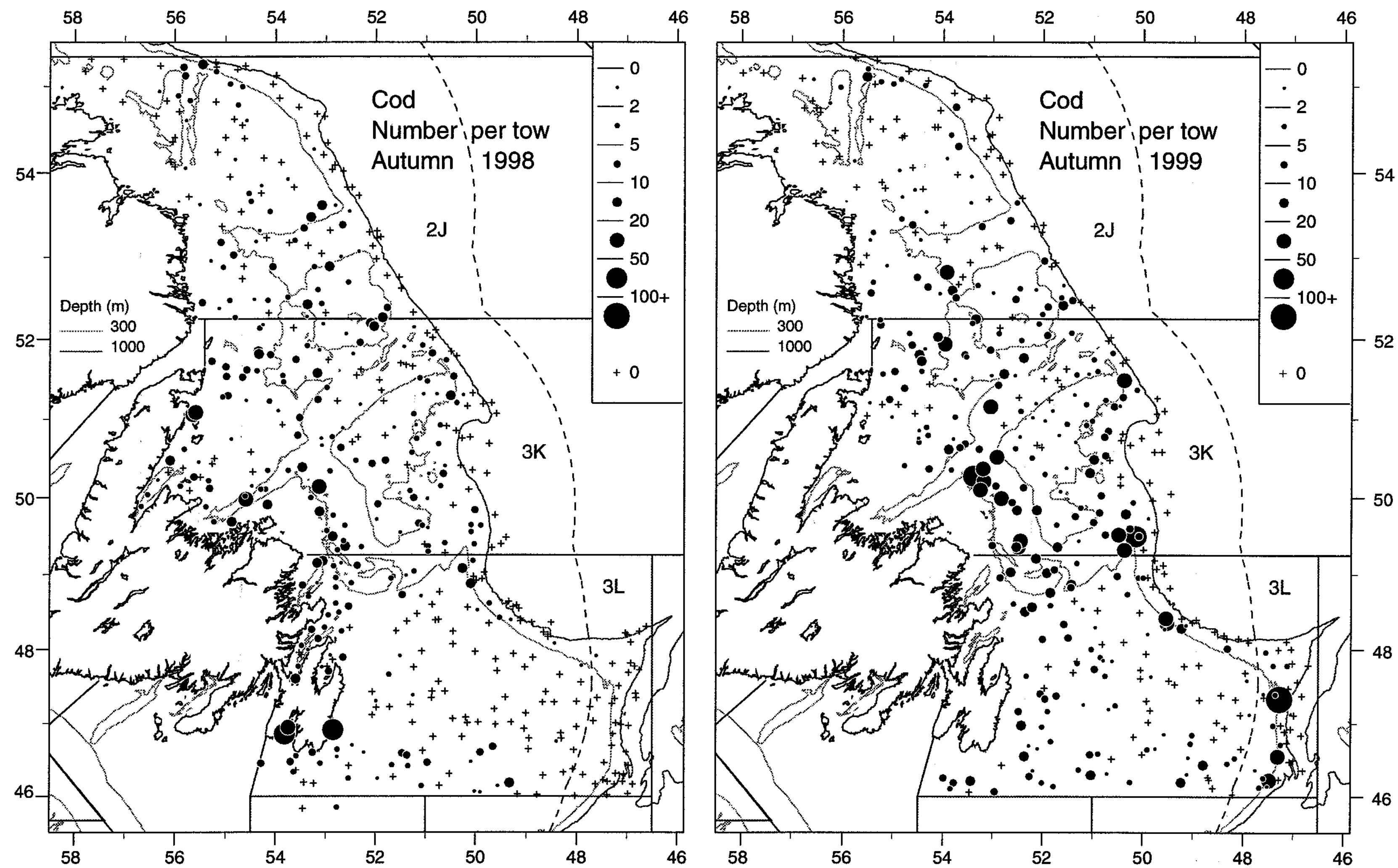
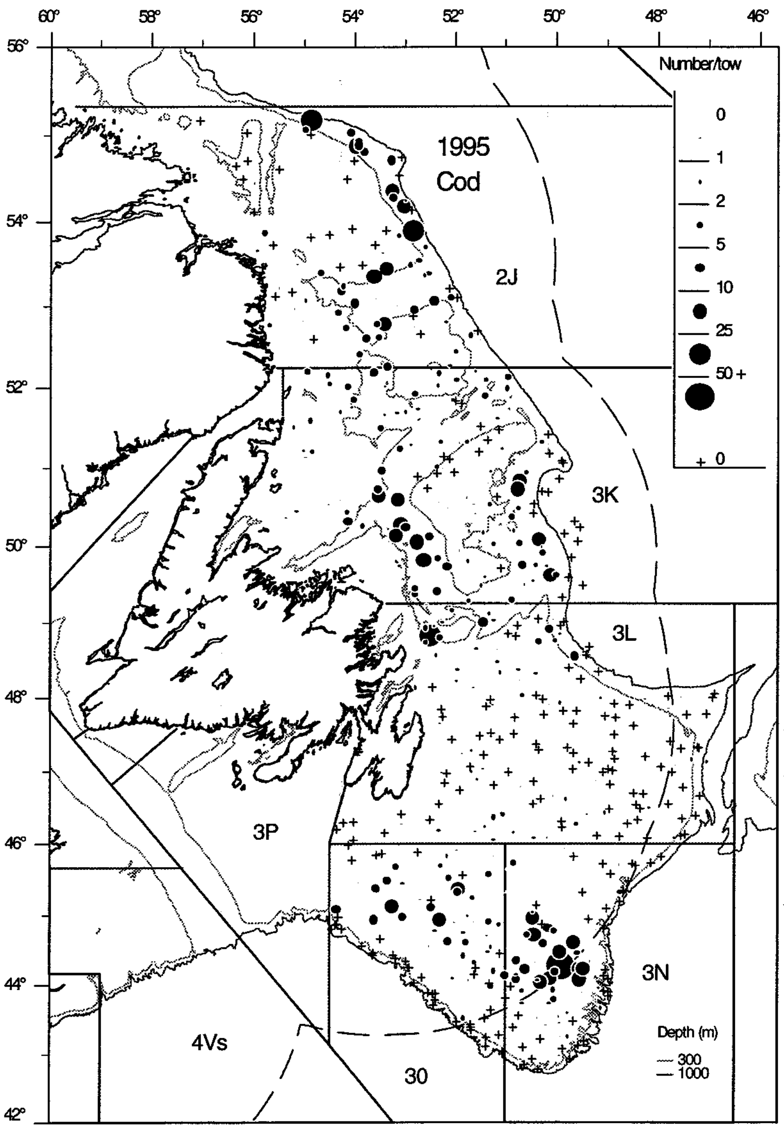


Fig. 14c. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L 1998-1999.



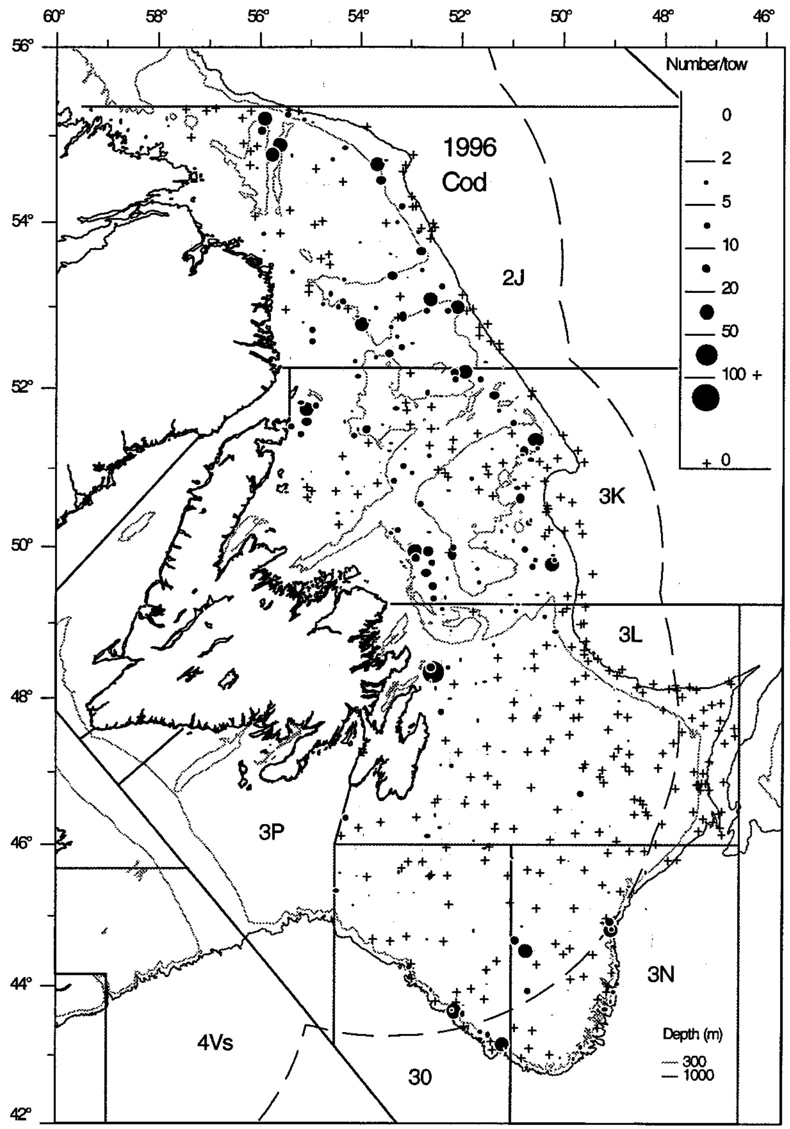


Fig. 15a. Cod distribution (number per standard tow) during the autumn survey in Divisions 2J3KLNO in 1995-1996.

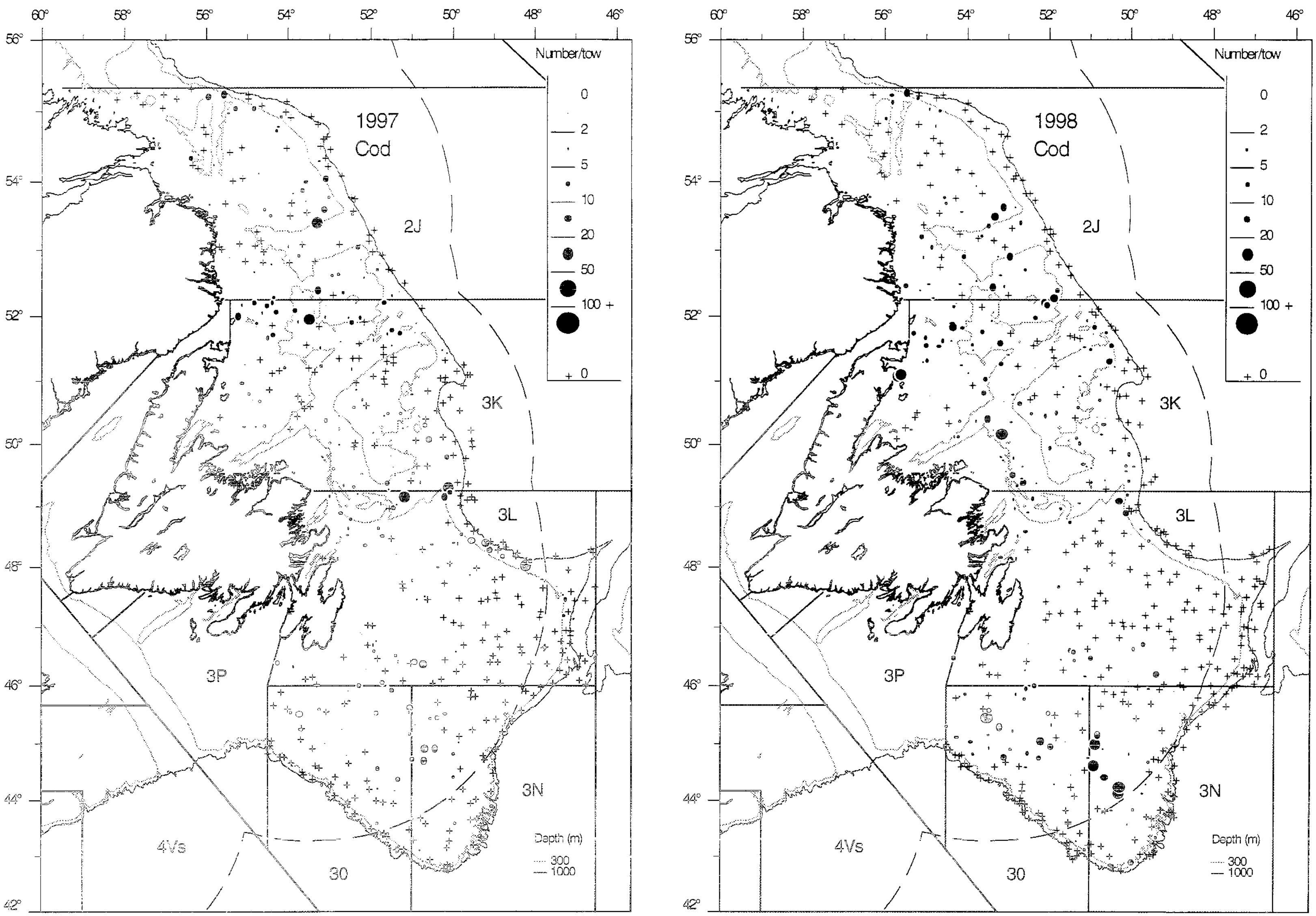


Fig. 15b. Cod distribution (number per standard tow) during the autumn survey in Divisions 2J3KLNO in 1997-1998.

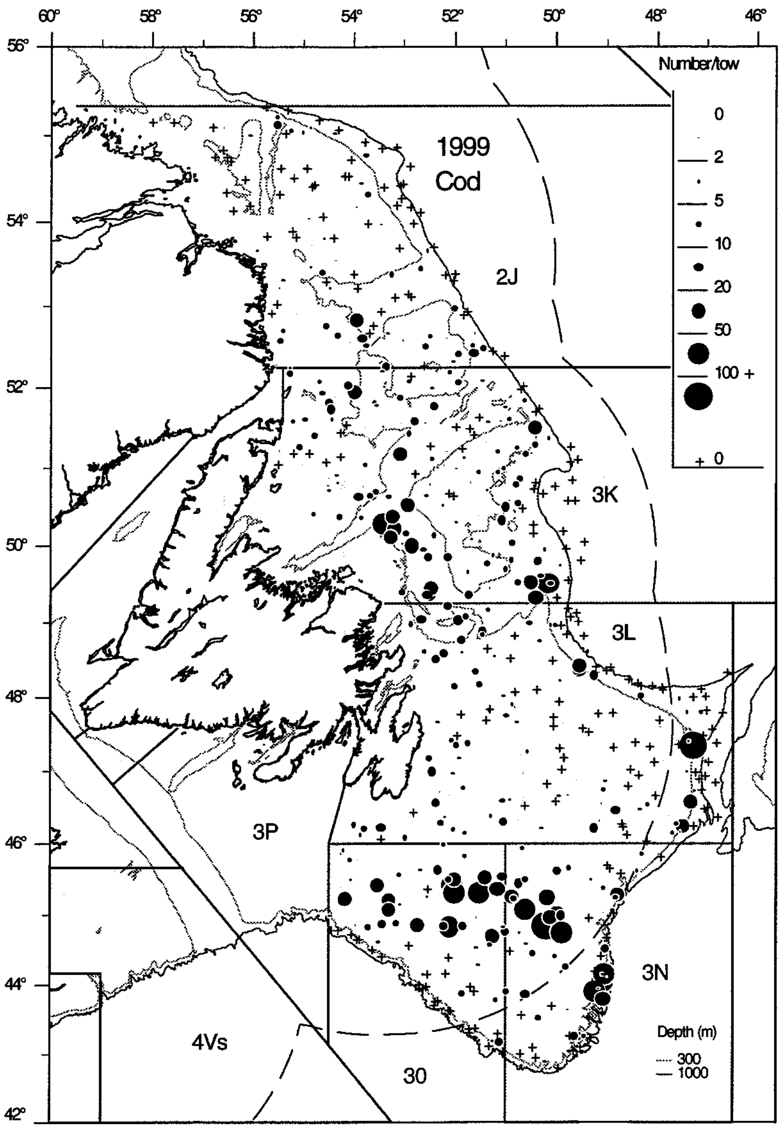


Fig. 15c. Cod distribution (number per standard tow) during the autumn survey in Divisions 2J3KLNO in 1999.

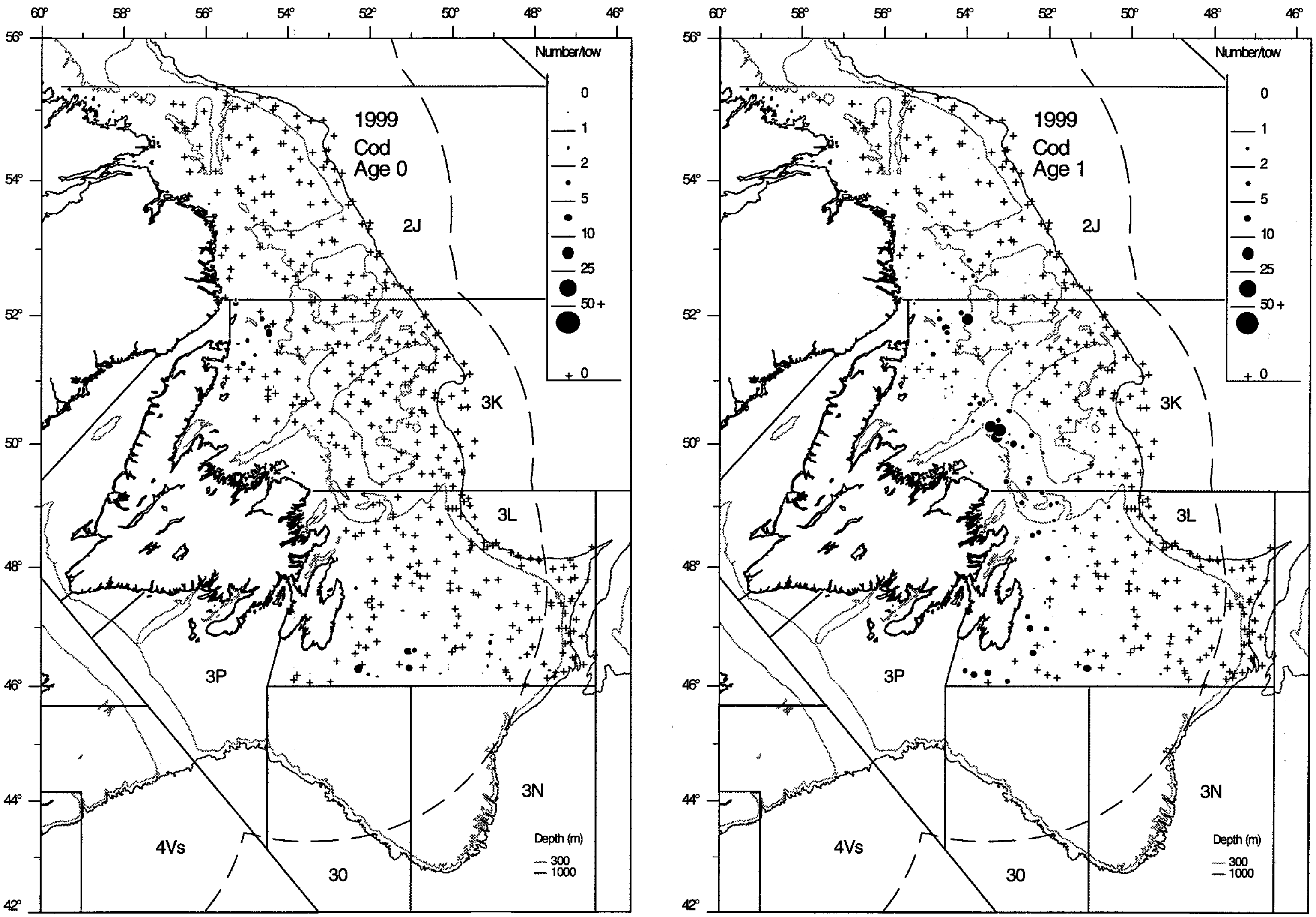


Fig. 16a. Distribution (number per standard tow) of cod of ages 0 and 1 during the autumn survey in divisions 2J3KL in 1999.

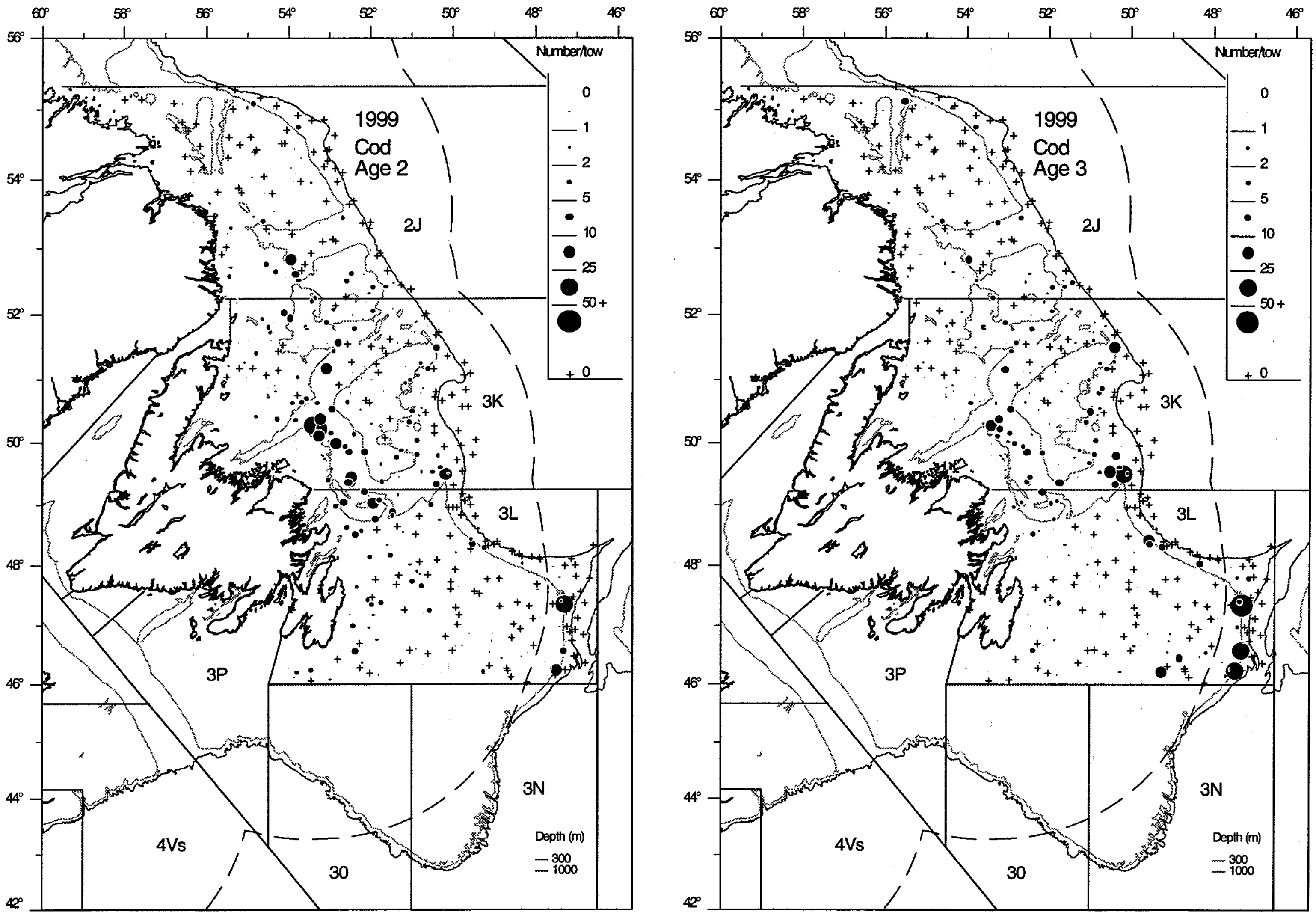


Fig. 16b. Distribution (number per standard tow) of cod of ages 2 and 3 during the autumn survey in divisions 2J3KL in 1999.

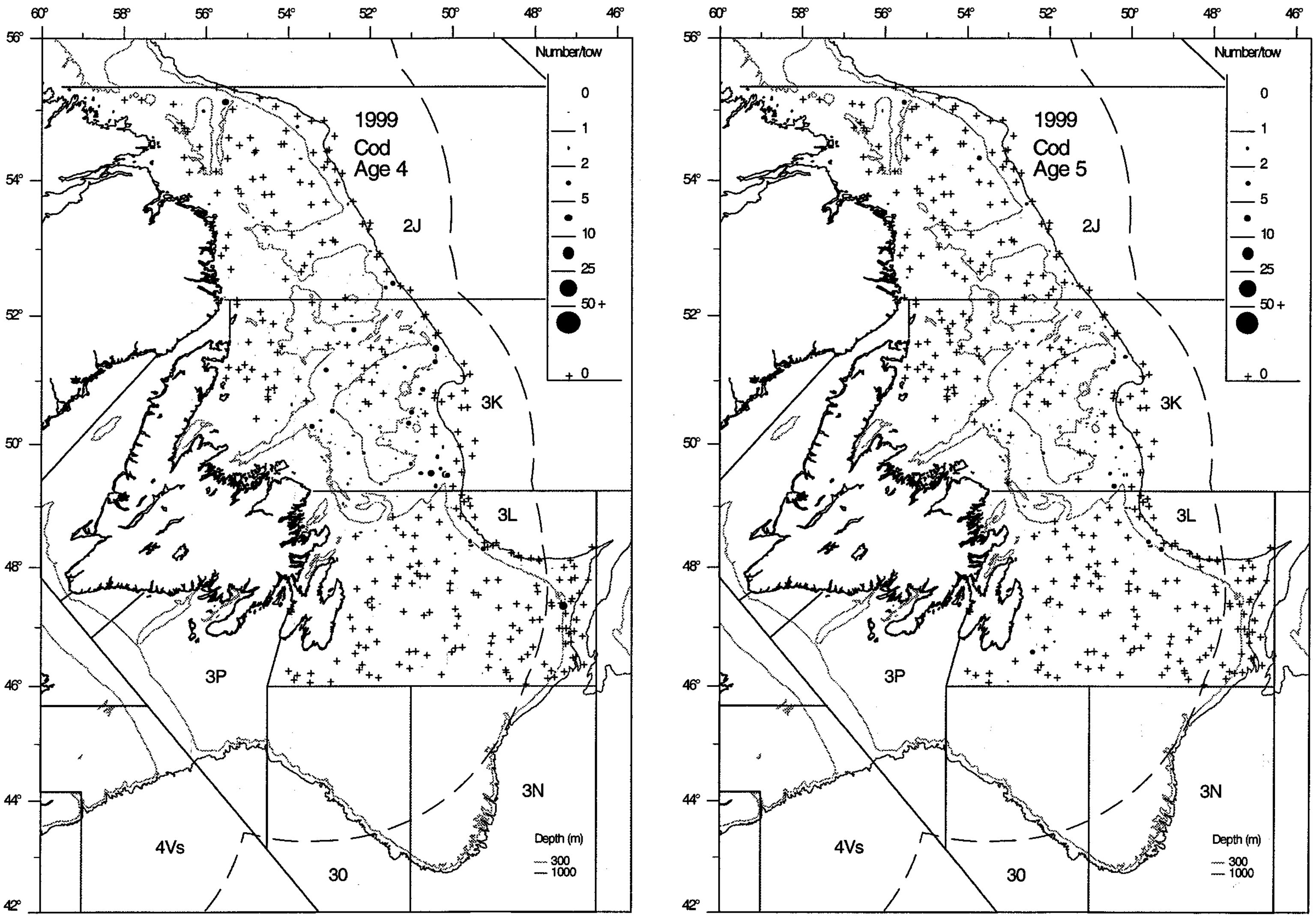


Fig. 16c. Distribution (number per standard tow) of cod of ages 4 and 5 during the autumn survey in divisions 2J3KL in 1999.

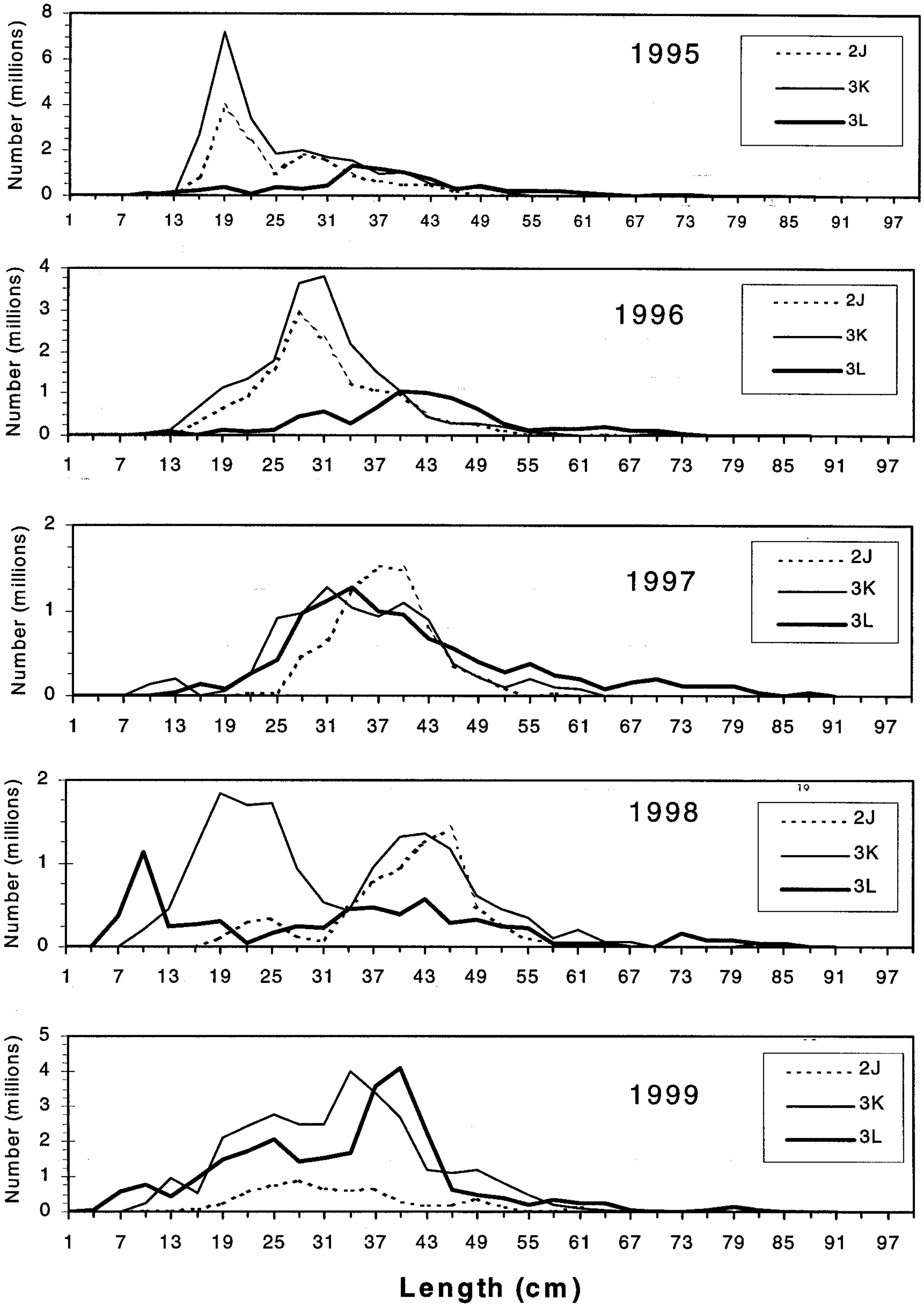


Fig. 17. Population numbers, by 3-cm length-groups, in divisions 2J, 3K and 3L in 1995-1999, as calculated from catches during autumn bottom-trawl surveys. Only index strata are included in the calculations.

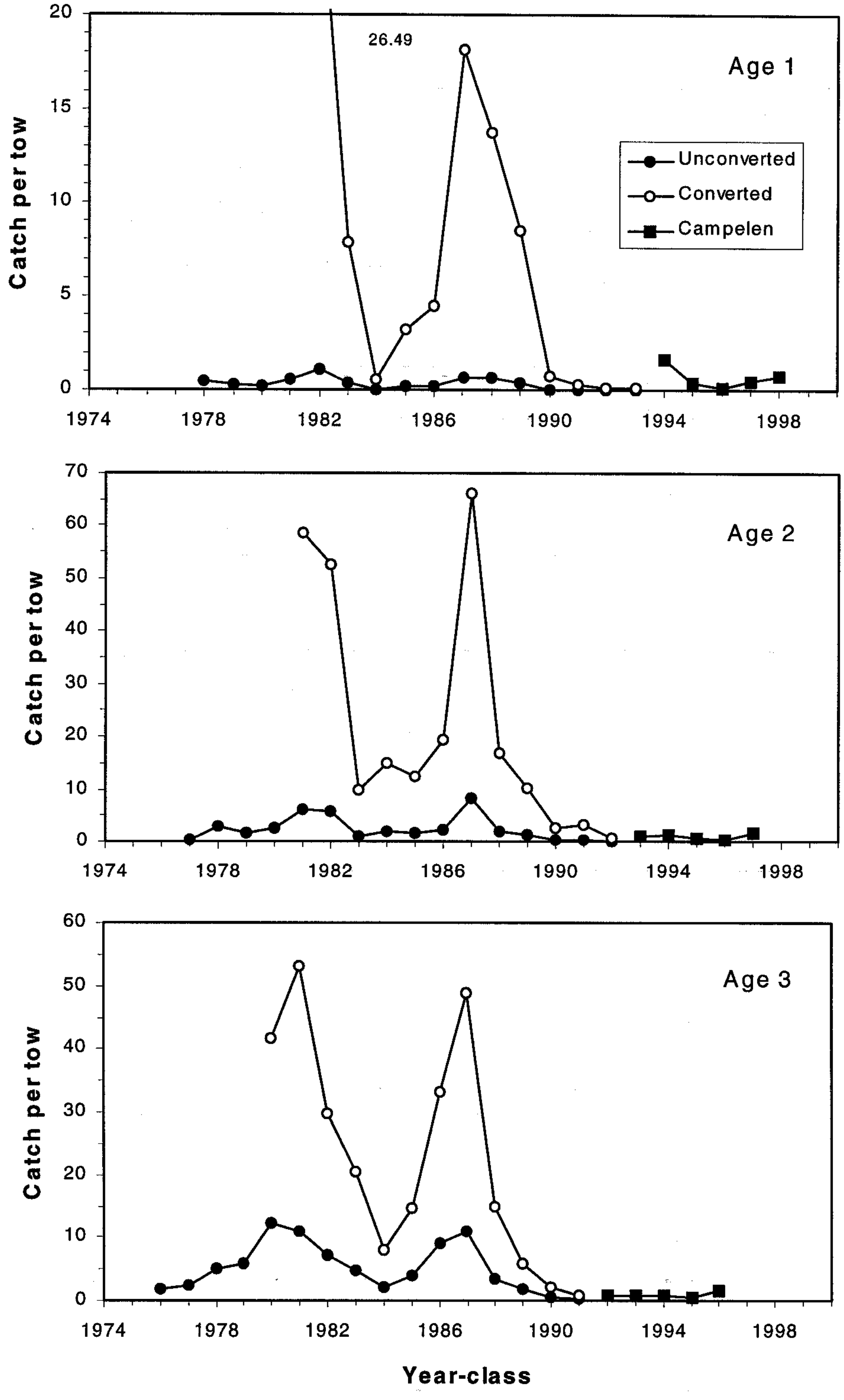


Fig. 18. Mean catch per tow of the 1976-1998 year-classes at ages 1-3 during autumn bottom-trawl surveys in divisions 2J, 3K and 3L combined. Data obtained prior to the introduction of the Campelen trawl in 1995 are shown as actual (unconverted) numbers (from Shelton et al. (MS 1996) and in numbers converted to Campelen equivalents.

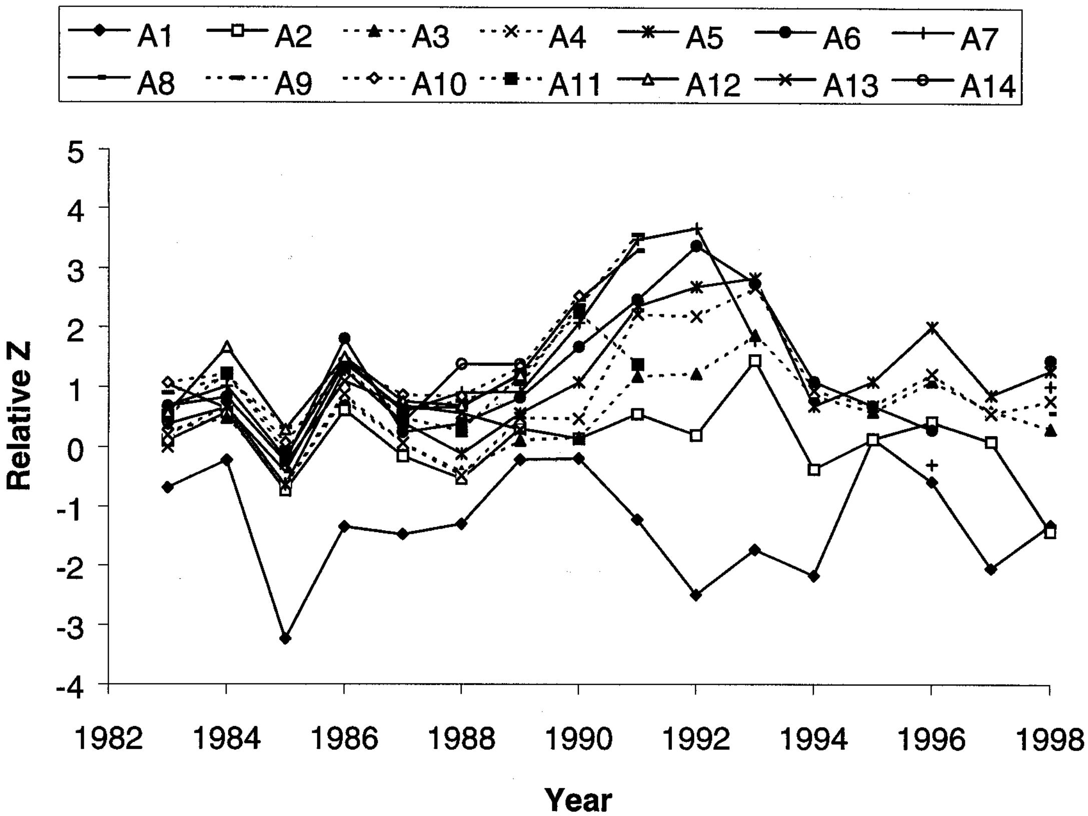


Fig. 19. Mortality rates on fish age 1 to 14 calculated from the autumn research vessel bottom-trawl catch at age for 1983-99.

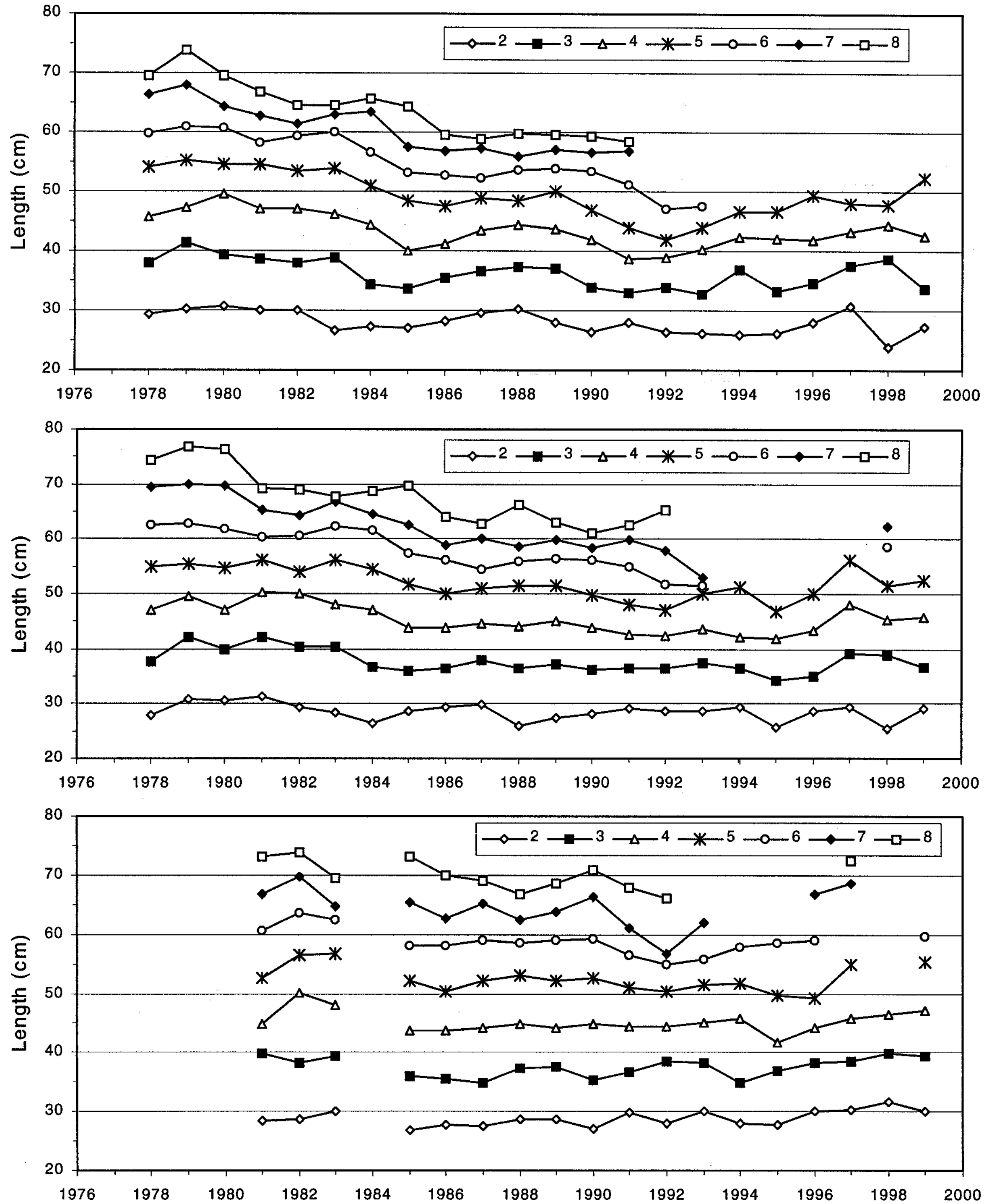


Fig. 20. Mean lengths at ages 2-8 of cod in Divisions 2J, 3K and 3L in 1978-1999, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

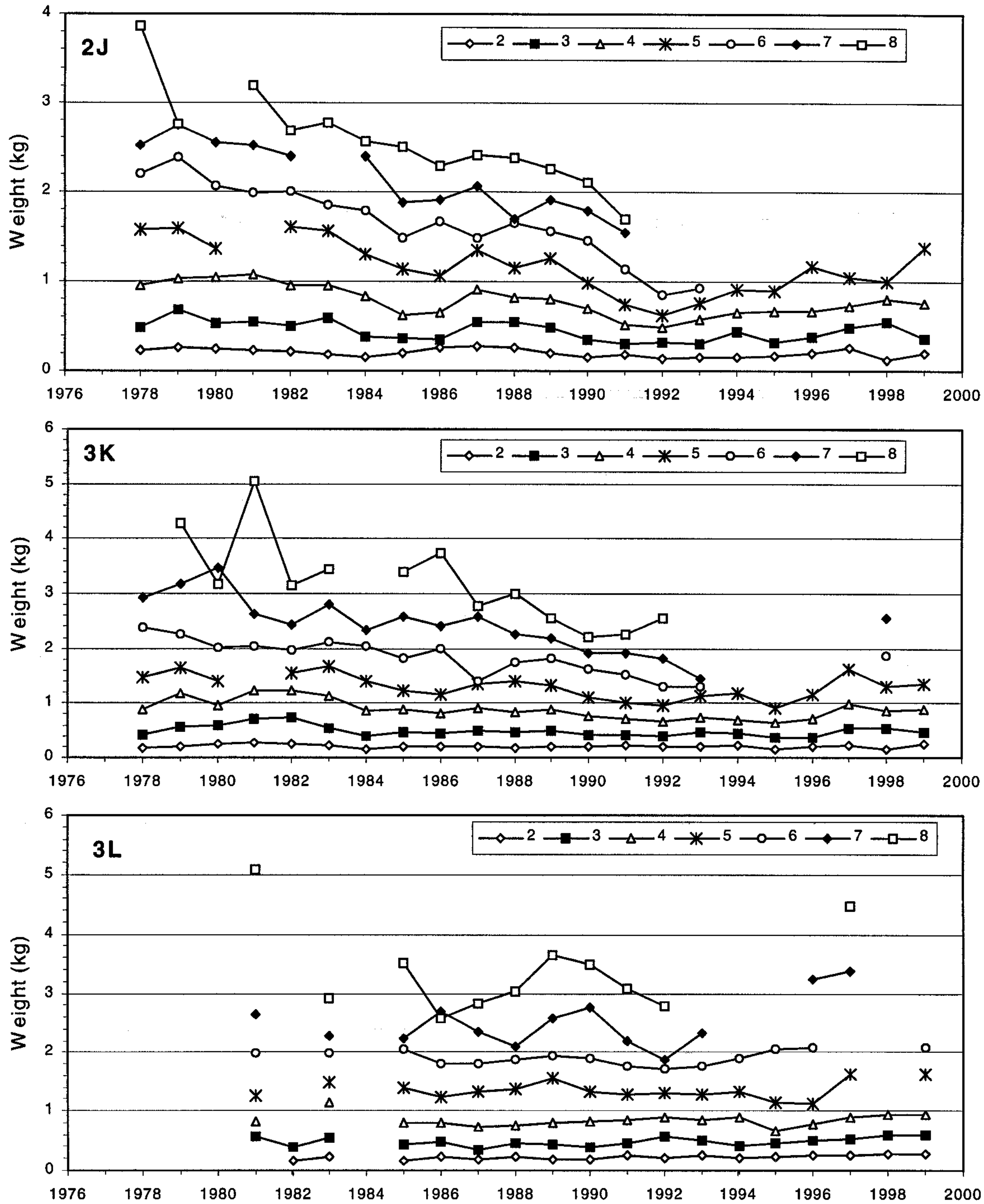


Fig. 21. Mean weights at ages 2-8 of cod in Divisions 2J, 3K and 3L in 1978-1999, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

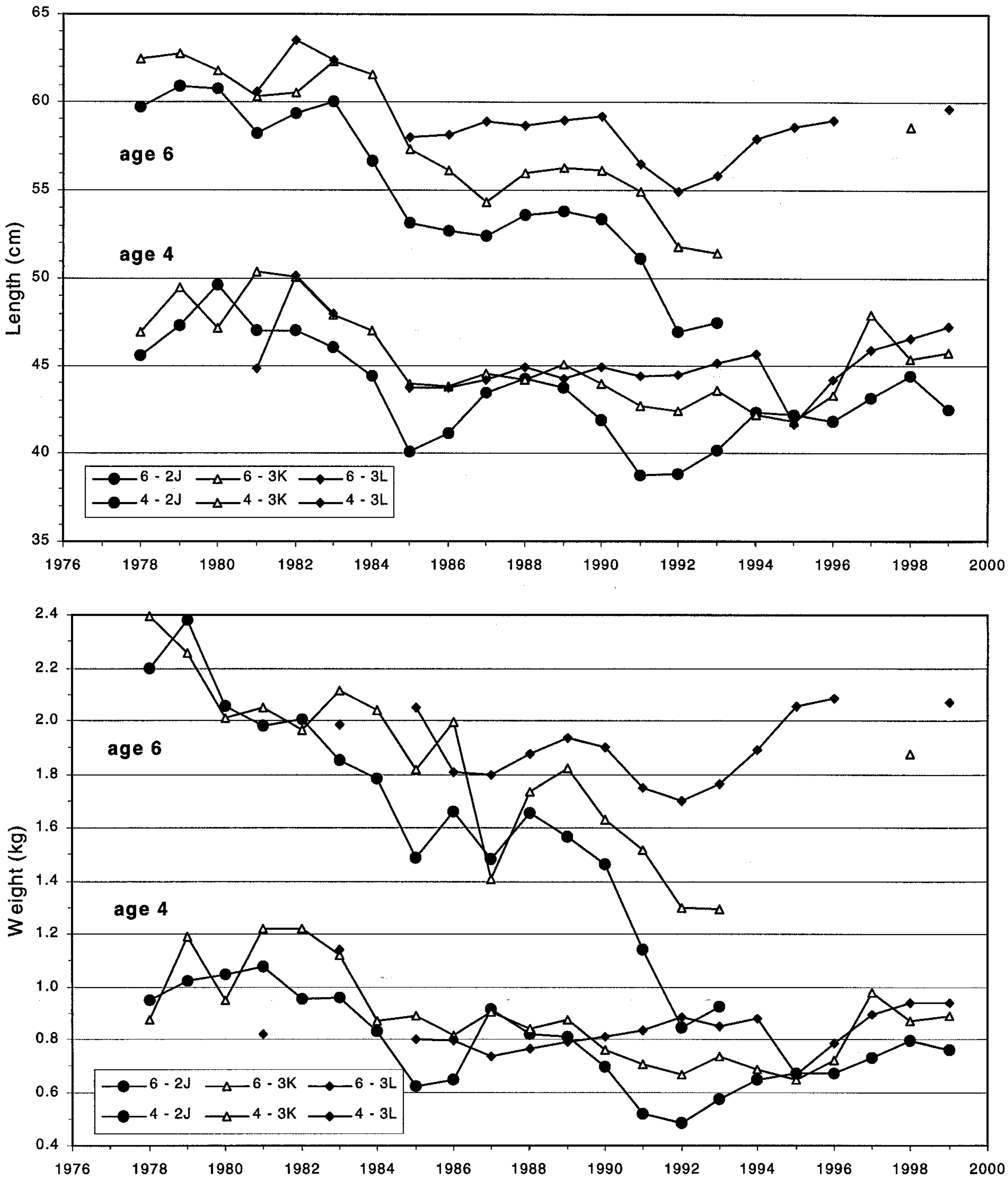


Fig. 22. Mean lengths and weights at ages 4 and 6 of cod in Divisions 2J, 3K and 3L in 1978-1999, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

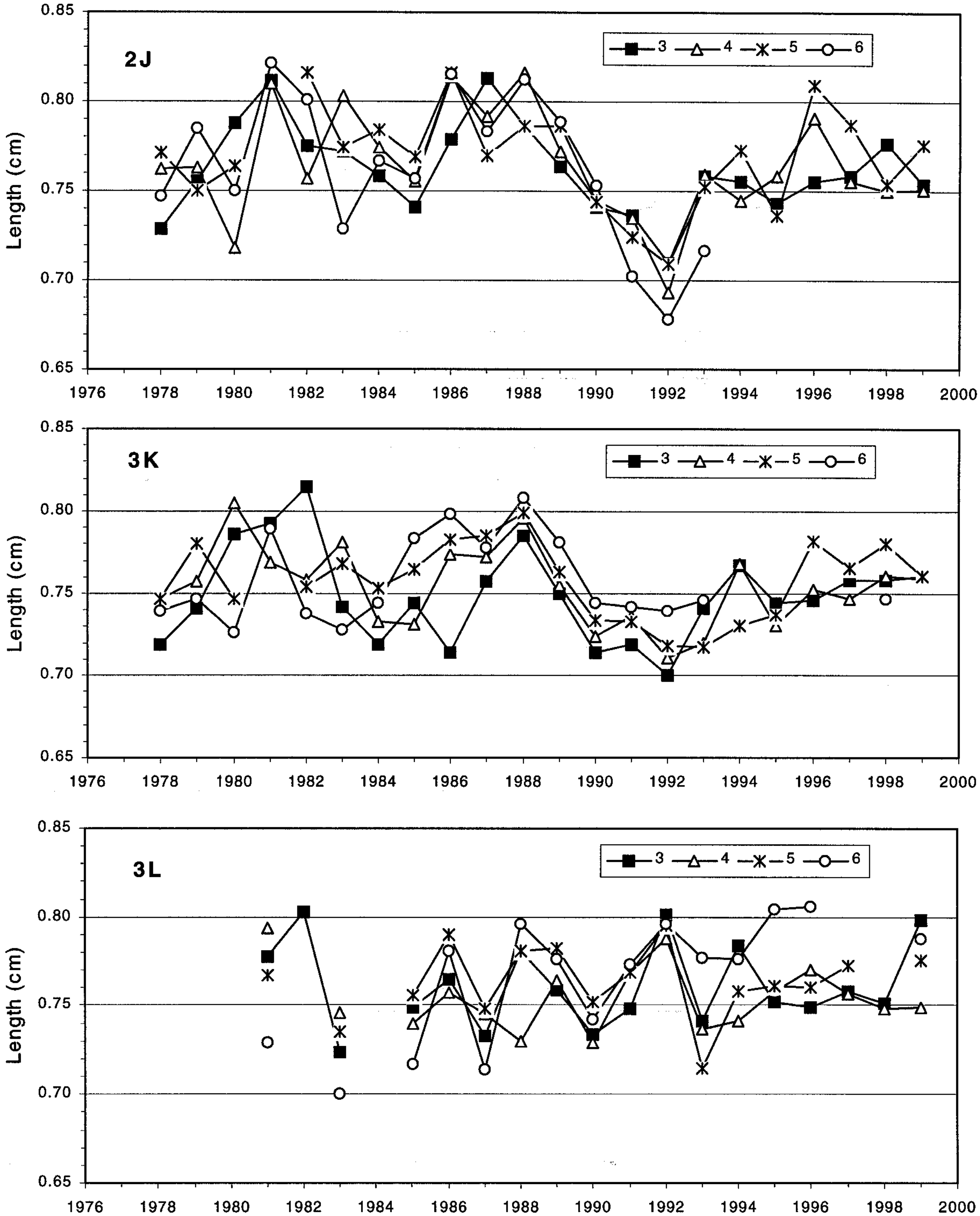


Fig. 23. Mean Fulton's condition (gutted weight) at ages 3-6 of cod in Divisions 2J, 3K and 3L in 1978-1999, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

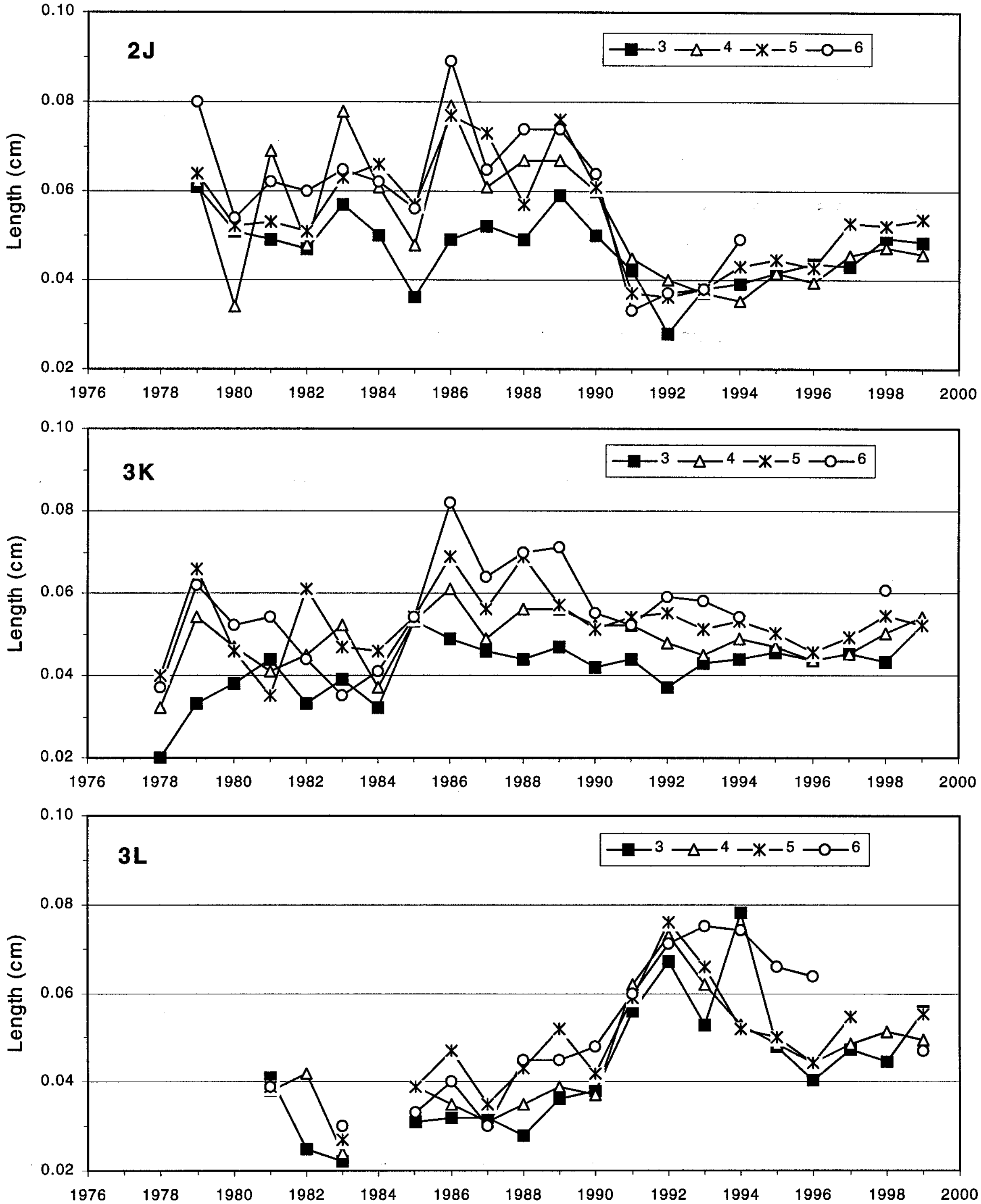


Fig. 24. Mean liver index at ages 3-6 of cod in Divisions 2J, 3K and 3L in 1978-1997, as determined from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish in 1995-1997 are not plotted. There were no surveys in Division 3L in 1978-1980 and 1984.

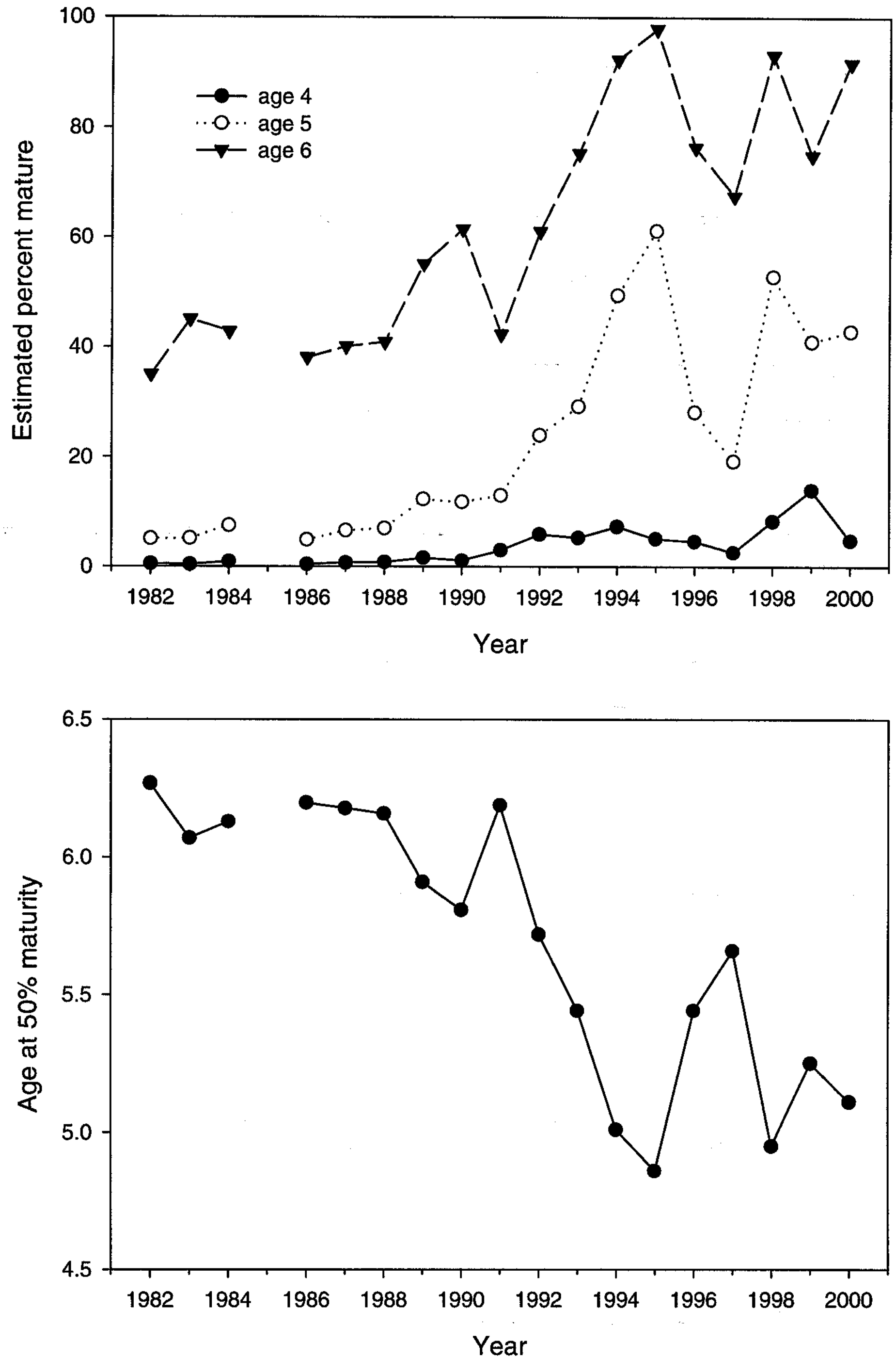


Fig. 25. Estimated proportion mature at ages 4, 5 and 6 for female cod in divisions 2J3KL for January 1 1982-2000 (top panel). Age at 50% maturity over the same period (bottom panel).

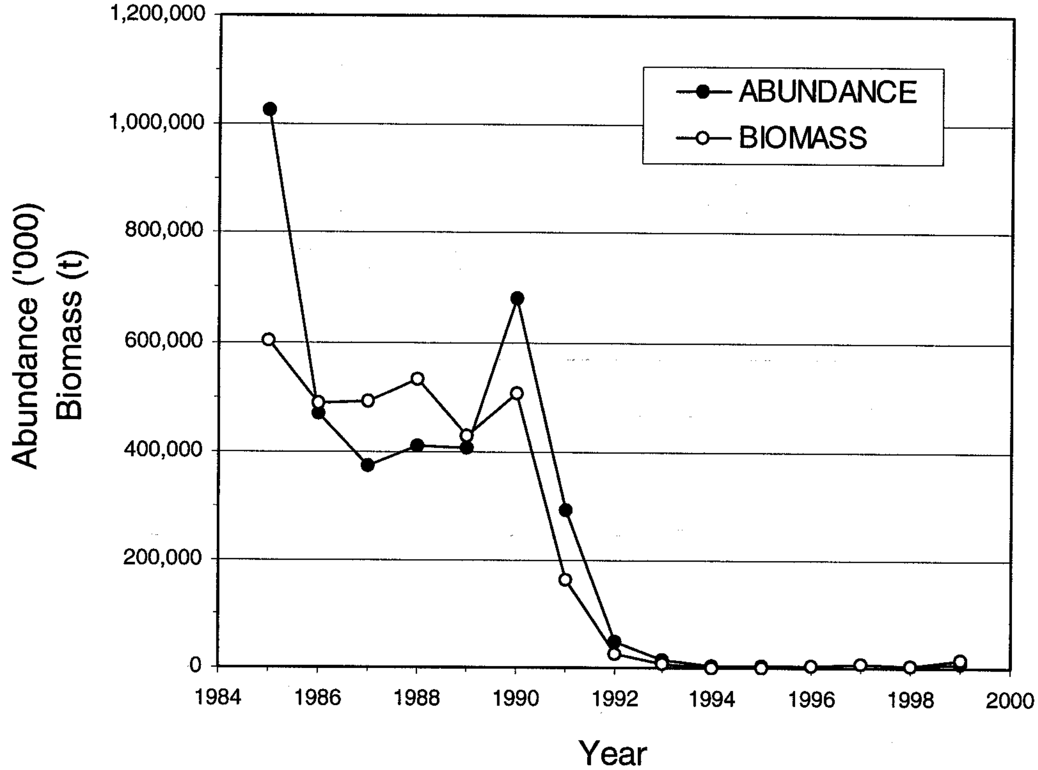


Fig. 26. Indices of abundance and biomass of cod from spring bottom-trawl surveys in Division 3L. Estimates for 1985-1995 are Campelen equivalents.

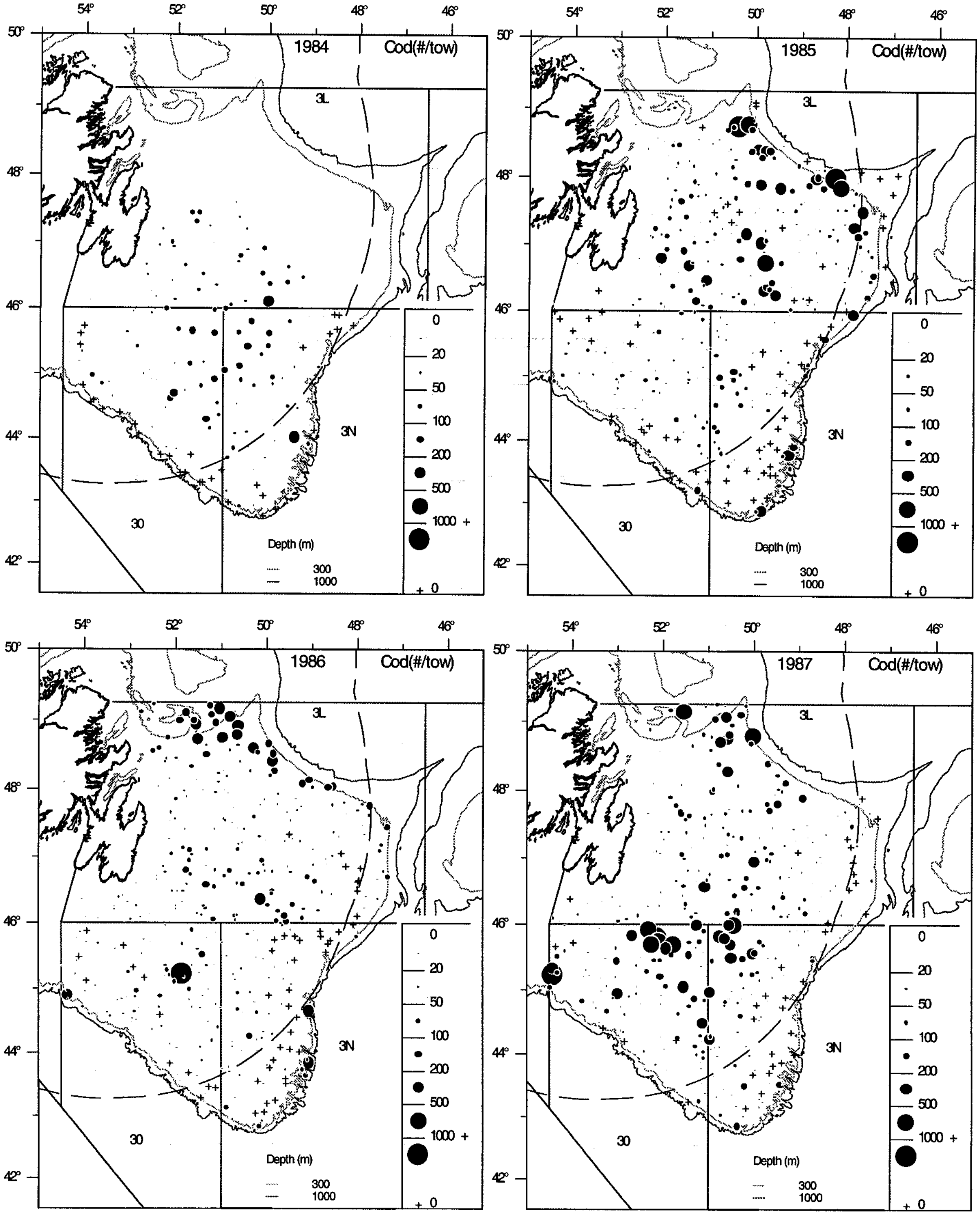


Fig. 27a. Cod distribution (numbers per standard tow) during the spring survey in divisions 3LNO during 1984-1987.

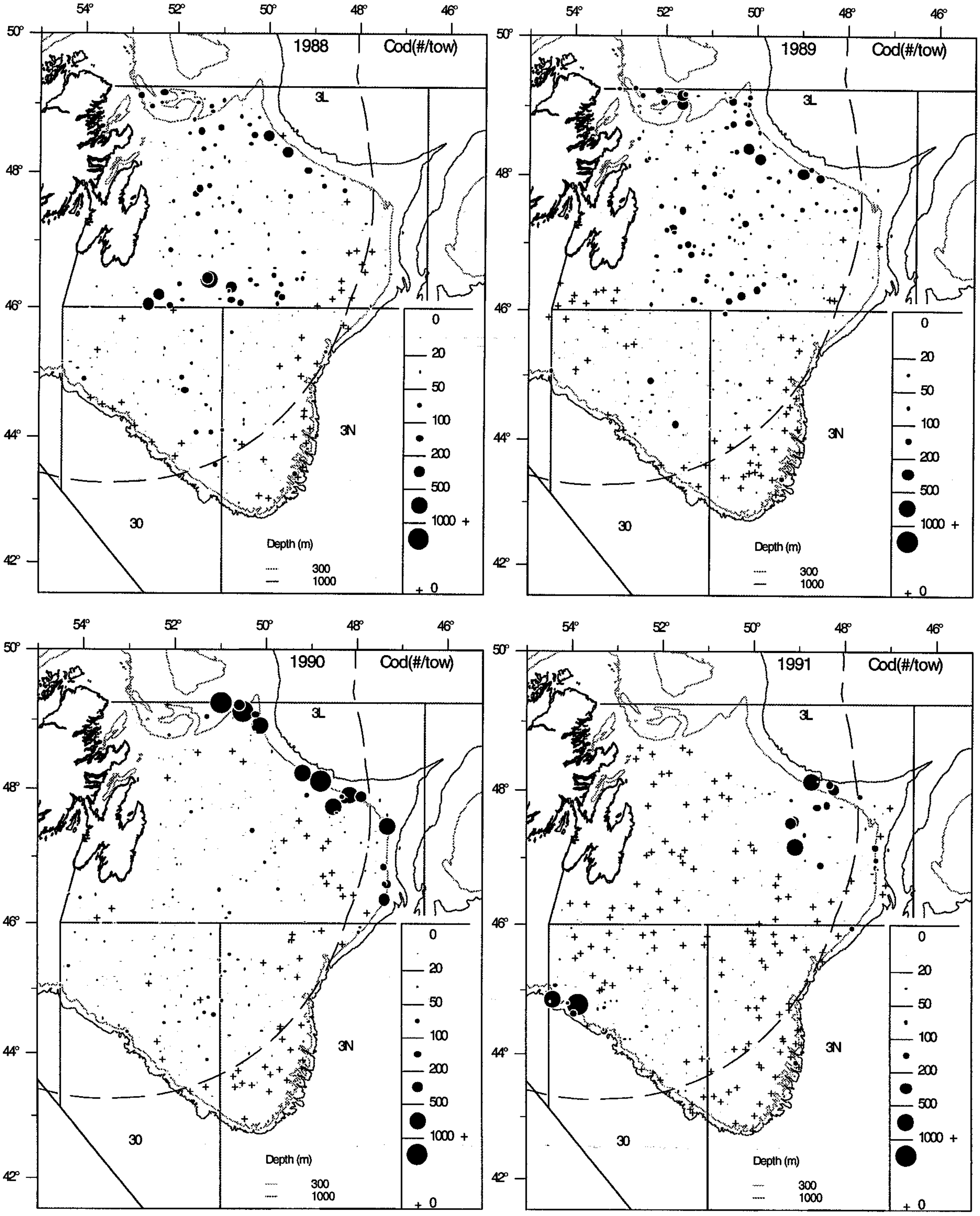


Fig. 27b. Cod distribution (numbers per standard tow) during the spring survey in divisions 3LNO during 1988-1991.

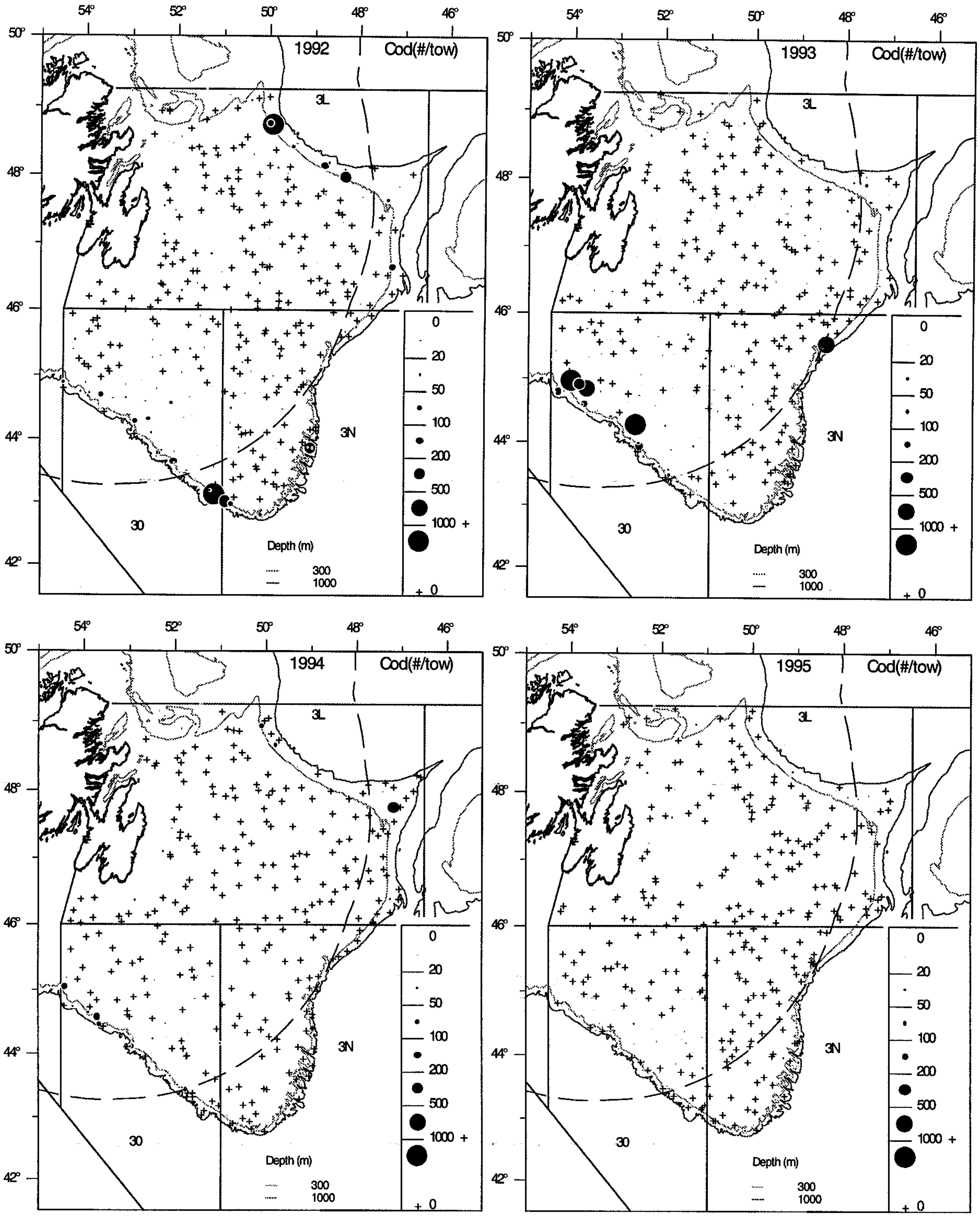


Fig. 27c. Cod distribution (numbers per standard tow) during the spring survey in divisions 3LNO during 1992-1995.

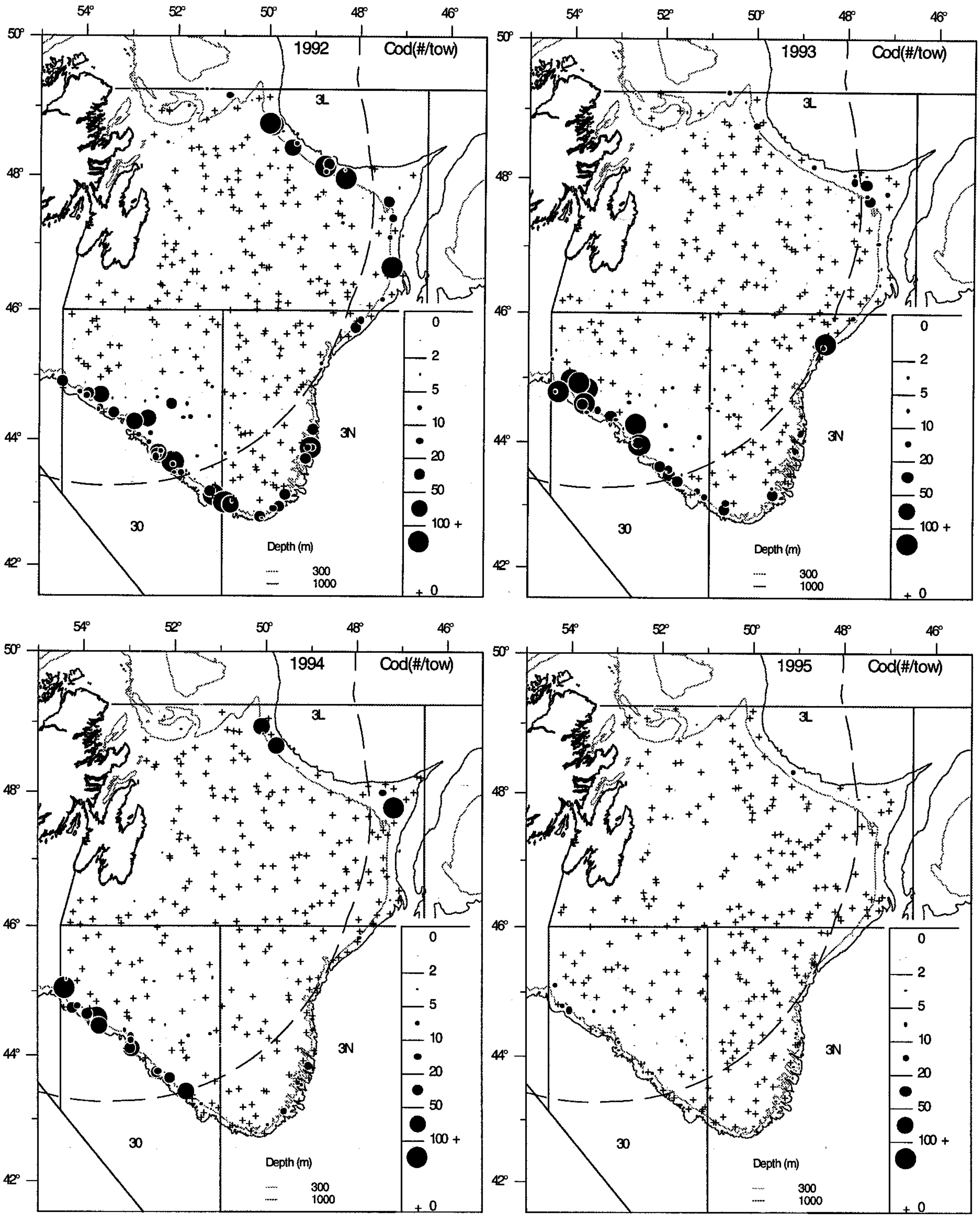


Fig. 28a. Cod distribution (numbers per standard tow) during the spring survey in divisions 3LNO during 1992-1995. (Note change in scale compared with Fig. 27c.)

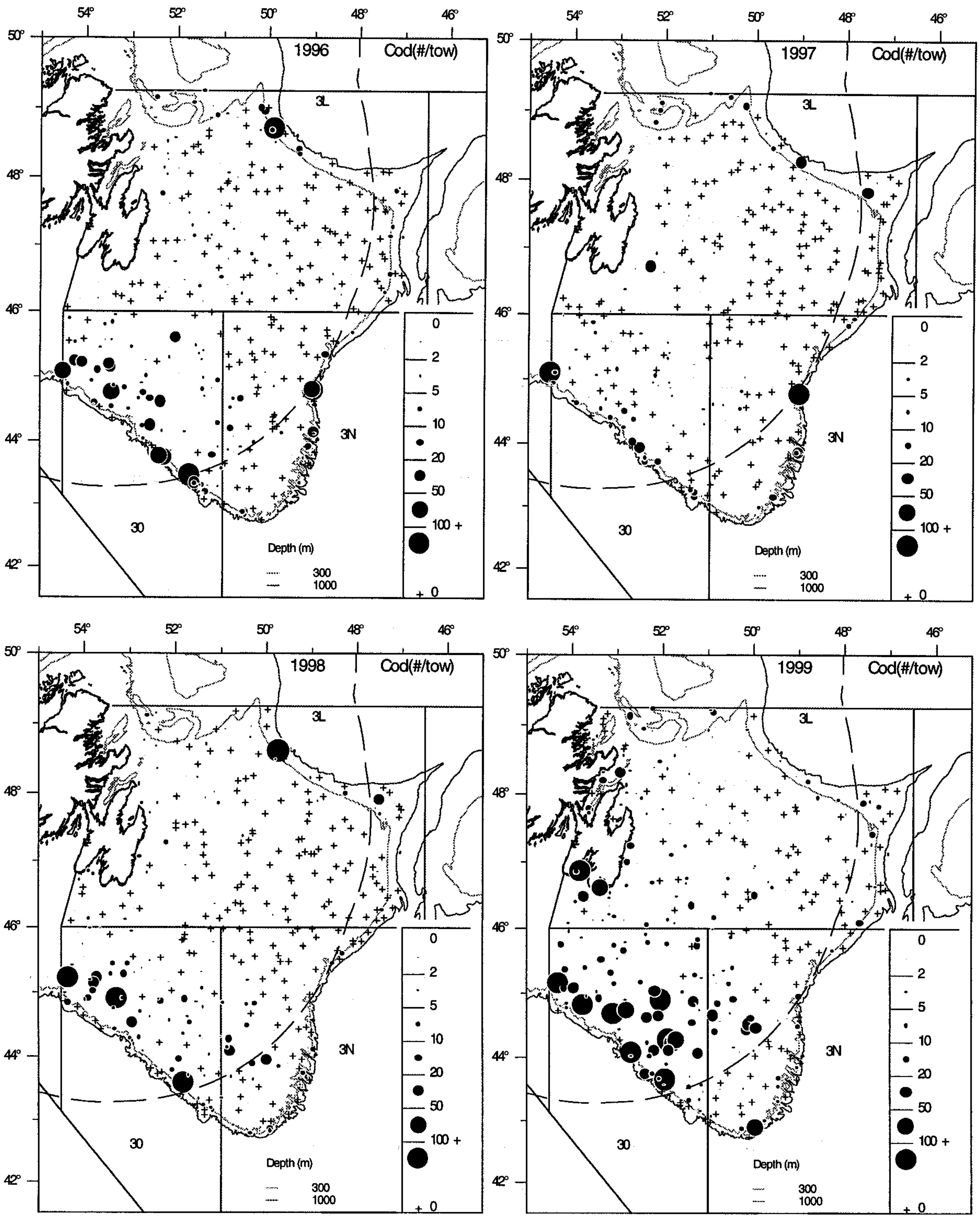


Fig. 28b. Cod distribution (numbers per standard tow) during the spring survey in divisions 3LNO during 1996-1999. (Note change in scale compared with Fig. 27.)

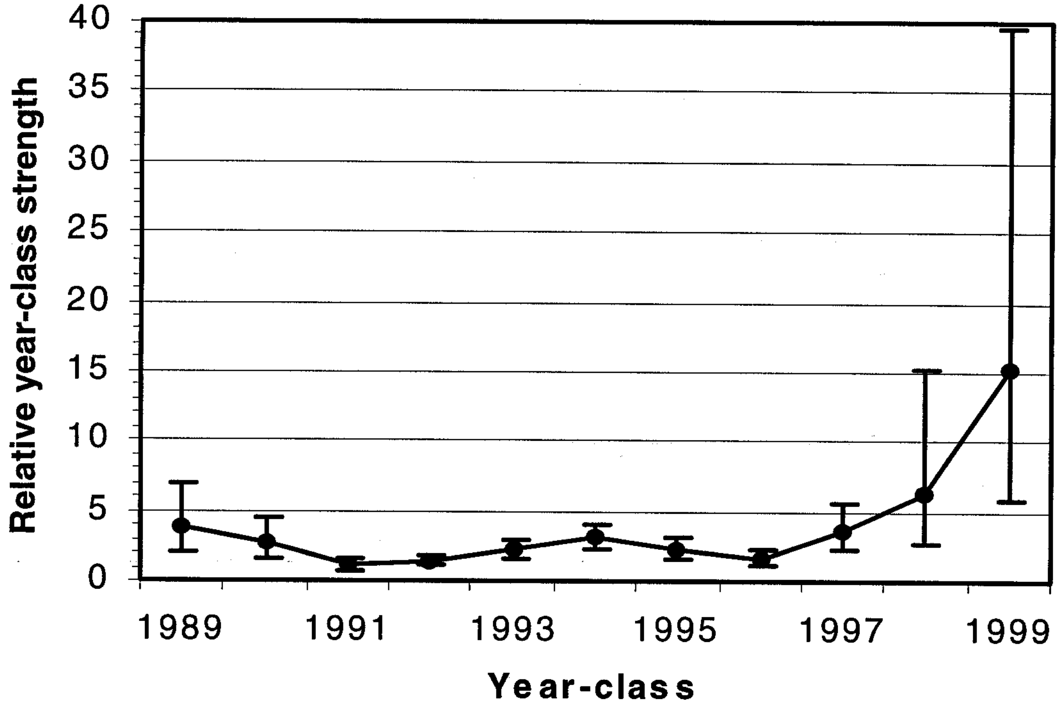
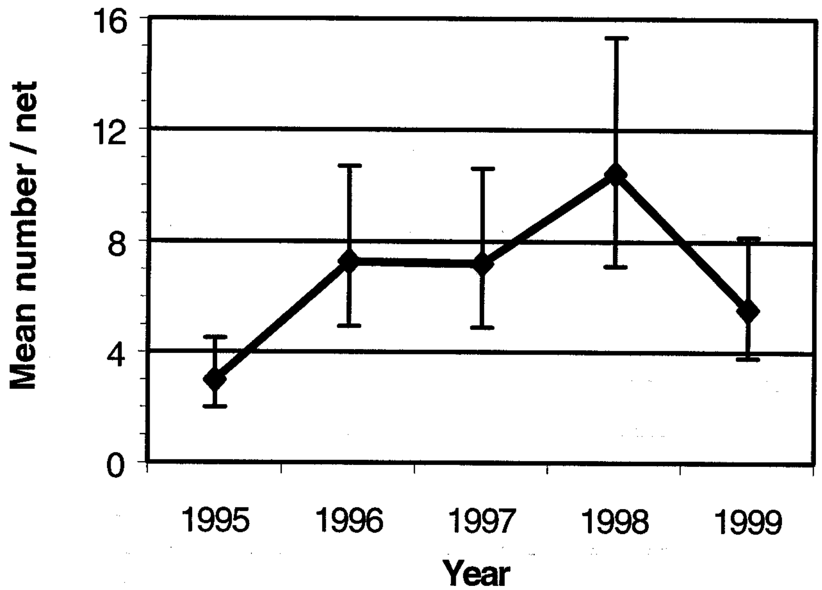


Fig. 29. Standardized year-class strength (see Section 5.3.3).



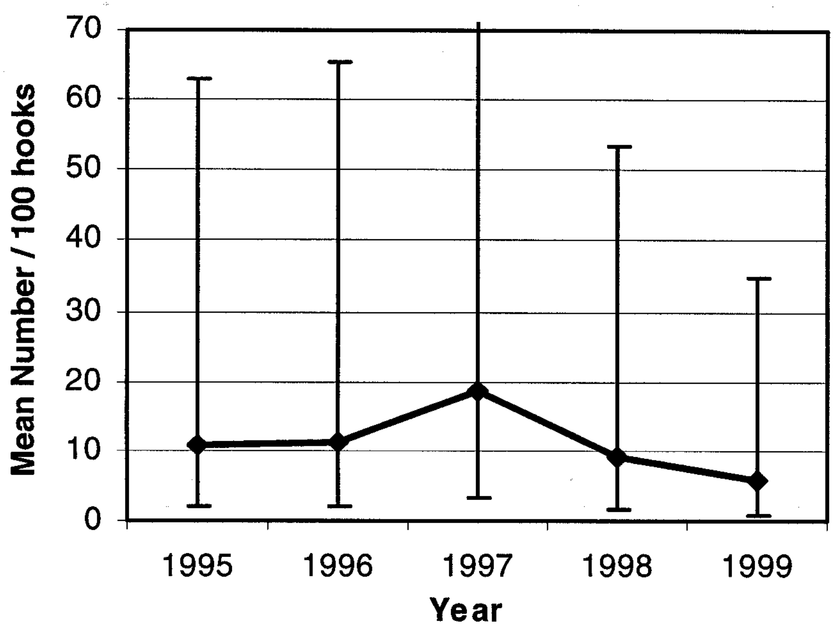


Fig. 30. Standardized catch rates from sentinel surveys in 3KL; gillnets above and linetrawls below.

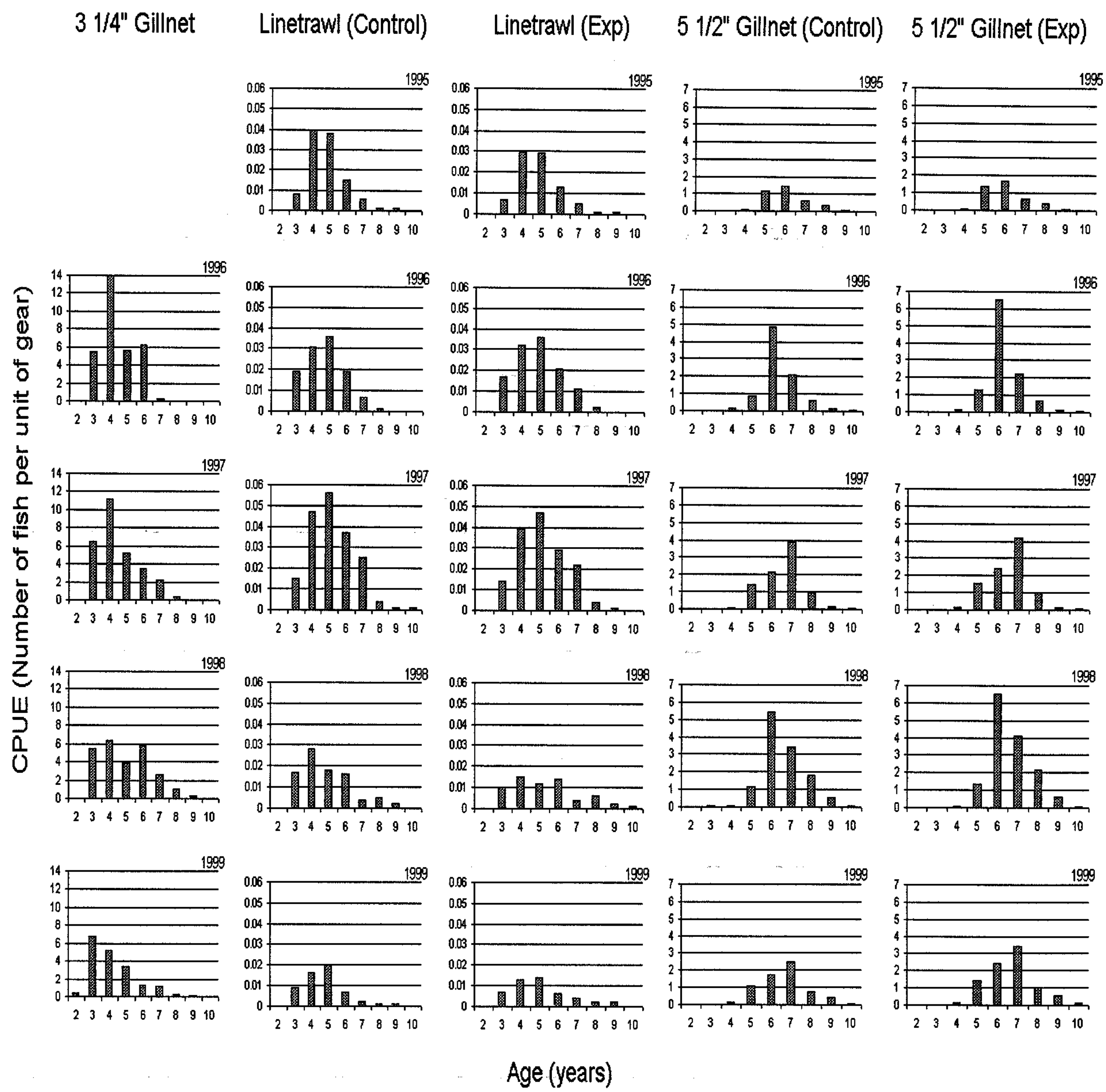


Fig. 31. Standardized catch rate at age for three gear types fished at either fixed or experimental gillnet sites in the sentinel survey.