Fisheries and Oceans Canada / Pêches et Océans Canada
Science / Sciences

C S A S / **S C C S**

Canadian Science Advisory Secretariat / **Secrétariat canadien de consultation scientifique**

Research Document 2009/061 / **Document de recherche 2009/061**

Assessment of the cod (*Gadus morhua*) stock in NAFO Divisions 2J+3KL in 2009

Évaluation du stock de morue (*Gadus morhua*) dans les divisions 2J+3KL de l'OPANO en 2009

J. Brattey, N.G. Cadigan, K. Dwyer, B. P. Healey, M.J. Morgan, E.F. Murphy,
D. Maddock Parsons and D. Power

Science Branch
Department of Fisheries and Oceans
P.O. Box 5667
St. John's NL A1C 5X1

ISSN 1499-3848 (Printed / Imprimé)
ISSN 1919-5044 (Online / En ligne)

Canada

TABLE OF CONTENTS / TABLE DES MATIÈRES

Correct citation for this publication:

Brattey, J., Cadigan, N.G., Dwyer, K., Healey, B.P., Morgan, M.J., Murphy, E.F., Maddock Parsons, D., and Power, D. 2009. Assessment of the cod (*Gadus mor*hua) stock in NAFO Divisions 2J+3KL in 2009. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/061. viii + 92 p.

ABSTRACT

The status of the northern cod (*Gadus morhua*) stock in NAFO Div. 2J+3KL was assessed at a Zonal meeting held in St. John's, NL during 24 February–6 March 2009. A directed "stewardship" cod fishery and a recreational fishery were re-opened in the inshore during 2006 and continued in 2007 and 2008; the offshore remained closed to directed fishing. There was no formal TAC, but commercial fishers were permitted an allowance of 3,000 lb of cod per license holder in 2006, 2,500 lb in 2007, and 3,300 lb in 2008. Recreational fishers were permitted 5 fish per person per day, up to a maximum of 15 fish per boat. Reported total landings from all fisheries in 2008 (stewardship, recreational, sentinel, and by-catch) were 4,162 t. The reported landings are comprised of 3,089 t in the stewardship fishery, which includes 121 t of by-catch, and 818 t in the recreational fishery; an additional 254 t were landed in the sentinel surveys.

Offshore abundance and biomass indices from the autumn DFO research vessel (RV) survey increased further in 2008 and have shown an increasing trend since 2003 at an average annual rate of 30% for abundance and 60% for biomass. Most of the increase is taking place in southern 3K and northern 3L in a region that encompasses only 14% of the total surveyed offshore area. The average index values during the past three years (2006-08) compared to the average of the 1980's have increased to ~8% for abundance, biomass, and spawning stock biomass (SSB). The recent decline in total mortality rate (Z) has persisted and the average annual value for Z in 2007-08 is 0.24 in spite of the resumption of the commercial and recreational fisheries in the inshore; this suggests that the rate of natural mortality (M) has declined substantially and the prospects for stock recovery have improved. Year-class strength in the offshore remains poor compared to the 1980s and most of the improvement in stock status seen in recent years is due to growth and improved survival rates, particularly for the 2000-02 year-classes. A second winter (March 2008) acoustic survey of the traditional over-wintering area along the continental shelf edge encountered a large aggregation (estimated at ~100,000 t total biomass and ~42,000 t SSB) of cod in southern 3K, but cod densities were generally low elsewhere. Offshore tagging and telemetry indicated that a substantial portion of cod from the offshore 3K aggregation migrated to the inshore of 3KL; exploitation of these offshore cod in the inshore (based on tagging) was 6%. This new evidence of inshore migration indicates that the moratorium in the offshore is no longer sufficient to protect the offshore stock until recovery is well established.

In the inshore, sentinel survey gillnet catch rates in the northern area are low but are currently above the average of the time series (1995-2008). In the central area, gillnet and line trawl catch rates have improved consistently since 2003, are above average, and are at a higher level than other inshore areas. In the southern area, catch rates with gillnets have remained stable since 2005, but are marginally below average. Mean exploitation rates (percent harvested) from tagging studies ranged from 3-7% among inshore central and southern areas. Recruitment information, from sentinel small-mesh gillnet and beach seine studies, suggests that the 2003 and 2004 year-classes are weaker than those produced during 2000-02.

Although specific limit reference points for this stock have not been established, overall the stock is well below any reasonable limit reference point and remains in the critical zone with respect to the precautionary approach (PA). Application of the PA would require that any catch in 2009 be at the lowest possible level. This would include no directed fishing and measures to reduce cod by-catch in other fisheries. Status offshore is improving, but the stock has not increased across much of the historical geographic range and management should focus on promoting further increases in SSB and improved recruitment until the stock is more resilient to the effects of fishing. Recent fisheries have resulted in low exploitation rates and permitted growth in SSB in some offshore areas; if fishing is conducted in 2009, exploitation rates should not be allowed to increase. Recruitment information suggests that inshore exploitable biomass in 2009-10 is likely to be similar to 2008-09; therefore, to achieve the same exploitation rates as in 2008 total removals (recreational plus commercial) should not be allowed to increase. In addition, catch rates in the inshore northern area, are lower than in other inshore areas suggesting lower cod abundance. Fisheries in the northern area depend on seasonal immigration of fish, possibly from offshore regions, including offshore 2J where biomass remains low. Therefore, it would be prudent to minimize removals from this area. In the inshore southern area, catches are partly dependant on seasonal immigration of cod from 3Ps where the stock is declining; future removals may therefore rely more heavily on cod from the offshore of 3KL.

RÉSUMÉ

L'état du stock de morue du Nord (*Gadus morhua*) dans les divisions 2J+3KL de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO) a été évalué à l'occasion d'une réunion zonale tenue à St. John's, Terre-Neuve, du 24 février au 6 mars 2009. Une pêche d'intendance dirigée de la morue et une pêche récréative ont été rouvertes dans les eaux côtières en 2006 et elles se sont poursuivies en 2007 et 2008; les eaux du large sont demeurées fermées à la pêche dirigée ces deux années. Aucun TAC (total autorisé des captures) n'a été officiellement établi, mais chaque titulaire de permis de pêche commerciale a été autorisé à capturer 3 000 livres de morue en 2006, 2 500 livres en 2007 et 3 300 livres en 2008. Les pêcheurs récréatifs ont été autorisés à capturer 5 poissons par personne par jour, jusqu'à un maximum de 15 poissons par bateau. Les débarquements totaux déclarés pour l'ensemble des pêches en 2008 (intendance, récréative, relevés sentinelles et prises accessoires) se sont établis à 4 162 t. Ce total comprenait 3 089 t pour la pêche d'intendance, dont 121 t de prises accessoires et 818 t dans les pêches récréatives; un total de 254 t supplémentaires ont été débarquées dans le cadre des relevés sentinelles.

Les indices de l'abondance hauturière et de la biomasse établis à partir des relevés d'automne par navire scientifique du MPO ont continué d'augmenter en 2008 et montrent une tendance à la hausse depuis 2003 à un taux annuel moyen de 30 % pour l'abondance et de 60 % pour la biomasse. La majeure partie de cette augmentation est enregistrée au sud de 3K et au nord de 3L, dans une région qui n'englobe que 14 % de la superficie totale des eaux du large couverte par des relevés. Au cours des trois dernières années (2006 à 2008), les valeurs moyennes des indices ont augmenté d'environ 8 % par rapport à la moyenne enregistrée pendant les années 1980 pour ce qui est de l'abondance, de la biomasse, et de la biomasse du stock reproducteur (BSR). Le récent déclin du taux de mortalité totale s'est maintenu et le taux moyen de mortalité totale pour 2007-2008 s'est établi à 0,24, en dépit de la reprise des pêches commerciale et récréative dans les eaux côtières; cela laisse croire que le taux de mortalité naturelle a diminué de façon marquée et que les perspectives concernant le rétablissement du stock se sont améliorées. L'importance des classes d'âge dans les eaux côtières demeure faible comparativement aux années 1980 et la majeure partie de l'amélioration de l'état du stock

constaté au cours des récentes années est attribuable à la croissance et à de meilleurs taux de survie, en particulier pour les classes d'âge de 2000 à 2002. Un second relevé acoustique mené en hiver (mars 2008) dans la zone d'hivernage traditionnelle qui suit le bord du plateau continental a permis la découverte de denses concentrations de morues (biomasse totale évaluée à environ 100 000 t et BSR évaluée à environ 42 000 t) dans le sud de 3K, mais la densité des concentrations de morues était généralement plus faible ailleurs. Des expériences de marquage et des études par télémétrie menées au large ont révélé qu'une portion importante des morues des concentrations du large de 3K migrait vers les eaux côtières de 3KL; l'exploitation de cette morue du large dans les pêches côtières (d'après le marquage) était de 6 %. Les nouvelles preuves de migration vers les eaux côtières révèlent que le moratoire imposé dans les eaux du large ne suffit plus pour protéger le stock du large, tant que le rétablissement n'est pas clairement établi.

Dans les eaux côtières, les taux de prise des relevés sentinelles à filet maillant menés dans la zone du nord sont faibles, mais ils sont actuellement supérieurs à la moyenne de la série chronologique (1995-2008). Dans la zone centrale, les taux de prise au filet maillant et à la palangre se sont améliorés de façon constante depuis 2003; ils sont supérieurs à la moyenne, et supérieurs à ceux des autres zones côtières. Dans la zone du sud, les taux de prise avec des filets maillants sont demeurés stables depuis 2005, mais sont légèrement inférieurs à la moyenne. Les taux d'exploitation moyens (pourcentage récolté) établis à l'aide des études de marquage allaient de 3 à 7 % dans les zones côtières du centre et du sud. Les données sur le recrutement, tirées des relevés sentinelles au filet maillant à maillage serré et des relevés à la senne de plage, laissent croire que les classes d'âge de 2003 et de 2004 sont moins abondantes que celles des années 2000 à 2002.

Même si aucun point de référence limite particulier n'a été établi, le stock dans son ensemble est bien en deçà de tout point de référence limite acceptable et demeure dans la zone critique en ce qui a trait à l'approche de précaution. L'application de l'approche de précaution exigerait que les prises, en 2009, soient maintenues au plus bas niveau possible. Cela comprend l'interdiction de la pêche dirigée et la prise de mesures pour réduire les prises accessoires de morues dans les autres pêches. L'état du stock du large s'améliore, mais celui-ci ne s'est pas accru dans la majeure partie de son aire de répartition historique. Les gestionnaires devraient axer leurs efforts sur la poursuite de l'augmentation de la BSR et l'amélioration du recrutement jusqu'à ce que le stock soit devenu plus résilient aux effets de la pêche. Les récentes pêches ont donné de faibles taux d'exploitation et ont permis une croissance de la BSR dans certaines zones au large; si la pêche est permise en 2009, les taux d'exploitation ne doivent pas augmenter. Les données sur le recrutement laissent sous-entendre que la biomasse exploitable dans les eaux côtières en 2009-2010 devrait être similaire à celle de 2008-2009. Par conséquent, pour obtenir les mêmes taux d'exploitation qu'en 2008, il faut éviter d'accroître les prélèvements totaux (pêche récréative plus pêche commerciale). De plus, les taux de prise dans la zone côtière du nord sont inférieurs à ceux des autres zones côtières, ce qui laisse sous-entendre une abondance de la morue moins élevée. Les pêches pratiquées dans la zone du nord sont tributaires de l'immigration saisonnière de poissons provenant probablement des régions du large, y compris les eaux du large de 2J où la biomasse demeure faible. En conséquence, il serait prudent de limiter les prélèvements dans cette zone. Dans la zone côtière du sud, les prises sont en partie fonction de l'immigration saisonnière de poissons provenant de 3Ps, où le stock est en déclin. Les prélèvements futurs peuvent, par conséquent, être davantage tributaires des morues provenant des eaux du large de 3KL.

INTRODUCTION

This document gives an account of the 2009 assessment of the northern (NAFO Div. 2J+3KL) cod (*Gadus morhua*) stock that inhabits waters off southern Labrador and eastern Newfoundland eastward to the edge of the continental shelf (Figs. 1a-1c). The current evaluation of the stock was conducted through a zonal assessment process (ZAP) where the status of 5 cod stocks in Atlantic Canada (2J3KL, 3Ps, 3Pn 4RS, 4TVn and 4X/5Y cod) was assessed. Participants included DFO Scientists, fisheries managers, and officials from provincial governments, fishing industry members, external experts and academia. The assessment was conducted during 26 February-6 March 2009 in St. John's, NL. Proceedings of the 2009 assessment meeting and a Science Advisory Report (SAR) for the 2J3KL stock have also been produced (DFO 2009a, 2009b). Details of previous assessments are reported elsewhere (Bishop 1994; Bishop and Shelton 1997; Bishop et al. 1993, 1994, 1995; Shelton et al. 1996; Lilly et al. 1998a; 1999, 2000, 2001, 2003, 2004, 2005; 2006; Brattey et al. 2008a).

To address the terms of reference (see DFO 2009a) data from several sources were reviewed. Physical, chemical, and biological oceanographic information was presented (Colbourne et al. 2008, 2009; DFO 2008a, b). Broad-scale changes in some major ecosystem components as well as potential key predators and prey were also reviewed. Commercial catch information was examined. For the offshore, indices of abundance, biomass and other biological characteristics were obtained from multi-species research vessel bottom-trawl (RV) surveys conducted by Fisheries and Oceans Canada (DFO) in Div. 2J3KL during the autumn (1983-2008). Information on recruitment and total mortality is obtained from catch rate at age in the autumn surveys. An offshore hydroacoustic-tagging-telemetry survey was initiated in February-March 2007 and repeated in March 2008. This survey provides information on the distribution, abundance, and subsequent movements of cod in the traditional over-wintering area along the continental shelf edge of 2J3KL. For the inshore, indices of abundance are provided by DFO-Industry fixed-gear Sentinel surveys (1995-2008), which are conducted by two traditional gears, gillnets of 5½ inch mesh and line-trawls, and a non-traditional 3¼ inch mesh gillnet (1996-2008) which is intended to provide information on young fish. Logbooks from vessels <35 ft for the fisheries in 1998-2002 and 2006-07 are typically examined for catch rate information, but logbooks from the 2008 fishery were not available. Tagging studies provide information on exploitation, distribution and migration; these were initiated in 1997 and were continued in 2006-08. Telemetry studies were also conducted in 2005-08 to investigate cod movement patterns and survival rates. Winter hydro-acoustic surveys (Rose 2003) of an over-wintering inshore aggregation in Smith Sound, Trinity Bay were conducted during 1997-2004 and in 2006-08. Annual telephone surveys of fish harvesters' observations is conducted by the Fish, Food and Allied Workers (FFAW) Union and results for the fisheries in 2008 are reported. Information on the relative abundance of young (age 0 and age 1) cod is provided by beach seine studies in Newman Sound, Bonavista Bay during 1996-2008. Information on the size and age composition of the commercial catch is obtained from lengths and otoliths collected from cod sampled at ports and at sea. DFO-Industry bottom-trawl surveys were conducted during July-August 2006-2008 using small (<65 ft) commercial vessels was continued in 2007 and 2008. This inshore trawl survey provides information on the relative abundance, age composition and distribution of cod inhabiting the coastal and near-shore area of 2J3KL.

ECOSYSTEM INFORMATION

At the 2009 assessment, ecosystem information was presented in the form on an overview of major signals and trends in various components of the marine fish and shellfish community off Newfoundland and Labrador. These findings are part of an ecosystem research initiative (ERI) which is part of a major focus of DFO Science activities over the next five years (see www.dfo.gc.ca/science/publications). Trends in biomass (B), abundance (A) and BA ratios of key species groups were examined based mainly on time series of catch data (1981-2008) from autumn research vessel (RV) surveys. Fish species were grouped into six major functional groups, namely: small benthivores [45 species] (max size <45 cm, e.g., alligator fish [*Aspidophoroides* sp., sculpins [*Myoxocephalus* spp.]), medium benthivores [34 species] (45 cm<max size <80 cm, e.g., yellowtail flounder [*Limanda ferruginea*], lumpfish [*Cyclopterus lumpus*]), large benthivores [29 species] (max size >80 cm, e.g., American plaice [*Hippoglossoides platessoides*), piscivores [31 species] (e.g., Atlantic cod, turbot [*Reinhardtius hippoglossoides*], Atlantic halibut [*Hippoglossus hippoglossus*]), plankton-piscivores [8 species] (e.g., redfish [*Sebastes* spp.], Arctic cod [*Boreogadus saida*]), planktivores [14 species] (e.g., capelin [*Mallotus villosus*], herring [*Clupea harengus*], butterfish [*Peprilus triacanthus*]). Biomass time-series for *Pandalus* shrimps and Snow crab (*Chionoecetes opilio*] were examined. The time series of survey catches was broken in 2 periods based on the gear used (Engels and Campelen trawls). Index values are not directly comparable between gears due to differences in catchabilities. There are no conversion coefficients for most species.

During the late 1980s and early 1990s the fish community in the Newfoundland and Labrador large marine ecosystem collapsed. This collapse was more dramatic in the northern regions and involved commercial and non-commercial species. Most fish functional groups showed significant declines in their BA ratio, which generally indicates loss of large fish. During the late 1980's and early 1990's there was an increasing trend in the population size of harp seals and a build-up of shrimp biomass; since the mid-1900s harp seals and shrimp have maintained a high population size. Since 2002-03 there is an increasing trend in the fish biomass, more so in 2J3KL than for 3NO. Abundance is also increasing, but the trend is less pronounced compared to biomass. The BA trends also show an increasing trend in some functional groups in 2J3KL. Some components of the fish community (e.g., piscivores such as Atlantic cod, turbot, and Atlantic halibut) and large benthivores (e.g., American plaice) appear to be showing some positive signals, but still remain at a significantly lower level in comparison to the pre-collapse period. These are the first significant changes observed in ecosystem structure since the collapse.

OCEANOGRAPHY

Oceanographic information (Colbourne et al. 2008, 2009; DFO, 2008a, 2008b) indicates that the marine environment off Labrador and eastern Newfoundland experienced considerable variability since the start of standardized measurements in the mid-1940s. A general warming phase reached its maximum by the mid-1960s. Beginning in the early 1970s there was a general downward trend in ocean temperatures, with particularly cold periods in the early 1970s, early to mid-1980s and early 1990s. Ocean temperatures have been above normal for the past decade, with 2006 at a record high, but temperatures in 2007 declined to nearer normal values.

Cod in the 2J3KL stock area may be more productive when water temperatures are toward the warm end of the regional norm; consistent with this observation cod in the offshore have shown improved growth rates since the low values of the early 1990s when water temperatures were low.

Recent environmental indicators for the 2J3KL stock area are generally positive. Water temperatures are at the high end of historic range, nutrient and phytoplankton inventories have been variable with no clear trend over time. Secondary productivity shows signs of improvement with the overall abundance of zooplankton species above the long-term mean after 2004. Recent trends in these indicators coincide with the recent increases in cod abundance and biomass in the offshore; though it is noteworthy that there are as yet no clear signs of improved cod recruitment in the 2J3KL area.

PREDATORS

Summary information from the second workshop to review the impacts of seals on Atlantic cod stocks in eastern Canadian waters was presented; the report of the second workshop was not available at the time of the cod assessment meeting. Some studies indicated an increase in the amount of cod consumed by harp seals since the late 1980s due, primarily, to increased occurrence of Atlantic cod in near shore diet samples. However, estimates of total 2J3KL cod consumption by harp seals are uncertain; estimation of diet composition is also highly method-dependant. Analyses presented in 2001 indicated that harp seals may have an impact on the recovery of 2J3KL cod. More recently, ongoing analyses from a simple biomass based model exploring the impact of harp seals on cod under a wide range of consumption estimates suggests that harp seal predation is not a significant factor in the lack of recovery to date.

Hooded seals and cetaceans are also found in significant numbers in the 2J3KL stock area; diet studies indicate that cod are eaten by hooded seals and some cetacean species but the overall impacts of these predators on cod are not known.

White hake (*Urophycis tenuis*) have been identified as an important predator of cod <1yr old in the nearshore environment.

PREY

Capelin is a key prey item for cod. An index of offshore capelin biomass, based on hydroacoustic surveys, indicates that capelin biomass was high in the 1980s, but dropped dramatically in the early 1990s and remained low for several years. No offshore biomass estimates are available for 2005 and 2006 due to incomplete or missed surveys; however, acoustic surveys indicate an increasing trend in capelin biomass offshore in the most recent years. In the inshore, indices of capelin biomass did not show such extensive declines in the early 1990's; inshore indices are no longer available. Overall, the status of capelin appears to be improving and the timing of the improvement coincides with the recent increases observed in biomass of cod in portions of the offshore. However, capelin biomass is still well below the level of the late 1980’s.

REPORTED LANDINGS OF COD

Reported landings from this stock from the 1950’s until 2007 are described in detail in Lilly et al. (2006) and Brattey et al. (2008a). An updated table of the entire time-series of landings is provided (Table 1, Figs. 2, 3). Fixed gear landings from 1975 to 2008 are also summarized (Table 2, Fig. 4). New landings information is described here for the stewardship and recreational fishery in 2008 (Table 3).

REPORTED LANDINGS DURING 2008

During the 2008 “stewardship” fishery the offshore remained closed to directed fishing. There was no formal TAC; commercial fishers were permitted an allowance of 3,300 lb of cod per license holder. Recreational fishers were permitted 5 groundfish per person day, and no more than 15 fish per boat.

Reported total landings from all fisheries in 2008 (stewardship, recreational, sentinel, and by-catch) were 4,162 t (Tables 1-3, Fig. 5). The catch is comprised of 3,089 t in the stewardship fishery, which includes 121 t of by-catch in the winter flounder (*Pseudopleuronectes americanus*) fishery and the Greenland halibut (turbot) test fishery in northern 3L. An additional 254 t were landed in the sentinel surveys.

Landings from the 2008 recreational fishery were estimated at 818 t based on results from a statistically designed telephone survey, which provided an estimate of recreational effort and the total number of fish landed. The estimate of total recreational landings assumed an average weight per fish of 1.5 kg based on an average mean length for all areas; as such this estimate is provisional and will be revised when the more detailed length information based on actual sampling of recreational fishery catches in each area becomes available. This information was not available at the time of the assessment. Further information on landings from the 2008 fishery, based on tag returns, is given later in this document (see Tagging and Telemetry section).

Estimates of commercial catch are also uncertain. Commercial fishers have commented at previous 2J3KL cod assessments that commercial landings are underestimated.

An estimate is not yet available for the 2008 catch by non-Canadian fleets outside the 200 nautical mile limit on the Nose of the Grand Bank (Div. 3L). The Scientific Council of the Northwest Atlantic Fisheries Organization (NAFO) reported that the annual catch of cod in the regulatory area during 2000-2007 was 80 t or less and has been declining.

Most of the landings in 2008 were from inshore areas during July-September, particularly unit area 3Ki (Fig. 1c) where there is a concentration of commercial effort (>700 active licenses) and reported landings (including recreational) exceeded 1,075 t (Table 3). Overall, the catch was concentrated inshore in Notre Dame Bay (3Kh/3Ki, >1,500 t), Bonavista Bay (3La, 680 t) and Trinity Bay (3Lb, 643 t). Catches and effort were much lower in the north (2J, 79 t) and in the extreme south (3Lq, 88 t).

BY-CATCH OF COD IN OTHER FISHERIES

By-catches of cod occur in ongoing Canadian and non-Canadian fisheries. All recorded by-catch has been incorporated into the catch (Tables 1-3), but not all by-catch is recorded and this is another reason why total catch is considered uncertain.

In the offshore, by-catches of cod by Canadian fleets have mostly come from an experimental gillnet fisheries for Greenland halibut at depths of 160-300 fathoms in northern 3L during late summer and autumn (August-November). Reported cod by-catch in this fishery in 2008 was 67 t. Further details of the time-series of cod by-catch in this fishery are provided later in this document.

In the inshore, by-catches are common in gillnet fisheries for lumpfish and especially winter flounder (blackback). They also occur in the herring gillnet fishery, the capelin trap fishery, and the bait-net fishery. Note that for winter flounder and herring there are both commercial fisheries and bait fisheries. The only inshore fishery that has been studied specifically for by-catch is the herring gillnet bait fishery, in which by-catches of cod appeared to be small (Reddin et al. 2002).

DISCARDS

The discarding of cod in the shrimp fishery was dramatically reduced with the introduction of the Nordmore grate in 1993 (Kulka 1998). Total discards from the large-vessel shrimp fishery in 2J3K were 5 t in 1995 and 13 t in 1996 (Kulka 1998).

Shrimp quotas increased dramatically during the late 1990’s, and a new fleet of smaller trawlers entered the fishery in 1997. The level of observer coverage in this fleet of smaller vessels has been low (Orr et al. 2002). Therefore, the total quantity of discards may have increased since the mid-1990's, and the opportunities for observing such discards have declined.

Shrimp fisheries expanded into Div. 3L during the 1990's and increased considerably starting in 2000. Studies during the early years of these fisheries indicated that there was little overlap between the distributions of shrimp and small cod during the autumns of 1995-98 (Orr et al. 1999), and the discards of cod by small and large shrimp vessels combined was less than 1 t annually during 2000 and 2001 (Orr et al. 2002).

D. Orr (Fisheries and Oceans Canada, St. John's, NL, October 2004, pers. comm.) provided estimates of the quantity of cod discarded by large and small shrimp vessels in 2J3K and 3L for the years 1997-2003 (Lilly and Murphy 2004). The procedure used was similar to that described for the estimation of by-catch of Greenland halibut in the same fisheries (Bowering and Orr 2004). It was estimated that discards in 2J, 3K and 3L by both fleets combined were less than 5 t each year. Similarly, Orr et al. (2008) estimated that discards of cod for the four year period from 2004/05 to 2007/08 were <20 t per year and <145,000 animals. They also noted that most of the juvenile cod (<=19 cm) were taken in the inshore area.

Additional un-quantified sources of mortality include the fallout and discarding of low quality cod caught in gillnets, mortality caused by contact with trawl gear, discarding of small cod caught by linetrawl, as well as hand-lining with baited and feather hooks in both the recreational and commercial fisheries. Size based price-differentials are also an incentive for commercial fishers to discard smaller cod and retain only the largest and most valuable fish.

ILLEGAL FISHING

In recent years there have been removals in inshore waters in excess of sentinel surveys and legal fisheries. The magnitude of poaching is not known.

IMPACT OF UNACCOUNTED FISHING MORTALITY

In the offshore, the level of mortality associated with unreported catch, discards and injury caused by contact with gear (e.g., shrimp trawls, fall-out from gillnets) is not known. However, any such deaths may be important because the abundance of cod in the offshore is much lower than it was prior to the moratorium in 1992.

In the inshore, the magnitude of unreported by-catch and poaching is not known, so the impact of such removals cannot be assessed.

CATCH NUMBERS AT AGE

The age composition and mean length-at-age of the cod landings were initially calculated by gear, unit area and quarter as described in Gavaris and Gavaris (1983).

Historic Pattern

The time-series of catch-at-age from the fishery for northern cod (inshore and offshore combined) extends from 1962 to 2008 (Table 4). Descriptions of the trends to 2007 and factors influencing them can be found in previous assessment reports (Lilly et al. 2006; Brattey et al. 2008a).

Catch At Age During 2008

In the 2008 fishery, the age range represented in the catch extends to about age 18, but most of the catch consists of ages 4-9 (Tables 4 and 5) which is typical for a fishery dominated by gillnets (see Table 2). Ages 6 and 7 (2002 and 2001 year-classes) make up most (69.2%) of the catch numbers in 2008. Comparison of the catch-at-age over the past three years (Fig. 6) is complicated by uncertainty in the estimate of recreational catch for 2007; however, the 2002 year class tracks through the catch and is the strongest at ages 4, 5 and 6. The 2003 year-class looks much weaker at ages 4 and 5 relative to the 2002 year class at the same ages. The 2004 year-class (4 yr olds in 2008) also looks relatively weak. The catch-at-age data are therefore consistent with recent information on recruitment from sentinel surveys and beach seine (see below) and suggest that the 2003 and 2004 year classes are weaker.

CATCH WEIGHTS AT AGE

The following standard relationship was applied in deriving average weight-at-age of cod:

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

The mean weights-at-age calculated from mean lengths-at-age in the landings have been variable, increasing in the late 1970's and early 1980's, followed by a decline through the 1980's to low levels in the early 1990's (Table 5, 6; Fig. 7). There has been substantial improvement in the latter half of the 1990's, and for some age-groups (e.g., ages 4-7) the weights-at-age calculated for recent years have been at or near the highest levels in the time-series. Interpretation of changes in the weights-at-age is difficult because of changes in the relative contributions of the various gear components and changes in the location and timing of catches from each gear component. For example, much of the landings prior to the moratorium came from otter trawling offshore early in the year, but since the moratorium most of the catch has come from fixed gear inshore in the second half of the year. In addition, the high proportion of landings coming from gillnets in recent years 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 4 and 5. There may also be an underestimate of weight-at-age for those age-classes leaving the selection range of gillnets. Average weights at age for the oldest ages (>age 12) tend to be more variable due to increased variability in weight with age combined with small sample sizes. Nonetheless, the overall trend in weights at age suggests an improvement since the low point in the early 1990's.

There are clearly problems with the 1993 weights-at-age for ages 8 and 9 that remain to be resolved and values for these ages have been omitted from Fig. 7.

STAKEHOLDER PERSPECTIVE

Telephone surveys conducted by the Fish, Food and Allied Workers (FFAW) Union (Jarvis and Stead 2005) were continued following the fisheries in 2006-08 to assess the opinions of fish harvesters regarding the abundance of cod in inshore waters, the size and condition of the cod, and the abundance of prey. Additional comments were conveyed at the assessment meetings and these are summarized below

The current stewardship fishery for cod (as prosecuted by commercial fish harvesters) is a limited entry fishery with gear restrictions (amount and type of gear), seasonal and duration restrictions, and landings are closely monitored and recorded. Fish harvesters believe that the data collected during their participation in this fishery is very important to the continued monitoring of the recovery of this stock (inshore and offshore).

Fish harvesters feel that while the high catch rates during the late 1990s were largely driven by a narrow band of cod aggregations close to shore, much has changed in recent years. While current catch rates are about the same as those of the late 1990s cod are much more widely distributed over traditional inshore and offshore fishing grounds. Harvesters feel that the current level of abundance combined with the current distribution and migration patterns that resemble historical patterns is evidence that a significant recovery has and is taking place. Based on observations of the range of year classes and the level of abundance, harvesters feel that the current allowance can be increased and recovery can continue to take place.

TELEPHONE SURVEY OF FISH HARVESTERS

Two hundred and thirty seven 2J3KL fish harvesters participated in a telephone questionnaire completed by the FFAW during January and February 2009. Most harvesters in 2J felt cod were less abundant in 2008 than in the late 1980s. However, most 3K and 3L harvesters felt cod abundance was better in 2008 than during the late 1980s. Harvesters in 2J3KL found cod to be more abundant in 2008 than in 2007. Most harvesters felt that cod were distributed throughout their area and felt that cod were in good condition. The majority of harvesters in all areas felt squid and mackerel abundance is low and decreasing. Most harvesters said herring abundance is good and increasing. Harvesters in 3K and 3L said capelin abundance is good and increasing.

INFORMATION FROM THE OFFSHORE

BOTTOM-TRAWL SURVEYS

Research bottom-trawl surveys have been conducted by Canada during the autumn in Div. 2J, 3K and 3L since 1977, 1978 and 1981, respectively. No autumn survey was conducted in Div. 3L in 1984, but the results of a summer (August- September) survey in 1984 have been used for some analyses. The 1995 and 2002-05 autumn surveys were not completed on time and continued into late January of the following years. In addition, the 2004 survey coverage was incomplete as a portion of 3L was not surveyed and the 2004 survey estimate is likely biased low. Also, in recent years the number of sets fished in some strata has been reduced due to time constraints associated with mechanical problems with the research vessels. Inshore strata were poorly covered in 2006 and omitted in 2007. These issues add uncertainty to survey estimates of abundance, biomass, mortality rates and biological characteristics.

Spring surveys have been conducted by Canada in Div. 3L during the years 1971-82 and 1985-present. The data for the 2008 spring survey of 3L were not available at the time of the 2009 assessment meeting; spring survey data to 2007 are reported in Brattey et al. (2008a).

Survey Design

Details of the stratified random trawl survey design are described in previous documents (Lilly et al. 2006; Brattey et al. 2008a). Additional information on surveys conducted by DFO since the introduction of the Campelen trawl in 1995 are provided by Brodie (2005) and Brodie and Stansbury (2007). The depth-based stratification scheme and location of numbered strata is illustrated by NAFO Division in Figs. 8-10.

Autumn Surveys

Autumn Abundance and Biomass Indices: Indices of cod abundance and biomass are based on the strata-area weighted 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. Note that such a procedure was not followed for the autumn survey in 2004, when several strata in Div. 3L were not fished, even though the survey was continued into January 2005. See Lilly et al. (2005) for additional information regarding the area that was not fished and the reasons for not estimating the quantity of cod that may have been in the un-fished area at the time of the survey.

Abundance and biomass indices from the autumn surveys in 1978-94 (Div. 2J and 3K) and 1981-94 (Div. 3L) may be found in Tables 12-19 of Shelton et al. (1996). The data from 1983 to 1994 have been converted to Campelen equivalents and are presented along with the actual Campelen data from 1995-2007 in Brattey et al. (2008a). Data for 1993-2007 for Div. 2J are based on a revised stratification scheme introduced in 1993 (Bishop 1994). Many survey tables in Brattey et al. (2008a) for each NAFO Div. are divided into two parts; up to 1992 and from 1993 onwards. Estimates for surveys in Div. 3L are given separately for strata in depths <=200 fathoms (Tables 18-21 in Brattey et al. (2008a)) and for those in depths >200 fathoms (Tables 22-23 in Brattey et al. [2008a]). Estimates for inshore strata added to the surveyed area in 1996 are given in Tables 24 and 25 of Brattey et al. (2008a).

There have been some changes over time in the depths covered during the survey; consequently, trends in the indices of abundance and biomass of cod has been monitored for those strata that have been fished most consistently since the start of the surveys. These "offshore index strata" are those in the depth range 100-500 m in Div. 2J and 3K and 55-366 m (30-200 fathoms) in Div. 3L. The inshore strata fished intermittently from 1996 onwards are not included in this index, nor are deep-water strata (>200 fathoms in Div. 3L, or >500 m in Div. 2J and 3K). Separate estimates of abundance and biomass by stratum have been calculated for the inshore and deep-water strata (see Brattey et al. 2008a), but coverage has been too poor in the past few years to determine recent trends and these results are not repeated here. Lilly et al. (2006) provide more details on the interpretation of the autumn survey data with respect to depth and timing of the survey.

For brevity, the full time series of tabulated autumn survey data is not repeated here; the data by NAFO Division and stratum are provided only for 2000 onwards, for Div. 2J (Tables 7a and 7b), 3K (Tables 8a and 8b), and 3L (Tables 9a, 9b, 10); the annual estimates for the abundance index and biomass index (from all offshore index strata combined) are highlighted in grey in these tables.

Trends in the indices of abundance and biomass in the offshore index strata are shown by Div. for the years 1983-2008 in Fig. 11. Overall, the trends in abundance and biomass are similar, although for individual Divisions there are some differences that mostly reflect changes in the relative abundance of small and large fish. Of note are the strong positive anomalies in 2J and 3K in 1986, the large increase in 3K in 1989, the increase in 3L in 1990, and the rapid decline during the early 1990's. Abundance and biomass indices remained at extremely low levels in all divisions for several years after 1993, but an increasing trend is evident in overall abundance and overall biomass during 2003-08. Biomass has not increased markedly in 2J, and the overall increase is driven by changes in 3K and 3L. The average biomass index in 2J3KL during 2006-08 was 8% of the average of the 1980's (excluding the 1986 value which has a strong positive year effect) and the value in 2008 is the highest since 1992. The 2008 survey abundance and biomass index values were 162 million fish and 148,000 t. During 2003-08 the abundance index has been increasing at an average annual rate of 32% per year and the biomass index by 66% per year.

An index of spawning stock biomass (SSB) was also calculated from the population biomass at age (see below) and cohort model estimates of proportion mature at age from offshore survey data (see below). The index of SSB shows a similar trend to that of abundance and biomass, and remained extremely low for several years after 1993, but an increasing trend is evident during 2005-08 (Fig. 12). The 2008 SSB index value (113,000 t) is the highest observed since 1991.

Autumn Mean Catch At Age Per Tow: The divisional mean number caught at age per tow in offshore index strata during autumn surveys from 1979 (1981 in Div. 3L) to 1994, and the mean number per tow for Div. 2J, 3K and 3L combined, may be found in Tables 3-6 of Bishop et al. (1995). The data from 1983 to 1994 have been converted to Campelen equivalents and are presented along with the actual Campelen data from 1995 to 2008 by division and for all three divisions combined in Table 11. Mean catch per tow was low for each age in each Div. for several years relative to 1983-1991, but there has been a slight increase in catches since 2003, particularly among ages 3-6; there has also been a slight broadening of the age structure.

The relatively large catch rate at age zero in Div. 2J in 2008 is due primarily to a single large catch of small fish in one tow in stratum 237, which is near the coast in central 2J; a similar single large catch was observed in this area in 2005. There are no age zeros in the catch at age matrix prior to 1996 and generally few in subsequent years as these small cod are poorly selected by trawl gears, either Engels or Campelen.

The time series of autumn survey mean catch at age per tow for 2J3KL combined is also illustrated using “bubble” plots (Fig. 13); only ages 1-12 are shown. Note that the raw data are converted to proportions within an age (left panel) or within a year (right panel). The left panel shows that prior to the 1990’s the numbers of cod in survey catches were much larger for all ages and the catch included a broad age structure which collapsed rapidly after 1990. Some larger than average year-classes track through successive surveys in the early part of the time-series as diagonals of large grey symbols, e.g., the 1981 and 1982 year classes at ages 2-8 and 1-8 respectively, and the 1987 year class at ages 1-4. In contrast, the 1977 and 1976 year classes appear as average (small dots) at ages 7-12 and 6-12 in successive surveys from 1983 to 1989. The standardized proportions of all ages from surveys from 1993 onwards appear as black symbols indicating they are lower than average.

In the right panel of Figure 13, where proportions are standardized within a year, the symbol sizes do not reflect the year to year changes in relative strength of year classes, but are useful for indicating how consistently individual year classes track through successive surveys. In the early to mid-1980s survey catches tended to be dominated by older cod (>age 4), whereas from 1993 onwards they are comprised mostly of younger cod (<= age 4). The 1994 year class is consistently well represented in survey catches at ages 1-4 from 1995-1998, but at older ages in subsequent surveys is poorly represented. In the recent period, the 2002 year class is well represented at ages 1-6 in several consecutive surveys (2003-2008). In contrast, the 2000 and 2001 year classes are less consistent, and the 2001 year class appears weak at ages 2-3, but average or relatively strong at age 1 and ages 5-6; there is uncertainty about the origins of the 2000 and 2001 year classes that appear more strongly at older ages (ages 5-8) in the survey. The age structure of survey catches is expanding in recent years, mainly as a result of catches of 5-8 year old cod from the 2000-2002 year classes. Interpretation of the trends in survey age composition is complicated by poor coverage in the 2004 survey.

Autumn Distribution

In previous documents, the distribution of cod in autumn surveys has been illustrated in a series of “expanding symbol” plots showing numbers per standard tow (Shelton et al. 1996; Murphy et al. 1997) and in weight (kg) per standard tow (Lilly 1994, 1995). The catch from each tow in the period 1983-94 has been recalculated to Campelen equivalents, and plots of these recalculated catches for 1985-94 are illustrated in Lilly et al. (1999).

A detailed history and interpretation of changes in the distribution of cod at the time of the autumn surveys to 2005 is provided in Lilly et al. (2006). Catches from the early to mid-1990’s onward tended to be very small, relative to the 1980’s (see Fig. 15 in Lilly et al. [2006] and note change in scale). Since the late 1990’s the offshore area with the most consistent catches of cod has been around Funk Island Bank (for location see Fig. 1b), particularly to the east and southeast. This pattern is evident in 2006 (see Brattey et al. 2008a), 2007, and 2008 where some larger catches were taken in a broad area that extends from off Cape Bonavista east and northeastward along the 3K-3L border and northward along the outer reaches of Funk Island Bank (Fig. 14, 15). In 2008, some slightly larger catches (in terms of numbers) were also taken in 2J (Hawke Channel and Hamilton Bank) and outside the 200 nm limit on the “nose” of the Grand Banks. When the catches are illustrated in terms of weight (Fig. 15), larger catches are more restricted, to the area south and east of Funk Island Bank, indicating that cod caught in this area were larger. Note that inshore strata were not fished in 2007 or 2008, although some larger catches have been taken in the inshore strata in previous surveys (see Lilly et al. 2006).

Survey catches by stratum area (Tables 8-10) were analyzed further to determine what fraction of the total abundance and biomass from the index strata were found in the 3KL border and eastern Funk Island Bank area. The total area for strata 628, 636, 637, 638, and 639 in 3K (see Fig. 9 for stratum locations) and 344, 345, 346, and 366 in 3L (see Fig. 10 for stratum locations) was combined and accounted for approximately 14% of total area surveyed (offshore index strata only). Catches from these nine strata combined were found to comprise about 14% of the total survey biomass and 11% of the total survey abundance in the 1980’s; however, in the 2006-2008 period these values increased to 76% of the total survey biomass and 49% of the total survey biomass.

These survey data clearly indicate that the recent improvements in survey biomass and abundance in the offshore area are largely restricted to the area adjacent to the 3KL border and eastern Funk Island Bank. There are large offshore areas where cod are still scarce relative to the 1980s, particularly in 2J, northern 3K, and on the northern plateau of the Grand Banks in southern 3L. The area showing the most significant improvement in terms of survey catches is adjacent to the central inshore area where catch rates in recent (2006-08) inshore fisheries have been highest. This region of improved survey catches also overlaps the area of northern 3L where cod by-catch in the turbot gillnet test fishery increased.

Recruitment in the Offshore

Catch rates of cod aged 2 and 3 (in Campelen equivalents prior to 1995 and actual Campelen catches from 1995 onwards) from the autumn surveys have been used to monitor trends in recruitment in the offshore. Interpreting catch rates of younger ages is problematic because of the gear change in 1995; the Engels trawl was poor at catching ages 0 and 1 and zero catches remain zero in the converted data; consequently the numbers of ages 0 and 1 are likely underestimated prior to 1995 in terms of comparison to the actual Campelen results.

Trends in the catch rates of cod aged 2 and 3 (shown as year-classes, not survey years) show that all cohorts produced since the late 1980's have been relatively weak (Fig. 16). The most recent information on offshore recruitment came from the 2008 autumn survey presented at the 2009 assessment. This survey provided information on 2-yr-old cod from the 2006 cohort and 3-yr-olds from the 2005 cohort. There is no information from the offshore on more recent cohorts which have yet to be sampled adequately by the Campelen gear. Nonetheless, the available information gives no indication of any recent improvement in recruitment in spite of the increasing trend in the offshore abundance and biomass indices. On the right hand panel in Fig. 16 the 2002 and 2005 year-classes appear marginally better than all cohorts since the early 1990's, but interpretation is complicated by incomplete coverage in the 2004 survey such that catches of the 2002 cohort at age 2 (and the 2001 cohort at age 3) may be underestimated. The 2003 and 2004 cohorts that will be age 5 and 6 during 2009 appear relatively weak.

Trends in Mortality Rates in the Offshore

Instantaneous rates of total mortality (Z) were estimated from autumn research vessel survey catch rate data as described by Lilly et al. (2006). Only ages 4-6 were used in this analysis and the time-series was restricted to the post-1995 period to avoid complications associated with the different type of trawl used in the earlier time-period. Ages 4-6 are assumed to be fully recruited to the gear (Campelen trawl) in this analysis. Older ages could not be included in this analysis because they were sporadic in the survey catches in the mid to late 1990's. Lilly et al. (2006) used survey data back to the early 1980's and provided estimates of total mortality rates for a longer period and outlined many of the details and problems that can influence the outcome of this type of analysis. The total mortality rate based on offshore trawl surveys from 1996 onwards is shown in Fig. 17.

At the 2009 assessment it was noted that the total mortality rate (Z) had remained at a high level throughout the mid-1990`s, increased further during 2001-03, but had subsequently declined substantially, possibly since 2003. It remains difficult to determine from fall survey data alone precisely when Z was changing, given the apparent year effect in the 2006 survey coupled with incomplete survey coverage in 2004 (which may also have influenced the 2004 and 2005 estimates of Z). However, there are now two consecutive surveys that give low values of Z and data from other sources also support the interpretation that the rate of total mortality in the offshore has decreased, i.e., (1) catch rates of larger fish increased in the spring survey of 3L in 2007, (2) winter acoustic surveys of the traditional over-wintering area along the shelf edge reported aggregations of commercial sized cod in 2007 and a larger aggregation with older fish was observed in 2008, and (3) the level of by-catch of commercial sized cod in the turbot gillnet fishery in northern 3L increased substantially between 2006 and 2007, and increased further in 2008 (see next section). The most recent value of Z (2008 survey) was 0.19. The average Z over the last two years is 0.23, which corresponds to 21% total mortality each year; this is the lowest estimate of Z in the entire time series of survey data that goes back to 1983 (excluding 2005 which appears to be a year effect). At the assessment there was some discussion that the recent decline in Z could be partly due to immigration, i.e., some cod that had recently over-wintered inshore (and hence outside the survey area) may have migrated to the offshore in recent years. However, it was noted that while Z may have been influenced by offshore migration, the decline in over-wintering biomass in Smith Sound amounted to about 10,000 t in the past three years, whereas the survey biomass index had increased by a much larger amount (~100,000 t). In addition, no inshore tags were returned from cod taken as by-catch in the turbot gillnet test fishery in northern 3L in the past three years; although total landings of cod from by-catch in the offshore have been low, some tags would be expected if migration to the offshore accounted for a large fraction of the observed increase. Similarly, there is no evidence the increases are due to colonization from neighbouring stock areas such as 3Ps or even 4R; there are extensive tagging programs in those areas and none of these tags were reported from cod captured in offshore of 2J3KL.

There was also some discussion that the recent upward trend in survey abundance and biomass, and lowering of estimates of Z, could be influenced by changes in the catchability coefficient (*q*). It was suggested that *q* may be lower when abundance is low; if the relationship between *q* and stock size was non-linear, part of the recent increase in stock size could be due to an increase in *q* rather than stock size *per se*. This possibility was acknowledged, but no evidence to support this suggestion was presented at the meeting. It was noted that there was also evidence from other sources using other gears (such as increased cod by-catch in the turbot gillnet test fishery in northern 3L) that stock size was increasing in the offshore. An additional consideration was that the age composition of the offshore stock was expanding gradually; if the increases observed were simply due to an increase in *q* one might expect much older fish to suddenly reappear in the survey catches and this had not been observed.

The reasons for the high Z throughout the 1990s and early 2000s are not well understood. Fishing has been restricted in much of this period, suggesting that the rate of natural mortality (M) has been high. The recent decline in Z and upward trend in offshore abundance and biomass occurred during the years after the inshore fishery re-opened (2006-2008) suggesting that the natural mortality rate has declined substantially in the recent period. High values for Z and/or M have been observed in many Canadian Atlantic stocks in the post-moratorium period, and various hypotheses have been proposed and investigated to account for this finding, including predation by marine mammals, unreported fishing, fishing by non-Canadian fleets (3L and 3NO), poor condition and associated high mortality, selection for early maturation and subsequent high post-spawning mortality (Sinclair 2001; Swain and Chouinard 2008; Trzcinski et al. 2006; Shelton et al. 2006; Fudge and Rose 2008, DFO, 2007a). The reasons likely differ among populations, but remain contentious and are the subject of ongoing investigation in many of the Canadian Atlantic cod stocks.

Spring 3L Bottom-Trawl Surveys

Due to time constraints, the data from the 2008 spring survey of 3L was not available at the time of the assessment. Data to 2007 are reported in Brattey et al. (2008a).

TRENDS IN THE BY-CATCH OF COD IN THE TURBOT TEST FISHERY

In the offshore, by-catches of cod by Canadian fleets have mostly come from an experimental gillnet fishery for turbot (Greenland halibut) at depths of 160-300 fathoms in northern 3L during late summer and autumn (August-November) (Table 12). Following the imposition of the Northern Cod moratorium in the early 1990's and subsequent expansion of the inshore crab fishery along the Northeast and East coast of Newfoundland, concerns were raised over the incidental catch and corresponding mortality of cod and crab in shallow water turbot gillnet fisheries. In recognition of these concerns, measures were taken to close the inshore fishing zones and the fishing grounds at the 160-300 fathoms depth within the mid-shore and offshore areas of NAFO Div. 3KL. These area closures were established on a long-term basis through Conservation Harvesting Provisions (CHP) of the Integrated Fisheries Management Plans (IFMP). The Inshore Fixed Gear Fleet CHP, however, contains a provision to allow for commercial testing within the closed areas to evaluate the possibilities for a re-opening of a directed gillnet turbot fishery.

Activation of the test fishery provision in NAFO Div. 3L started in 2004 and continued over the ensuing three years (Table 12). Fisher participation climbed from 13 in the first year to 86 in 2007. Specific management measures employed included special individualized test permits and the establishment of 3 test zones in the northern portion of 3L (north of 48◦30' N latitude to 49◦15' N and from approx 22 to 170 nautical miles east from land). Gear limits ranged from a high of 150 gillnets in zone 3 to a low of 60 nets in zone one depending on the zone, year and problems encountered in the fishery. Generally, the gillnet limit for each of the three zones decreased over the 4 year period due to undesirable incidental crab and groundfish catches. A 6 inch mesh size minimum was mandatory and appeared to be the standard gillnet mesh used by all turbot fishers.

License conditions restricted incidental cod catch to 10% daily (of turbot catch) to a season cap of 2,000 lbs round weight for 2004 and 2005. The cap increased to 3,000 lbs in 2006 and was 2,500 lbs in 2007, reflecting limits approved for the Northern Cod Stewardship fishery. Once fishers reached their cod seasonal cap, either through a directed fishery or by way of by-catch in other groundfish fisheries, by license condition they were obligated to cease all groundfish fisheries for the remainder of the year. A "three strikes" provision was also in play in the test fishery requiring fishers to exit the fishery should they encounter three daily occurrences of >10% cod by-catch. Commencing in 2005, a minimum of 20 deepwater floats were required on the head-ropes of each turbot gillnet; a measure adopted to mitigate high crab by-catch occurrences.

Seasons for the test fishery ranged from early August to late October depending on the number of fishers licensed in the year and available "<65 foot vessel fixed gear" fleet sector TAC. Test fishing trips completed increased from 61 in 2004 to a high of 248 in 2005 and averaged 157 for the last 2 years. At-sea observer coverage (observed trips) was very high in 2004 (72%) and 2005 (61%) but dropped to 24% and 30%, respectively, in the later years.

Average cod incidental catch, relative to the landed turbot catch, was at or below 2% for the 3 years from 2004 to 2006 but increased to 18% in 2007 (Table 12). The highest cod by-catch trip per season increased over the 4 year series; from 9% (461 lbs cod vs. 5,122 lbs turbot) in 2004, 20% (1,162 lbs vs. 5,810 lbs) in 2005, and 14% (2,768 lbs vs. 19,771 lbs) in 2006, to 306% (11,801 lbs vs. 3,862 lbs) in 2007. It is evident that in 2007 there was a marked increase in cod by-catch. Cod were captured over a wide area of northern 3L during August-October when catch rates in some adjacent inshore areas were also high. This increase in cod by-catch is consistent with the increased cod biomass and appearance of older cod observed in the same area of 3L during the autumn and spring RV surveys in 2007 and the autumn survey in 2008.

ACOUSTIC-TRAWL SURVEY OF OFFSHORE OVER-WINTERING AREAS

Hydro-acoustic/bottom-trawl surveys were conducted during March 2007 and 2008 covering the traditional over-wintering area of northern cod along the shelf edge off southern Labrador and Eastern Newfoundland (NAFO Divisions 2J3KL). The survey objectives included determining the distribution, biomass, abundance and biological traits of cod in this area.

In the 2007 survey, most cod were found in two main regions; adjacent to the Bonavista Corridor (NAFO 3KL) and in Hawke Channel (NAFO 2J). The fish were more aggregated at these locations (especially in part of 3K) and found in the demersal zone at depths ranging between 400-550 m. These fish were predominantly younger (3-5) and of smaller size-classes (24-55 cm), although several larger fish (70-87 cm) were caught in the Bonavista Corridor. The remaining areas, including most of NAFO 3L, were characterized by low density. Biomass estimates (using acoustic data) over the surveyed areas ranged from approximately 2,600-4,000 t (3L and 2J respectively) to 17,000 t in 3K.

In the 2008 survey, two aggregations were detected, in the same two areas as in 2007, but the aggregation in southern 3K was much larger than was detected in 2007. Biomass in the surveyed portion of each division in 2008 was estimated at 4,800 t in 2J, 101,200 t in 3K and 771 t in 3L; survey coverage of 3L was lower in 2008 than in 2007. The estimate of SSB for 3K was 42,000 t. In 2J, most sampled cod were aged 2-3, but in 3K cod aged 4-7 were most abundant with small numbers of ages 8-9 also observed; approximately 20% of the cod sampled in 3K were mature fish.

INFORMATION FROM THE INSHORE

SENTINEL SURVEYS

Sentinel surveys for cod were conducted by fishing enterprises operating from many communities in Div. 2J, 3K and 3L at various times during summer and autumn from 1995 onwards. Lilly et al. (2006) summarized sentinel data up to 2005 and the most recent accounts are provided by Maddock Parsons and Stead (2009, and document in preparation) who extend the time series to 2008.

The primary goal of these surveys when they were initiated was to obtain information on relative density of cod on traditional inshore fishing grounds during the moratorium. The surveys continued during the period of index/commercial fishing (1998-2002, 2006-08) and when there was significant by-catch during the intervening years (2003-05). The sentinel surveys have been conducted primarily with gillnets (5½ inch mesh). Linetrawls have been used extensively in only a few areas, and the use of linetrawls has declined over time. Handlines and cod traps have been used much less and have not provided sufficient information over time to discern trends and have been discontinued. Small mesh (3¼ inch) gillnets were introduced at many sites in 1996 to provide information on the relative size of incoming year-classes.

The sentinel surveys were also intended to provide samples that would yield information on various aspects of the biology of cod in the inshore, including age compositions, size-at-age, condition, maturity and feeding. Various analyses were conducted on data collected in 1995-97 (Lilly 1998b; Lilly et al. 1998a). Aggregated length-frequencies were examined each year up to 2005 (Lilly et al. 2006) and age compositions for the full time period are available in the form of standardized catch rates at age for each gear type (see below).

The number of enterprises participating in the sentinel surveys varied between 53 and 59 during 1995-2002, but was reduced to 43-45 in 2003-08. See Maddock Parsons and Stead (2009, and document in preparation) for additional details regarding fishing methods and sampling strategy.

Maddock Parsons and Stead (2009, and document in preparation) provided weekly average catch rates and annual relative length frequencies (total number of fish caught at length divided by total amount of gear deployed) by gear, NAFO division, and year (to 2008); data for individual sites are also given.

Sentinel Standardized (Modeled) Catch Per Unit Effort (CPUE) by Area

An age-disaggregated index of standardized relative abundance for cod in the inshore of 2J3KL was calculated from data gathered from sentinel fishing with gillnets and linetrawls (Stansbury et al. 2000). The catch from 2J3KL was divided into cells defined by gear type (5½ inch mesh gillnet, 3¼ inch mesh gillnet and linetrawl), NAFO Div. (2J, 3K, 3L), statistical unit area (e.g., 3Ki, 3Lh), year (1995 onwards, or 1996 for 3¼ inch mesh gillnet) and quarter. Age-length keys were generated for each cell using fish sampled from both fixed and experimental sites. There were no fixed sites using 3¼ inch gillnets. Length frequencies and age-length keys were combined within cells. Numbers of fish at length were assigned ages using an age-length key. Because there were few or no discards in the sentinel survey and the fish harvesters measured the length of all the fish caught with line-trawl and gillnet, obtaining catch numbers-at-age was relatively straight forward [see Stansbury et al. (2000) for details].

Age-disaggregated CPUE data were standardized to remove site and seasonal effects. For gillnets, only sets fished during June to November (prior to 2006, July-November) with a soak time between 12 and 32 hours were included in the analysis. For linetrawl, sets fished during August to November with a soak time less than or equal to 12 hours were selected. Sets with effort and no catch for some or all ages were considered valid entries in the model. Ages in the model ranged from 3-10 years for 5½ inch gillnets, 2-10 years for 3¼ inch gillnet and 3-9 years for linetrawl. Fish older than age 10 were not included because of their rarity.

A generalized linear model (McCullagh and Nelder 1989) was applied to the catch and effort data for each gear and survey method. The details are described in Lilly et al. (2006). The model was fitted using the SAS procedure GENMOD. Amount of gear is expressed as number of nets for gillnet and number of hooks for line trawl. Estimates for age nested in year were adjusted for month nested in site effects (i.e., least-squares means) and transformed to a linear scale to give the relative index at age for each year. Additional details regarding the models (proportion of available data that was actually included, model output and residual plots) were reviewed at the assessment meetings in 2009 but are not shown here. Initially the data were grouped into three inshore areas as in previous assessments (Fig. 18); an inshore northern area (White Bay, the northern Peninsula and southern Labrador), an inshore central area (Notre Dame, Bonavista, and Trinity bays), and an inshore southern area (Conception Bay, eastern Avalon and St. Mary's Bay). The area boundaries were assigned based on catch rates and information from tag returns in the post-moratorium period. Standardized catch rate indices were computed for each of these inshore areas although for some area/gear combinations there were insufficient data.

Sentinel Catch Rates Indices

The model adequately fitted the data from 5½" mesh gillnets for each of the three inshore areas, and for small-mesh gillnet and linetrawls from the central area only. Age-aggregated and age dis-aggregated indices were computed, the former by summing the age within year effects for each year. The addition of one more year of data for 2008 did not markedly change the fits from the previous assessment.

The gillnet (5½ inch mesh) standardized catch rate indices show different trends in each inshore area (Fig. 19). In the northern area, catch rates with gillnets (5½ inch mesh) in 2008 were similar to those observed in 2005-07 and are now marginally above the average of the time series, but are lower than those in other areas. In the central area, catch rates continued to increase in 2008 and are currently well above average, are above those in other areas, but below the levels observed in the central area in 1998. In the southern area, catch rates have remained similar since 2003, and in 2008 are marginally below average and below those observed in the central area.

In the central area, standardized catch-rate indices from line-trawls increased during 2008 and are above the average of the time-series (Fig. 20). There are fewer data for linetrawls and the trends are more variable and confidence intervals larger than those observed for gillnets.

In the central area, standardized catch-rate indices for small-mesh gillnets are plotted separately for younger cod (ages 3 and 4) and older cod (ages 5-10; Fig. 21). The catch rates for younger cod are higher in most years. The trend for older fish declines to lowest values in 2002 and subsequently increases to 2007, whereas for younger fish there is no clear trend. Catch rates for 3-4 year old cod were lowest in 1998 and 1999, but higher in 1996, 2003 and 2005. The three most recent values are not high, suggesting that incoming recruitment is weaker. The data for 3-4 year old cod is also plotted by year class (Fig. 22) and these results suggest that while the 2000 and 2002 year classes are slightly stronger, subsequent year classes (2003-2005) are weaker and similar to those observed during the mid-1990's.

Trends in the standardized age-disaggregated catch rates for each gear type from the central area (Table 13, 14) are illustrated as "bubble" plots (Figs. 23, 24). Although there is some variability among gear types, in general these show that the 1990 and 1992 year-classes were relatively strong in the late 1990's. Subsequent year-classes appear to have been weaker and catch rates, particularly for older fish (≥ age 6), were lower. However, catch rates at age started to increase again, particularly for the 2000-2002 year classes in consecutive years at ages 3-6. The catch rates of young cod (ages 3-4) in small mesh gillnet and linetrawl in 2006-08 are lower, suggesting that incoming recruitment after the 2002 year class is weaker.

Interpretation of the trends in catch rate indices from sentinel surveys is complicated because the time-series includes periods with and without commercial fisheries taking place at the same time. In some years, particularly 1998-2002, and 2006-08 there may have been competition for space on fishing grounds (some sentinel fishers report commercial nets set across their sentinel gear) and possibly local depletion of cod on some fishing grounds where effort is high. Sentinel catch rates may also be influence by changes in the spatial distribution of cod; the area covered by the sentinel survey is close to shore and covers a very small fraction of the stock area; consequently, catch rates are prone to annual shifts in the distribution of cod due to changes in factors such as prey availability and water temperature.

TAGGING AND TELEMETRY

The mark-recapture study of cod in the inshore of NAFO Div. 3KL that started in the mid-1990's was continued in 2006-08. The re-opening of the directed fishery for cod in the inshore during 2006 provided another opportunity to use tag returns to determine exploitation rates and cod movement patterns; this approach was used extensively during the 1998-2002 period when the directed fishery was open (Brattey 1999, 2000; Brattey and Healey 2003, 2005, 2007; Cadigan and Brattey 2000, 2003). Several thousand additional cod were tagged and released with external Floy tags in the inshore of 3KL during 2006-2008 (Table 15).

Tag returns from the 2006-08 fisheries were used to estimate exploitation (harvest) rates among cod released in four inshore unit areas (3Ki, 3La, 3Lb, 3Lj). The tagging study incorporated estimates of tagging mortality, tag loss, and reporting rates using methods described in Brattey and Healey (2003); the instantaneous rate of natural mortality was assumed to be 0.4 for cod tagged in 3K and 0.2 for those tagged in 3L. Annual estimates of exploitation (percent harvested) were computed based on tagged cod >50 cm fork length (FL) and <=85 cm FL at release and recaptured within two years of release. In 2008, exploitation rates (% harvested) were low in all four inshore areas, ranging from 3 to 7% (Table 15). Exploitation rates have tended to remain stable or decline in the past three years, with the decline most evident in 3Ki. The distribution of recaptures (not shown) was similar to that of previous (1997-2002) inshore cod tagging experiments and indicated that cod tagged inshore in early spring or late fall tended to remain inshore, but with considerable movement among adjacent bays. Cod tagged and released inshore in 3Ki, 3La, 3Lb tended to be recaptured within an area bounded by the 3Kd/3Ki border in the north and the 3Lb/3Lf border to the south. Cod tagged in southern 3L (3Lj) were often recaptured either locally or to the south in the neighbouring 3Ps stock area.

During the 2009 assessment, a request was made to further analyze the cod tag return information separately for commercial and recreational fishers and to split the commercial returns into those caught using different gear types, especially handline. The analyses indicated that 139 tags were reported as being from commercial fishers and 91 from recreational fishers, suggesting that the recreational catch was a substantial fraction of the total landings. The difference in reporting rate of tags between commercial versus recreational fishers was not tested formally, but cursory examination of the data indicated no major difference between the two groups. Only 26 of 139 commercial tags came from handline (90 came from gillnets), whereas 83 recreational tags came from handline. The results were not consistent with the reported catches for handline from commercial (~600 t) versus recreational fishers (~800 t) and suggested that the recreational catch could be underestimated; the recreational catch estimate is provisional and was based on an average mean length converted to a mean weight of 1.5kg for all areas; this could be revised upward if the average weight was actually larger and preliminary indications from sampling of commercial handline catches suggested this could be true. The mean length at release of recaptured tagged cod was similar between commercial and recreational fishers (typically 65-70 cm). Tag returns by statistical unit area were also compared between commercial and recreational fishers; recreational tags comprised more than half (51-67%) of the total tags returned from Bonavista Bay, Trinity Bay and Conception Bay, whereas in more northerly regions (Fogo, Twillingate, Notre Dame Bay) and southerly areas (eastern Avalon) commercial fishers returned the largest percentage (71-94%). Unfortunately, it was not possible to divide the recreational and commercial catches by smaller geographic areas (i.e., bays) to compare reported catches with tagging information on a smaller scale; this comparison could be important because commercial handline catches may have come from different areas compared to recreational ones resulting in different availabilities of tagged fish between the two groups of fishers. These analyses also depend strongly on the assumption that fishers report honestly whether they were fishing recreationally or commercially, as commercial fishers could participate in both fisheries. After examining all the data it was concluded that that the actual lengths of fish measured during recreational fisheries by fisheries officers should be made available to determine if this would eliminate the discrepancy in tag returns relative to catch between commercial and recreational fishers.

The annual tag reporting rate was estimated using data from the high-reward tagging, as described by Cadigan and Brattey (2008). The reporting rate for single low reward tags in 3KL during 2008 was 0.63, slightly lower than the rate estimated for the 1997-2005 period (70-91%); the estimates were used in the computation of annual exploitation rates.

In 2007 and 2008, cod were also tagged and released in the offshore of 3K on the continental slope edge during March; this is the first time offshore cod tagging has been conducted in 2J3KL since the early 1990's (Taggart et al. 1995). In 2007, a total of 1,127 cod >45 cm FL were tagged and released but no recaptures were obtained in 2007 and only two were received in 2008. These cod were captured using an otter trawl in extremely deep water (~430 m) and were assumed to have suffered high post-release mortality; consequently, the results were not used to estimate exploitation rates.

In 2008, a total of 2,268 cod >45 cm fork length were tagged and released in the offshore of 3K about 25 nm northwest of the 2007 release site. The cod were captured using an otter trawl in shallower water (~340 m) than during the 2007 survey, but likely suffered considerable post-release mortality. In the summer and autumn of 2008, a total of 36 tagged cod were recaptured inshore during recreational and commercial fisheries; thirteen tags were returned by recreational fishers and 23 by commercial fishers. The inshore recaptures were widely distributed, throughout

3K and the northern portion of 3L as far south as Petty Harbour (Fig. 25). To estimate the exploitation rate of these offshore cod from the tagging data we used a rate of tagging mortality immediately after release of 0.44; this was the average mortality rate of cod trawled from deep (200 m) water in Smith Sound implanted with transmitters. Natural mortality was assumed to be 0.2 per yr and the tag reporting rate estimate of 0.63 (described above) for inshore 3KL was used. Using these values and model estimates of tag loss rates based on double-tagging, the exploitation rate of offshore cod in the inshore during 2008 was estimated at 6%. While there is uncertainty regarding the estimate of initial tagging mortality for cod trawled offshore in deep water, the value used was considered more likely to be conservative than too high. Ongoing research is being conducted to provide more information on the survival rate of tagged cod captured for tagging in deep water.

Updated results from an ongoing ultrasonic telemetry project (Brattey et al. 2008b) were also presented, based on release of cod in Smith Sound (SS) and other areas following surgical implantation of transmitters; arrays of receivers have been deployed around the inshore of 3KL since the autumn of 2005. The objectives of this work are to investigate the home range, seasonal movements, fidelity to over-wintering areas, and survival (mortality) rates of cod. Movement patterns inferred from telemetry results were also compared with those based on recaptures of conventionally tagged cod. Following a pilot scale study in 2005, large numbers of cod (>100 per year) were released with surgically implanted coded transmitters (Vemco V16, 69kHz) and two external (Floy) t-bar tags. A “counting fence” of receivers (Vemco VR2) was deployed at the mouth of SS to provide detailed information about daily movements of cod. Arrays of receivers were also deployed along the northeast coast of NL to investigate migration patterns and dispersal, and determine if SS cod were subsequently over-wintering in other inshore areas. Small numbers of cod (<20) with implanted transmitters were also captured and released at other sites along the north east coast and their movements monitored. Survival of telemetred cod following release was only 56% for trawled cod from deep (190-225 m) water, compared to 96.4% for those caught with hand-lines in shallow (10-82 m) water. There was a clear seasonal pattern in cod movements that was repeated in three consecutive years (2005-07); most cod left SS in spring (March-June), remained outside SS during summer, dispersed mainly northward in Trinity and Bonavista bays, and returned during late autumn and winter (November-January); a small proportion of telemetred cod (0-20%) remained in SS throughout the year. Cod released in SS showed strong over-wintering site fidelity and return rates were: 9 of 9 (100%) in 2005, 64 of 77 (83%) in 2006, and 65 of 99 (65%) in 2007. Less than 10% of telemetred cod showed other behaviours, including over-wintering elsewhere in subsequent years, and returning to and leaving SS repeatedly during summer and fall. Ten percent of telemetred SS cod were captured in the fishery in 2006, 9% in 2007, and 3% in 2008 from reported landings of only a few thousand tons. Direct estimates of the minimum survival rate of two groups of telemetred cod were 79% (from 19 May 2006 to 29 January 2007) and 73% (from 31 May 2007 to 29 January 2008). Some cod released with transmitters off Twillingate and in Newman Sound over-wintered in the deep inlets of southern Bonavista Bay, whereas those released in southern 3L (Petty Harbour) in mid-July stayed in the local area or moved south and some were captured in NAFO Subdiv. 3Ps the following winter. Some telemetred cod reappeared at Petty Harbour early in the season in 2008 (late May and early June) before moving further northwards close to shore and it was thought that these were fish that had over-wintered to the south in 3Ps. The telemetry results provide information about the location and movements of cod throughout the year and support the revised stock structure used in assessments of northern cod since 2005, and indicate a resident component in the inshore central region of 3KL, and a migratory component in southern 3L.

During the offshore winter acoustic/trawl survey in March 2007, 164 fish were also released in 3K with surgically implanted transmitters and two external tags. Three of the telemetred fish were detected on inshore receivers in 2007 and one in 2008 indicating that they had migrated inshore; they were detected in Trinity Bay and Bonavista Bay. The telemetred cod were captured, tagged, and released in deep water (~450 m) along with conventionally tagged cod and likely suffered high post-release mortality due to the extreme depth. Nonetheless, the results provided a hint that some offshore cod were migrating inshore.

During the offshore winter acoustic trawl survey in March 2008, a further 147 cod were released in 3K with surgically implanted transmitters and external tags; they were captured and released along with conventionally tagged cod. A total of 22 offshore cod with implanted transmitters have been detected on inshore receivers (for receiver array locations see Brattey and Healey 2008b) at the time of the 2009 assessment meeting. The telemetred cod were detected on receivers moored at widely dispersed locations across the northeast coast, from Twillingate in 3Ki southward to Petty Harbour (3Lj). The first detections of offshore cod were from receivers in northern Trinity Bay in mid-July, but offshore cod were not detected in southern 3L until August. Arrival dates in the inshore were considered to be somewhat later than the traditional times observed in the 1980s when offshore cod would typically begin to appear inshore in late June. A substantial number of the inshore receivers had not been retrieved at the time of the 2009 assessment and the numbers of offshore cod detected is likely to increase. Four of the offshore cod with transmitters were captured inshore during the fishery in 2008. Overall, these results indicate that a substantial fraction of the offshore cod migrated to the inshore, confirming that the traditional inshore migration pattern did take place during 2008.

This new evidence of inshore migration from tagging and telemetry is a significant new finding with several ramifications for both science and management. Although there has been speculation that inshore migration has been ongoing since the moratorium, the offshore stock has been at an extremely low level, particularly with respect to the abundance of commercial sized fish. It has been perceived that the majority of inshore catches in the post-moratorium have come from coastal components of the stock that remained inshore throughout the year. With abundance and biomass offshore increasing, combined with the direct evidence of inshore migration, it is likely that catches in the 2006-2008 period include a mixture of inshore and offshore cod, with the proportion of offshore cod increasing during this period. It is not possible to split the total catch and sentinel indices into inshore and offshore components; consequently, an inshore SPA as formulated during recent assessments, would no longer be consistent with this new biological information even if a reliable time series of catch estimates were available. From a management perspective, the new evidence of inshore migration indicates that offshore cod are vulnerable to exploitation by inshore fisheries. Continuing to impose a moratorium in the offshore is no longer an adequate measure to protect offshore cod and new management measures are needed to promote further rebuilding of cod in the offshore. Advice from science on this issue is provided at the end of the present document.

HYDRO-ACOUSTIC SURVEYS OF COD IN SMITH SOUND

Hydro-acoustic studies have been conducted in an effort to quantify a large aggregation of cod that over-winters in Smith Sound in western Trinity Bay (see Fig. 18) (Rose 2003); this aggregation was first observed in 1995. Most cod leave Smith Sound from late spring to early summer and disperse around the coast in summer, but tagging and telemetry studies show that these cod show strong over-wintering site fidelity and many return to Smith Sound the following autumn or early winter (Brattey et al. 2008b).

Estimates of the over-wintering biomass of cod within Smith Sound have varied considerably. From hydro-acoustic surveys in January-February, the average index of biomass has ranged from 15,000 t in 1999 to about 26,000 t in 2001 (Rose 2003). There was no comparable January-February survey of Smith Sound during 2005, but surveying resumed in 2006. Average indices of biomass were stable in 2006 at 16,500-18,500 t, but declined in 2007 to 13,000 t, and to

7,200 t in 2008, the lowest in the time series. Sampling has been sporadic, but samples collected during the 2004 survey typically included a wide range of cod sizes (30-120 cm).

BEACH SEINE SURVEYS

Information on recent year-classes is available from a beach seining survey in Newman Sound, Bonavista Bay (Gregory et al. 2006). The survey catches cod mainly of ages 0 and 1, with age 0 being much more strongly represented. New information from this survey in 2008 was presented at the 2009 assessment.

The pre-recruit ages sampled in this survey are not adequately represented in surveys with other gear types and information from this survey can provide useful early indications of the relative strength of recent year classes entering the population. Trends in the numbers of age 1 cod from the beach seine survey are illustrated in Fig. 26. Although the beach seine survey has limited spatial coverage, the information on age 1 cod from this study has been consistent with the sentinel gillnet indices for the same year-classes at older ages (DFO, 2007b). Recent year-classes (2003-2006) are all weak at age 1 and the 2005 year-class is the lowest in the time-series; however, the 2007 year class at age 1 is close to the average for year-classes produced during 1995-2007. Numbers of age 0 cod caught at Newman Sound and several other sites during 2008 surveys were lower than those observed in 2007. However, survival to age 1 can be highly variable; therefore, the strength of the 2008 year-class is currently uncertain.

INSHORE TRAWL SURVEY

This joint industry-DFO survey was initiated in July-August 2006 and continued in August 2007 and 2008. The surveyed area included the coastal zone from 15 to 200 m depth and the intent was to cover the area where recent inshore commercial fisheries have taken place, within the 12 nm limit. The survey followed a stratified random design. A stratification scheme in place since the mid-1990's for "inshore" strata employed on the DFO multi-species spring and autumn surveys (generally beginning at 50m) was available, but further stratification landward of this was required. The allocation of sets was apportioned separately for two areas and within each area set allocation was proportional to stratum size. The new strata most adjacent to land (within which most of the fishery was to occur) encompassed an area of 3837 sq. n. mi and these were allocated 110 sets. Perimeter strata on the seaward side, but adjacent to the inshore strata taken from the existing DFO multispecies stratification, covered an area of 9095 sq. n. mi; this area was allocated 65 sets. With the exception of trawl doors and restrictor cables on the warps, each vessel used the same gear employed in the Northern Gulf (4RS-3Pn) and Southern Gulf (4T) cod surveys, i.e., a Star Balloon 300 trawl with Rockhopper footgear and a 40mm liner in the cod-end. Vessel speed was 2.5 knots. A net monitoring system that enabled measurements of door spread and opening was used. An estimation of wingspread was then possible (approximately 15.8m~52 ft) for swept area estimates of biomass and abundance.

In spite of the rough bottom that is characteristic of many near-shore areas, the survey coverage was reasonably good in each year, with >=140 sets successfully completed. A summary of catches, with strata grouped into the same three inshore areas as described in the sentinel survey results, is given in Table 16. The time series is too short to interpret trends in catch rates or to use the data as an index of abundance or biomass, but catches have generally been higher in the shallowest strata (<50 m depth) and lowest in the northern area. Lengths of cod caught ranged from 12 to 73 cm with a mode at about 20-23 cm in 2006 and 2007 (Fig. 27); the age structure changed in 2008, with a strong mode at 13 cm and smaller modes at 46 cm and 55 cm. Ages of cod caught ranged from 1 to 10 years, but ages 2 and 3 were most strongly represented in 2006 and 2007, comprising about 70% of the numbers caught in each year (Fig. 27). In contrast, age 1 is most strongly represented in 2008. Among older ages, the 2002 year classes is evident as a slight “bump” at ages 5 in 2007 and age 6 in 2008 surveys, respectively.

SCIENCE LOGBOOKS

Catch and effort data for the <35 ft sector from log-books for the 2008 fishery were not available at the time of the assessment. Catch rates during 2007 were higher than those observed in all three inshore areas during 2006 (Brattey et al. 2008a).

POPULATION BIOLOGY

The information on maturity, growth and condition reported in this section is derived from sampling during the autumn offshore bottom-trawl surveys.

MATURITY

Annual estimates of age at 50% maturity (A50) for females from the 2J3KL cod stock, collected during annual autumn DFO research bottom-trawl surveys, were calculated as described by Morgan and Hoenig (1997). Maturation is estimated by cohort. The estimated age at 50% maturity (A50) was generally between 6.0 and 7.0 among cohorts produced in the late-1950’s and around 6.0 among those produced during the late 1960’s to the early 1980’s, but declined dramatically thereafter (Fig. 28). Age at maturity has remained low but variable (4.9-5.7) for the 1990-2004 cohorts, with no clear trend. The last three cohorts (2002-04) show the lowest estimated values for A50 in the time-series, but are more uncertain because only younger ages are available to estimate A50. Estimates of A50 for the 1990 cohort onwards from the 2008 assessment are overlaid on the 2009 assessment results (Fig. 28). This comparison shows that the addition of one more year of data has a declining influence on progressively older cohorts that are mostly mature, and mainly influences the most recent cohorts for which there is less data. Males show a similar trend over time (data not shown), but tend to mature about one year earlier than females.

Estimates of proportion mature for ages 3-8 show a similar increasing trend (i.e., increasing proportions of mature fish at young ages) through the late 1970’s and 1980’s, particularly for ages 5, 6, and 7 (Fig. 29). For example, the proportion of 6 yr olds that are mature has increased from about 15% during the early 1960’s to about 50% in the 1970’s and 1980’s and to about 80% or more during the 1990’s and 2000’s.

Although the number of cod older than age 6 has increased in the past 2-3 years, the age composition of the offshore components of 2J3KL cod remains extremely protracted relative to the pre-moratorium period. A spawning stock biomass that consists mainly of older fish, or a broad age range, may result in a longer time span of spawning (Hutchings and Myers 1993; Trippel and Morgan 1994). Older, larger fish also produce more viable eggs and larvae (Solemdal et al. 1995; Kjesbu et al. 1996; Trippel 1998; Stares et al. 2007). However, Morgan et al. (2007) also found that there was no consistent relationship between age-composition of the spawning stock and recruitment in three populations of cod including those in 2J3KL.

GROWTH

The lengths-at-age and weights-at-age of cod sampled during the autumn surveys confirm the general pattern of a decline in the 1980's and early 1990's as observed in commercial weights-at-age (Fig. 7). The research survey data (Tables 18, 19; Figs. 30a, b, 31a, b) illustrate that the changes varied with Division; there was a strong decline in Div. 2J, a lesser decline in Div. 3K, and little or no decline in Div. 3L. The Divisional differences in mean lengths and weights are more apparent in Figs. 30b and 31b which focus on changes in cod of ages 4 and 5.

The trend toward low mean lengths-at-age and weights-at-age in the early 1990's has been reversed during the latter half of the 1990's. For example, in Div. 2J, where the decline was the greatest, recent mean lengths-at-age have been at about the average for the 1978-2008 period (Fig. 30b).

Overall, size-at-age has varied without much trend in recent years (Figs. 30a, 31a). Sample sizes at ages greater than ages 4-5 have been small since the early to mid-1990s, but since about 2005 some older ages (age 6 and 7) have reappeared in the survey catches. The length-at age and weight-at-age of 6 and 7 year olds appear to be comparable to values observed in the early 1980s.

CONDITION

Information on condition is obtained from sampling during the autumn survey and it should be noted that there is a strong seasonal cycle in condition of cod, with lowest values typically occurring in spring just after spawning. Values reported here are based on sampling when condition would be near the high end of the seasonal cycle.

Condition can be expressed in various formulations and Fulton's condition factor ($W/L^3 * 10^5$) is often used, where W is either the gutted weight of the fish or the liver weight in kg, and L is the length in cm. A time series of annual estimates of Fulton's condition factor and liver weight of cod by NAFO Division and age is given (Tables 20, 21; Figs. 32, 33). Gutted condition and liver indices were also calculated for each Division for three cod length classes (27-29 cm, 36-38 cm and 48-50 cm; Figs. 34, 35). In Division 2J and 3K gutted condition at length declined during the early 1990's and then increased to the levels observed prior to the 1990's. Gutted condition at length showed little trend over time in Division 3L (Fig. 34). For Division 3K and 3L, liver condition increased up to the early 1990's, and has subsequently varied without trend (Fig. 34). In Division 2J, there is an indication of lower liver condition after the 1990's, particularly for bigger fish (Fig. 35).

Another way to examine condition without an effect of length is to calculate relative condition (relative K). A length versus gutted weight regression was fitted to data for each division. The condition index is then observed condition divided by the condition predicted from the length-weight regression for a fish of that length. Relative liver condition (relative LK) was calculated in a similar fashion using a liver weight-length regression. Relative K and relative LK for each year were estimated for each division using a generalized linear model with an identity link function and a gamma error distribution, with year as a class variable. In each division there was a significant year effect. Both Div. 2J and 3K show lower relative K in the early 1990's (Figs. 36 and 37). There is little trend in Div. 3L, but condition is estimated to have been unusually high in 1995. The cause of this large estimate has not been examined. There was a significant year effect in all three divisions. Relative LK showed a decline in the late 1980's to early 1990's in Div. 2J. Relative LK subsequently increased, but did not reach the levels of the early 1980's. Relative LK has increased in both Div. 3K and 3L.

The two methods of calculating condition show essentially the same patterns. In Div. 2J and 3K gutted condition declined during the early 1990's and then increased to the levels observed prior to the 1990's. Gutted condition at length showed little trend over time in Div. 3L. For Div. 3K and 3L, liver condition has shown some increase. In Div. 2J, there is an indication of lower liver condition after the 1990's compared to the 1980's.

Overall, the biological data based on sampling during the autumn research surveys indicate that aspects of stock productivity such as growth and condition have improved over values in the 1990s, but are below the peak values observed in the early part of the time series, especially in the north (2J). The apparent lack of a strong improvement in growth rates in spite of greatly reduced population size suggests that the stock is not as productive as it was in the past. Age-at-maturation remains low and values for the most recent cohorts are among the lowest observed. The assessment meeting noted the contrast between slightly improved growth (especially relative to the early 1990s), but no improvement in age-at-maturity in spite of apparently lower levels of total mortality in the past three years. It was recommended that trends in length-at-maturity be investigated in future to determine if this has increased recently. This is important in relation to stock productivity and sustainable harvest levels.

POPULATION ANALYSIS

There have been no accepted population models that capture the dynamics of the 2J3KL stock as a whole since the early 1990's. Since the mid-1990's there have been strong indications that the inshore and offshore components of the stock were showing different dynamics; furthermore, the dynamics also appear to differ north to south along the coastal region of 2J3KL (i.e., Fig. 19). A sequential population analysis (SPA) that attempted to capture the dynamics of the inshore components of the stock was introduced in 2001. These analyses, using inshore catch from the post-moratorium period and tuned with indices from the inshore, were refined and modified in various ways as new data became available at assessments conducted during 2001-06; in these analyses the offshore components of the stock were at very low levels and were assumed to be contributing little to catches and indices in the inshore. The "inshore" SPA was refined to capture the dynamics of the inshore components of the stock inhabiting only the central inshore region (i.e., 3Ki, 3La, 3Lb) where resident inshore cod appeared to be most abundant. These analyses were not continued in the 2008 assessment because the total catch from the fishery in 2007 was unknown. However, the new evidence from tagging and telemetry indicates that the inshore fishery catch in 2008, and hence the sentinel catches which were used to tune the inshore SPA, likely included considerable numbers of fish from the offshore. Given that biomass in the offshore has been increasing in the last few years it is likely that the contribution of offshore cod to inshore catch and sentinel indices has also been increasing. Consequently, the inshore can no longer be considered as harbouring a discrete component of the stock at the time of the fishery.

Some exploratory analysis using the 2J3KL cod survey data were conducted using SURBA (Beare et al. 2005) and presented at the 2009 assessment, but these analyses were not used directly in the formulation of advice. These analyses do not incorporate catch information, and pertained only to that portion of the total stock that was surveyed within the offshore index strata during the autumn trawl survey. Various formulations were investigated and findings are reported in summary form elsewhere (DFO 2009a).

PRECAUTIONARY APPROACH

Under the DFO precautionary approach (PA) framework, upper and lower (limit) reference points need to be determined with regard to spawner biomass in order to define the boundaries of the Cautious, Critical and Healthy zones (Shelton and Sinclair 2008). In the 2003 Zonal assessment of cod stocks it was determined that a spawner biomass of 150,000 t represented a milestone for 2J3KL stock recovery, at which point it may be possible to determine an appropriate limit reference point for the 2J3KL stock as a whole. It was considered that an appropriate limit reference point would be a level greater than 300,000 t of SSB and that recovery to this level would likely take several years. Subsequent assessments considered the status of inshore and offshore components separately as they were showing different dynamics, and there were no requests regarding the PA in the Terms of Reference (ToR) for assessments in 2006 or 2007. At the 2009 ZAP, the PA issue was re-introduced in the ToR and there were several presentations regarding the PA (see DFO 2009a). However, no formal analyses regarding the 2J3KL cod stock as a whole were presented with respect to the PA. Nonetheless, the meeting concluded that although no specific limit reference point had been established, the 2J3KL stock was well below any reasonable value. If management wished to adhere strictly to principles of the PA, this would require that catches in 2009 would be at the lowest possible level. This would include no directed fishing and measures to reduce cod by-catch in other fisheries.

At the Zonal assessment there were presentations and discussion regarding broader issues around the PA that were not specifically directed at 2J3KL cod. These are reported elsewhere (DF0 2009).

CONCLUSIONS

Conclusions are presented for offshore and inshore separately, and for the stock as a whole.

OFFSHORE

Based on autumn surveys, offshore abundance and biomass indices have been increasing since 2003; spawning stock biomass (SSB) has been increasing since 2005. The average abundance, biomass, and SSB of cod in the offshore over the last 3 years are 8% of the average during the 1980's. During 2003-2008 the biomass has been increasing at an average annual rate of 66% and abundance at an average annual rate of 32%.

Total mortality in the offshore was extremely high during 1996-2003 and has been a major impediment to stock recovery. Total mortality has declined substantially since 2003 and the prospects for recovery have improved. The value of Z for 2007-2008 was 0.23, corresponding to 21% mortality per year. Much of the improvement in the stock is due to improved survival, particularly of the 2000-2002 year-classes, but recruitment remains weak and improved recruitment would be an essential component of a sustained recovery.

Offshore tagging and telemetry in 2008 indicated that a substantial portion of cod from the offshore aggregation migrated to the inshore of 3KL during the summer, and some were caught in inshore fisheries. Exploitation of offshore cod in the inshore was estimated at 6%. This rate has not prevented recent rebuilding in some regions of the offshore, notably along the 3K-3L border and along the southeastern side of Funk Island Bank.

Some aspects of stock productivity such as growth and condition have improved over values in the 1990s, but are below the peak values observed in the early 1980s, especially in the north (2J). The apparent lack of a strong improvement in growth rates in spite of greatly reduced population size suggests that the stock is not as productive as it was in the past. Age-at-maturation remains low and values for the most recent cohorts are among the lowest observed.

INSHORE

For assessment purposes the inshore was divided into three areas: 1) a northern area (2J and northern 3K); 2) a central area (southern 3K and northern 3L); and 3) a southern area (southern 3L).

During 2008, mean exploitation rates from tagging studies ranged from 3-7% among inshore central and southern areas; no tagging was conducted in the northern area. These exploitation rates are similar to the estimate for offshore cod tagged in 3K and captured in inshore fisheries (6%).

In the inshore southern area, catches are partly dependent on seasonal immigration of fish from 3Ps where the stock is declining. Future removals may therefore rely more heavily on cod from the offshore of 3KL. The similarity in the recent age compositions from the Sentinel gillnet survey for the southern area and the 2J3KL DFO offshore RV survey reflect this concern; the 2002 year-class is well represented in the catch in both these areas.

STOCK AS A WHOLE

In the inshore northern area catch rates are lower than those in the central area suggesting lower cod abundance in the northern area. Fisheries in this area depend on seasonal immigration of fish, possibly from offshore regions, including 2J where offshore biomass remains low. Therefore, it is recommended to minimize removals from this area.

The new evidence of inshore migration from tagging indicates that the moratorium in the offshore is no longer sufficient to protect the offshore stock until recovery is well established.

Although a specific limit reference point has not been established, the stock as a whole is clearly below any reasonable value given historical biomass estimates. The application of the precautionary approach would require catches in 2009 to be at the lowest possible level. This would include no directed fishing and measures to reduce cod by-catch in other fisheries.

Although status offshore has improved in some areas, the stock has not increased across much of its historical geographic range and overall remains far below historical biomass levels. Management should focus on promoting further increases in SSB and improved recruitment until the stock is more resilient to the effects of fishing.

Exploitation rates on offshore cod by inshore fisheries have been low enough to permit growth in biomass of some offshore components. However, exploitation rates should not be allowed to increase above the levels observed in 2008. Recruitment information suggests that there are weaker year-classes supplying the fishable stock after the 2002 year-class and inshore exploitable biomass in 2009-2010 is likely to be similar to 2008-2009. To achieve the same exploitation rates as in 2008, total removals (recreational plus commercial) should not increase.

Any fishery should be managed such that catches are not concentrated in ways that would increase exploitation on individual stock components.

OTHER CONSIDERATIONS

Recreational Fishery

Recreational landings can be a substantial fraction of the total and the management of recreational fisheries should be improved so that total removals can be effectively controlled. In addition, length compositions based on sampling of recreational fishers catches by Fisheries Officers should be provided to science in a timely manner to improve the accuracy of recreational catch estimates. Accurate catch information from all sources is essential for science to evaluate the impacts of fishing.

Consequences of an Inshore Fishery

Cod currently offshore in 2J3KL have now been shown to undergo spring/summer feeding migrations to the inshore during 2008, similar to their historic pattern. The moratorium in the offshore is therefore no longer sufficient to protect the offshore stock until recovery is well established. At current levels of exploitation, the risk that fishing inshore will prevent stock growth offshore seems low, as the stock has grown in the presence of a small inshore fishery.

The fisheries in 2006-2008 have not resulted in an increase in total mortality offshore, or a reduction in catch rates inshore, and tagging suggests that exploitation (harvest) rates were low in 2008. However, if exploitation rates increase in the future then this situation may change. Managers should be aware that a recent reduction in the strength of year-classes entering the fishery, as indicated by the beach-seine surveys and small-mesh sentinel catch rates, will likely result in no increase in exploitable biomass in 2009/2010, even if total catches remain unchanged.

Implications of Fishing Bay-By-bay

The distribution of fish harvesters is not uniform and does not match the distribution of cod. For example, there is a concentration of harvesters in 3Ki, 3La and 3Lb, but relatively few harvesters in 2J and in the extreme south in 3Lq. In some years this has caused geographic variability in fishing mortality rates, as evidenced by tagging studies. Therefore, fishing bay-by-bay may result in local over-exploitation, particularly in areas such as 3Ki, where resident inshore cod are less abundant and effort is high. In addition, some areas such as 2J depend on seasonal immigration of fish, possibly from offshore regions, including the offshore of 2J where biomass remains low. Managers should attempt to keep exploitation rates low on all components. This will encourage further rebuilding and preserve and enhance population spatial structure and diversity within the stock.

REFERENCES

Beare, D.J., Needle, C.L., Burns, F. and Reid, D.G. 2005. Using survey data independently from commercial data in stock assessment: an example using haddock in ICES Division Via. ICES J. Mar. Sci. 62: 996-1005.

Bishop, C.A. 1994. Revisions and additions to stratification schemes used during research vessel surveys in NAFO Subareas 2 and 3. NAFO SCR Doc. 94/43, Ser. No. N2413. 23 p.

Bishop, C.A., Anderson, J., Dalley, E., Davis, M.B., Murphy, E.F., Rose, G.A., Stansbury, D.E., Taggart, C., and Winters, G. 1994. An assessment of the cod stock in NAFO Divisions 2J+3KL. NAFO SCR Doc. 94/40, Ser. No. N2410. 50 p.

Bishop, C.A., Murphy, E.F., Davis, M.B., Baird, J.W., and Rose, G.A. 1993. An assessment of the cod stock in NAFO Divisions 2J+3KL. NAFO SCR Doc. 93/86, Ser. No. N2271. 51 p.

Bishop, C.A., and Shelton, P.A. 1997. A narrative of NAFO Div. 2J3KL cod assessments from extension of jurisdiction to moratorium. Can. Tech. Rep. Fish. Aquat. Sci. 2199: 66 p.

Bishop, C.A., Stansbury, D.E., and Murphy, E.F. 1995. An update of the stock status of Div. 2J3KL cod. DFO Atl. Fish. Res. Doc. 95/34.

Bowering, W.R., and Orr, D.C. 2004. By-catch of Greenland halibut (*Reinhardtius hippoglossoides*, Walbaum) in the Canadian fishery for northern shrimp (*Pandalus borealis*, Koyer) in NAFO Subarea 2 and Divisions 3KL. NAFO SCR Doc. 04/67.

Brattey, J. 1999. Stock structure and seasonal migration patterns of Atlantic cod (*Gadus morhua*) based on inshore tagging experiments in Div. 3KL during 1995-97. DFO Can. Stock Ass. Sec. Res. Doc. 99/103. 19 p.

2000. Stock structure and seasonal movements of Atlantic cod (*Gadus morhua*) in NAFO Div. 3KL inferred from recent tagging experiments. DFO Can. Stock Ass. Sec. Res. Doc. 2000/084.

Brattey, J., and Healey, B.P. 2003. Exploitation rates and movements of Atlantic cod (*Gadus morhua*) in NAFO Div. 3KL based on tagging experiments conducted during 1997-2002. DFO Can. Sci. Adv. Sec. Res. Doc. 2003/032.

2005. Exploitation and movements of Atlantic cod (*Gadus morhua*) in NAFO Div. 3KL: further updates based on tag returns during 1995-2004. DFO Can. Sci. Adv. Sec. Res. Doc. 2005/047.

2007. Exploitation of Atlantic cod (*Gadus morhua*) in NAFO Div. 3KL: tagging results from the reopened fishery in 2006. DFO Can. Sci. Advis. Sec. Res. Doc. 2007/027.

Brattey, J., Cadigan, N.G., Dwyer, K., Healey, B.P., Morgan, M.J., Murphy, E.F. Maddock Parsons, D., and Power, D. 2008a. Assessments of the cod (*Gadus morhua*) stock in NAFO Divisions 2J3KL (April 2007 and April 2008). DFO Can. Sci. Advis. Sec. Res. Doc. 2008/047.

Brattey, J., Healey, B.P., and Porter, D. 2008b. Northern cod (*Gadus morhua*) 16 years after the moratorium: new information from tagging and acoustic telemetry. DFO Can. Sci. Advis. Sec. Res. Doc. 2008/047. DFO Can. Sci. Advis. Sec. Res. Doc. 2008/086.

Brodie, W. 2005. A description of the autumn multispecies surveys in SA2+ Divisions 3KLMNO from 1995-2004. NAFO SCR Doc. 05/8.

Brodie, W. and Stansbury, D. 2007. A brief description of Canadian multispecies surveys in SA2+ Divisions 3KLMNO from 1995 to 2006. NAFO SCR Doc. 07/18. Ser. No. N5366.

Cadigan, N., and Brattey, J. 2000. Lower bounds on the exploitation of cod (*Gadus morhua*) in NAFO Div. 3KL and Subdiv. 3Ps during 1997-99 from tagging experiments. DFO Can. Stock Ass. Sec. Res. Doc. 2000/073.

2003. Analyses of stock and fishery dynamics for cod in 3Ps and 3KL based on tagging studies in 1997-2002. DFO Can. Sci. Adv. Sec. Res. Doc. 2003/037.

2008. Reporting rates from cod tagging studies in NAFO Divisions 2J3KL and Subdivision 3Ps. DFO Can. Sci. Advis. Sec. Res. Doc. 2008/031.

Colbourne, E.B., Craig, J., Fitzpatrick, C., Senciall, D., Stead, P. and Bailey, W. 2008. An assessment of the physical oceanographic environment on the Newfoundland and Labrador Shelf during 2007. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2008/020.

2009. An assessment of the physical oceanographic environment on the Newfoundland and Labrador Shelf during 2007. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/ in prep.

DFO 2007a. Accounting for changes in natural mortality in Gulf of St. Lawrence cod stocks. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/002.

2007b. Stock assessment of Northern (2J3KL) cod in 2007. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/018.

2008a. 2007 State of the ocean: physical oceanographic conditions in the Newfoundland and Labrador Region. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2008/017.

2008b. 2007 State of the ocean: chemical and biological oceanographic conditions in the Newfoundland and Labrador Region. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2008/038.

2009a. Proceedings of the Newfoundland and Labrador Regional Advisory Process for 2J3KL Cod, 2009. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2009/ (in prep).

2009b. Stock assessment of Northern (2J3KL) cod in 2008. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2008/034.

Fudge, S.B., and Rose, G.A. 2008. Life history co-variation in a fishery depleted Atlantic cod stock. Fish. Res. 92: 107-113.

Gavaris, S., and Gavaris, C.A. 1983. Estimation of catch at age and its variance for groundfish stocks in the Newfoundland region. *In* Sampling commercial catches of marine fish and invertebrates. Edited by W.G. Doubleday and D. Rivard. Can. Spec. Publ. Fish. Aquat. Sci. 66. pp. 178-182.

Gregory, R.S., Morris, C., Sheppard, G.L., Thistle, M.E., Linehan, J.E., and Schneider, D.C. 2006. Relative strength of the 2003 and 2004 year-classes, from nearshore surveys of demersal age 0 and 1 Atlantic cod in Newman Sound, Bonavista Bay. DFO Can. Sci. Advis. Sec. Res. Doc. 2006/038.

Hutchings, J.A., and Myers, R.A. 1993. Effect of age on the seasonality of maturation and spawning of Atlantic cod, *Gadus morhua*, in the Northwest Atlantic. Can. J. Fish. Aquat. Sci. 50: 2468-2474.

Jarvis, H., and Stead, R. 2005. Results of the 2005 fish harvesters' telephone survey on the status of northern (2J3KL) cod. DFO Can. Stock Ass. Sec. Res. Doc. 2005/092.

Kjesbu, O.S., Solemdal, P., Bratland, P., and Fonn, M. 1996. Variation in annual egg production in individual captive Atlantic cod (*Gadus morhua*). Can. J. Fish. Aquat. Sci. 53: 610-620.

Kulka, D.W. 1998. Update of discarding of cod in the shrimp and cod directed fisheries in NAFO Divisions 2J, 3K, and 3L. DFO Can. Stock Ass. Sec. Res. Doc. 98/12.

Lilly, G.R. 1994. Predation by Atlantic cod on capelin on the southern Labrador and Northeast Newfoundland shelves during a period of changing spatial distributions. ICES Mar. Sci. Symp. 198: 600-611.

1995. Did the feeding level of the cod off southern Labrador and eastern Newfoundland decline in the 1990's? DFO Atl. Fish. Res. Doc. 95/74. 25 p.

1998. Size-at-age and condition of cod in Divisions 2J+3KL during 1978-1997. DFO Can. Stock Ass. Sec. Res. Doc. 98/76.

Lilly, G.R., Brattey, J., and Davis, M.B. 1998b. Age composition, growth and maturity of cod in inshore waters of Divisions 2J, 3K and 3L as determined from sentinel surveys (1995-1997). DFO Can. Stock Assess. Sec. Res. Doc. 98/14.

Lilly, G.R., and Murphy, E.F. 2004. Biology, fishery and status of the 2GH and 2J3KL (northern) cod stocks: information supporting an assessment of allowable harm under the Species at Risk Act for the COSEWIC-defined Newfoundland and Labrador population of Atlantic cod (*Gadus morhua*). DFO Can. Sci. Adv. Sec. Res. Doc. 2004/102.

Lilly, G.R., Murphy, E.F., Healey, B.P., Maddock Parsons, D., and Stead, R. 2004. An update of the status of the cod (*Gadus morhua*) stock in NAFO Divisions 2J+3KL in March 2004. DFO Can. Sci. Adv. Sec. Res. Doc. 2004/023. 55 p.

Lilly, G.R., Murphy, E.F., Healey, B.P., and Brattey, J. 2005. An assessment of the cod (*Gadus morhua*) stock in NAFO Divisions 2J3KL in March 2005. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/018.

2006. An assessment of the cod (*Gadus morhua*) stock in NAFO Divisions 2J3KL in April 2006. DFO Can. Sci. Advis. Sec. Res. Doc. 2006/043.

Lilly, G.R., Shelton, P.A., Brattey, J., Cadigan, N.G, Murphy, E.F., and Stansbury, D.E., Davis, M.B., and Morgan, M.J. 1998a. An assessment of the cod stock in NAFO Divisions 2J+3KL. DFO Can. Stock Ass. Sec. Res. Doc. 98/15. 102 p.

1999. An assessment of the cod stock in NAFO Divisions 2J+3KL. DFO Can. Stock Ass. Sec. Res. Doc. 99/42. 165 p.

Lilly, G.R., Shelton, P.A., Brattey, J., Cadigan, N.G., Murphy, E.F., and Stansbury, D.E. 2000. An assessment of the cod stock in NAFO Divisions 2J+3KL. DFO Can. Stock Ass. Sec. Res. Doc. 2000/063. 123 p.

Lilly, G.R., Shelton, P.A., Brattey, J., Cadigan, N.G., Healey, B.P., Murphy, E.F., and Stansbury, D.E. 2001. An assessment of the cod stock in NAFO Divisions 2J+3KL. DFO Can. Stock Ass. Sec. Res. Doc. 2001/044. 148 p.

Lilly, G.R., Shelton, P.A., Brattey, J., Cadigan, N.G., Healey, B.P., Murphy, E.F., Stansbury, D.E., and Chen, N. 2003. An assessment of the cod stock in NAFO Divisions 2J+3KL in February 2003. DFO Can. Sci. Adv. Sec. Res. Doc. 2003/023.

McCullagh, P., and Nelder, J.A. 1989. Generalized linear models. London, Chapman and Hall.

Maddock Parsons, D., and Stead, R. 2009. Sentinel surveys 1995-2008: catch per unit effort in NAFO Divisions 2J3KL. DFO Can. Sci. Adv. Sec. Res. Doc. 2006/074.

Maddock Parsons, D., and Stead, R. In preparation. Overview of Sentinel Surveys in NAFO Divisions 2J3KL and Subdivision 3Ps 1995-2008. DFO Can. Sci. Adv. Sec. Res. Doc.

Morgan, M.J. 2008. The retrospective issue with estimates of maturity for 2J3KL cod (*Gadus morhua*). DFO Can. Sci. Advis. Sec. Res. Doc. 2008/038.

Morgan, M.J., and Hoenig, J.M. 1997. Estimating maturity-at-age from length stratified sampling. J. Northw. Atl. Fish. Sci. 21: 51-63.

Morgan, M.J., Shelton, P.A., and Brattey, J. 2007. Age composition of the spawning stock does not always influence recruitment. J. Northw. Atl. Fish. Sci. 38: 1-12.

Murphy, E.F., Stansbury, D.E., Shelton, P.A., Brattey, J., and Lilly, G.R. 1997. A stock status update for NAFO Divisions 2J+3KL cod. NAFO SCR Doc. 97/59, Ser. No. N2893. 58 p.

Orr, D.C., Kulka, D., and Firth, J. 2002. Groundfish by-catch in the Canadian small (<500 tons; LOA <100') and large (= >500 tons) vessel Division 3L shrimp fishery, during 2000 and 2001. NAFO SCR Doc. 02/6, Ser. No. N4607. 6 p.

Orr, D.C., Parsons, D.G., Atkinson, D.B., Veitch, P.J., and Sullivan, D. 1999. Information pertaining to northern shrimp (*Pandalus borealis*) and groundfish in NAFO Divisions 3LNO. NAFO SCR Doc. 99/102, Ser. No. N4181. 22 p.

Orr, D.C., Veitch, P., Sullivan, D., Firth, J., Peters, C., and Inkpen, T. 2008. Groundfish by-catch within the northern shrimp fishery off the eastern coasts of Newfoundland and Labrador over the years 2004-2008. NAFO SCR Doc. 08/31. Serial No. N5532.

Reddin, D.G., Johnson, R., and Downton, P. 2002. A study of by-catches in herring bait nets in Newfoundland, 2001. DFO Can. Sci. Adv. Sec. Res. Doc. 2002/031. 19 p.

Rose, G.A. 2003. Monitoring coastal northern cod: towards an optimal survey of Smith Sound, Newfoundland. ICES J. Mar. Sci. 60: 453-462.

Shelton, P.A., and Sinclair, A.F. 2008. It's time to sharpen our definition of sustainability. Can. J. Fish. Aquat. Sci. 65: 2305-2314.

Shelton, P.A., Stansbury, D.E., Murphy, E.F., Lilly, G.R., and Brattey, J. 1996. An assessment of the cod stock in NAFO Divisions 2J+3KL. DFO Atl. Fish. Res. Doc. 96/80 (also NAFO SCR Doc. 96/62.).

Shelton, P.A., Sinclair, A.F., Chouinard, G.A., Mohn, R., Duplisea, D. 2006. Fishing under low productivity conditions is further delaying recovery of Northwest Atlantic cod (*Gadus morhua*). Can. J. Fish. Aquat. Sci. 63: 235-238.

Sinclair, A. 2001. Natural mortality of cod (*Gadus morhua*) in the southern Gulf of St. Lawrence. ICES J. Mar. Sci. 58: 1-10.

Smith, S.J., and Somerton, G.D. 1981. STRAP: A user-oriented computer analysis system for groundfish research trawl survey data. Can. Tech. Rep. Fish. Aquat. Sci. 1030: iv + 66 p.

Solemdal, P., Kjesbu, O.S., and Fonn, M. 1995. Egg mortality in recruit- and repeat-spawning cod - an experimental study. ICES C.M. G:35: 14 p.

Stansbury, D.E., Maddock Parsons, D., and Shelton, P.A. 2000. An age disaggregate index from the sentinel program for cod in 2J3KL. DFO Can. Stock Ass. Sec. Res. Doc. 2000/090. 64 p.

Stares, J.C., Rideout, R.M., Morgan, M.J., and Brattey, J. 2007. Did population collapse influence individual fecundity of Northwest Atlantic cod? ICES J. Mar. Sci. 64: 1338-1347.

Swain, D.P., and Chouinard, G.A. 2008. Predicted extirpation of the dominant demersal fish in large marine ecosystem: Atlantic cod (*Gadus morhua*) in the southern Gulf of St. Lawrence. Can. J. Fish. Aquat. Sci. 65: 2315-2319.

Taggart, C.T., Penney, P., Barrowman, N., and George, C. 1995. The 1954-1993 Newfoundland cod-tagging database: statistical summaries and spatial-temporal distributions. Canadian Technical Report of Fisheries and Aquatic Sciences 2042: 441p.

Trippel, E.A. 1998. Egg size and viability and seasonal offspring production of young Atlantic cod. Trans. Amer. Fish. Soc. 127: 339-359.

Trippel, E.A., and Morgan, M.J. 1994. Age-specific paternal influences on reproductive success of Atlantic cod (*Gadus morhua* L.) of the Grand Banks, Newfoundland. ICES Mar. Sci. Symp. 198: 414-422.

Trzcinski, M.K., Mohn, R., and Bowen, D. 2006. Continued decline of an Atlantic cod population: how important is gray seal predation? Ecol. Appl. 16: 2276-2292.

Table 1. Historical landings (t) of cod from NAFO Div. 2J+3KL from 1959 onward.

	2J				3K				3L				2J3KL			
	Offshore mobile gear		Fixed gear		Offshore mobile gear		Fixed gear		Offshore mobile gear		Fixed gear					
Year	Canada	Other	Canada	Total	Canada	Other	Canada	Total	Canada	Other	Canada	Total	Total Canada	Total Other	Total	TAC
1959	0	46372	17533	63905	0	97678	56264	153942	4515	51515	85695	141725	164007	195565	359572	
1960	1	164123	15418	179542	53	74999	47676	122728	7355	63985	94192	165532	164695	303107	467802	
1961	1	243144	17545	260690	0	64023	31159	95182	4675	73899	70659	149233	124039	381066	505105	
1962	0	226841	23424	250265	0	47015	42816	89831	4383	90276	72271	166930	142894	364132	507026	
1963	1	197868	23767	221636	0	79331	47486	126817	4446	83015	73295	160756	148995	360214	509209	
1964	13	197359	14787	212159	0	121423	40735	162158	10158	142370	75806	228334	141499	461152	602651	
1965	0	246650	25117	271767	21	50097	26467	76585	7353	130387	58943	196683	117901	427134	545035	
1966	39	226244	22645	248928	13	58907	32208	91128	8253	120206	55990	184449	119148	405357	524505	
1967	28	217255	27721	245004	114	78687	24905	103706	13478	200343	49233	263054	115479	496285	611764	
1968	4650	355108	12937	372695	1849	119778	40768	162395	15784	211808	47332	274924	123320	686694	810014	
1969	30	405231	4328	409589	56	80949	24923	105928	18255	151945	67973	238173	115565	638125	753690	
1970	0	212961	1963	214924	92	78274	21512	99878	14471	137840	53113	205424	91151	429075	520226	
1971	0	154700	3313	158013	31	61506	21111	82648	11976	148766	38115	198857	74546	364972	439518	
1972	0	149435	1725	151160	7	133369	14054	147430	4380	109052	46273	159705	66439	391856	458295	
1973	1123	52985	3619	57727	108	159653	13190	172951	1258	97734	24839	123831	44137	310372	354509	666000
1974	0	119463	1804	121267	19	149189	10747	159955	880	67918	22630	91428	36080	336570	372650	657000
1975	410	78578	3000	81988	189	112678	15518	128385	670	53770	22695	77135	42482	245026	287508	554000
1976	94	30691	3851	34636	771	79540	20879	101190	2187	40998	35209	78394	62991	151229	214220	300000
1977	525	39584	3523	43632	1051	26776	28818	56645	5362	26799	40282	72443	79561	93159	172720	160000
1978	4682	17546	6638	28866	7027	6373	29623	43023	9213	12263	45194	66670	102377	36182	138559	135000
1979	9194	6537	8445	24176	21572	16890	27025	65487	14184	12693	50359	77236	130779	36120	166899	180000
1980	13592	7437	17210	38239	21920	6830	37015	65765	15523	13963	42298	71784	147558	28230	175788	180000
1981	22125	4760	14251	41136	23112	3847	23002	49961	21754	15070	42827	79651	147071	23677	170748	200000
1982	58384	8923	14429	81736	8881	4074	42141	55096	27181	9271	56490	92942	207506	22268	229774	230000
1983	37276	4158	10748	52182	31621	2815	40683	75119	39123	10920	55001	105044	214452	17893	232345	260000
1984	9231	2782	13150	25163	48114	11059	35143	94316	47668	15973	49351	112992	202657	29814	232471	266000
1985	1466	78	10211	11755	68880	12945	30368	112193	36863	31176	39306	107345	187094	44199	231293	266000
1986	5734	7859	12916	26509	62086	5781	28384	96251	57805	53946	32202	143953	199127	67586	266713	266000
1987	39344	3999	16022	59365	39686	6160	27442	73288	44612	25916	36743	107271	203849	36075	239924	256000
1988	41468	9	17112	58589	40260	50	33820	74130	57805	26748	51405	135958	241870	26807	268677	266000
1989	33626	1003	23304	57933	37350	1179	20711	59240	40958	36621	59238	136817	215187	38803	253990	235000
1990	17883	183	14505	32571	26920	504	27516	54940	31187	25488	75266	131941	193277	26175	219452	199262
1991	621	82	2214	2917	30112	311	13332	43755	30264	49660 [2]	45416 [3]	125340	121959	50053	172012	190000
1992	0	0	18	18	584	273	884	1741	13627	14610 [4]	10960 [5]	39197	26073	14883	40956	0
1993	0	0	13	13	0	0	541	541	2	2425 [6]	8411 [7]	10838	8967	2425	11392	0
1994	0	0	9	9	0	0	368	368	0	1	936	937	1313	1	1314 [8]	0
1995 [13]	0	0	0	1	0	0	122	122	1	0	290	290	413	0	413 [9]	0
1996 [13]	0	0	3	3	0	0	961	961	1	1	908	910	1874	1	1875 [10]	0
1997 [13]	0	0	4	4	0	0	280	280	0	0	592	593	877	0	877	0
1998 [13]	0	0	16	16	0	0	1994	1994	1	6	2491	2497	4501	0	4507	4000
1999 [13]	0	0	33	33	0	0	3554	3554	0	1	4938	4939	8525	1	8526	9000
2000 [1]	0	0	3	3	0	0	1410	1410	26	54 [12]	3937	4017	5376	54	5430	7000

Table 1. (Cont'd.)

Year	2J Offshore mobile gear Canada	2J Offshore mobile gear Other	2J Fixed gear Canada	2J Total	3K Offshore mobile gear Canada	3K Offshore mobile gear Other	3K Fixed gear Canada	3K Total	3L Offshore mobile gear Canada	3L Offshore mobile gear Other	3L Fixed gear Canada	3L Total	2J3KL Total Canada	2J3KL Total Other	2J3KL Total	TAC
2001 [1]	0	0	21	21	0	0	1736	1736	7	82 [12]	5124	5212	6887	82	6969	5600
2002 [1]	0	0	13	13	0	0	647	647	3	53 [12]	3533	3589	4196	53	4249	5600
2003 [1]	0	0	2	2	0	0	29	29	3	23 [12]	937 [11]	963	971	23	994	0
2004 [1]	0	0	3	3	0	0	152	152	6	6	482	494	643	6	649	0
2005 [1]	0	0	6	6	1	0	555	556	1	1	767	769	1330	1	1331	0
2006 [1]	0		65	65	5	0	1103	1109	0	22	1506	1528	2679	22	2701	0
2007 [1,14]	0.1		71	71	0	0	1178	1178	0	0	1668	1669	2918	0	2918	0
2008 [1]			79	79			1802	1802	3		2278	2280	4162	0	4162	0

[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 (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 estimated 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 275 t caught in the sentinel survey and 138 t caught as bycatch.

[10] Comprised of a sentinel survey catch of 296 t, a food fishery catch of 1155 t and bycatch of 422 t.

[11] 780 t of this catch was the result of a mass mortality in Smith Sound

[12] NAFO Scientific Council agreed catches.

[13] Canadian catches have been updated based most recent catch data

[14] Excludes Canadian recreational fishery catch

Table 2. Annual fixed gear landings of cod from NAFO Div. 2J, 3K and 3L from 1975 onwards. Landings from statistical areas other than Newfoundland are not included. GN=gillnet, LT=Line-trawl, HL=hand-line.

	2J					3K					3L					2J3KL
Year	Trap	GN	LT	HL	Total	Trap	GN	LT	HL	Total	Trap	GN	LT	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	0	0	0	9	9	0	8	0	359	367	6	38	22	870	936	1312
1995	0	0	0	0	0	25	65	31	1	122	23	207	41	20	291	413
1996	0	0	0	3	3	65	184	31	680	959	42	335	30	501	656	1500 [4]
1997	0	2	0	0	2	57	150	63	8	278	71	427	42	45	585	865
1998	0	3	5	8	16	24	1081	245	644	1994	31	1377	284	798	2490	4501
1999	0	20	4	9	33	14	3080	110	350	3554	35	4469	70	365	4938	8525
2000	0	4	0	1	5	15	1126	43	275	1459	63	2954	189	684	3891	5354
2001	0	3	1	17	21	28	796	90	822	1735	175	2844	110	1994	5124	6880
2002	0	7	0	6	13	2	272	30	342	647	128	2517	30	858	3533	4193
2003	0	2	0	0	2	0	25	4	0	29	0	152	4	781	937 [5]	968
2004 [1]	0	1	0	0	1	0	146	5	0	152	0	479	2	0	481	635
2005 [1]	0	6	0	0	6	0	547	8	1	555	0	763	4	0	767	1328
2006 [1]	0	5	0	31	35	0	856	21	203	1080	5	1004	58	439	1505	2621
2007 [1,6]	0	17	2	52	71	0	783	21	374	1178	6	1112	13	538	1668	2917
2008 [1]	0	38	2	40	79	0	1260	25	517	1802	6	1407	25	839	2278	4159

[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.

[5] 780t of this catch was the result of a mass mortality in Smith Sound. (Actual gear used was gaff or dip net).

[6] Excludes recreational fishery catch.

Table 3. Reported landings (t) of cod in NAFO Div. 2J+3KL during 2008 from all sources (including recreational fishery) by unit area and month.

DIV/UNIT	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2JA	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
2JD	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
2JM	0.0	0.0	0.0	0.0	3.0	12.2	58.8	4.8	0.0	0.0	78.9
3KA	0.0	0.0	0.0	0.0	6.2	22.4	33.4	2.8	0.0	0.0	64.9
3KB	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.3	0.0	0.0	2.7
3KD	0.0	0.0	0.0	0.0	18.0	38.5	106.0	8.4	0.0	0.0	170.8
3KG	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
3KH	0.0	0.0	0.0	0.3	32.1	43.8	279.9	131.1	0.2	0.0	487.4
3KI	0.0	0.0	0.0	4.3	105.0	166.5	729.7	62.7	7.9	0.1	1076.3
3LA	0.0	0.0	0.0	0.7	71.2	115.7	440.7	46.9	4.9	0.0	680.0
3LB	0.0	0.3	0.0	8.9	51.0	72.5	461.7	48.7	0.0	0.0	643.0
3LC	0.0	0.0	0.0	0.0	0.0	14.4	0.0	0.0	0.0	0.0	14.4
3LD	0.0	0.0	0.0	0.0	0.0	2.5	2.2	0.6	0.0	0.0	5.3
3LF	0.0	0.0	0.0	1.8	50.1	57.3	305.0	37.7	0.2	0.0	452.1
3LG	0.0	0.0	0.0	0.1	1.2	8.9	1.0	0.3	0.0	0.0	11.5
3LJ	0.0	0.0	0.0	0.7	47.0	57.7	230.2	47.5	0.0	0.0	383.0
3LQ	0.0	0.0	0.0	2.0	19.7	22.0	34.9	9.6	0.0	0.0	88.2
3LR	0.0	0.0	0.0	1.4	1.3	0.0	0.0	0.0	0.0	0.0	2.6
TOTAL	0.1	0.3	0.0	20.1	405.8	634.6	2683.8	403.4	13.2	0.1	4161.5

Table 4. Annual catch numbers at age (000's, ages 2-20) for cod caught in the fishery in NAFO Div. 2J+3KL from 1962 onwards.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
2	301	1446	2872	85	819	790	288	59	6819	33	236	0	473	420	15	108
3	8666	5746	19338	5177	14057	15262	6142	4330	18104	12876	6737	3963	3231	3968	13767	7128
4	26194	27577	27603	28709	65992	77873	94291	39626	60102	71557	79809	40785	13201	14101	33727	65510
5	64337	60234	57757	46800	93687	100339	205805	100858	82357	95384	116562	94844	34927	25370	28049	40462
6	58163	118112	60681	66946	62812	96759	150541	163228	101249	98111	76196	59503	74403	34426	20898	12107
7	47314	58996	100147	64360	59312	54996	83808	107509	85696	57865	55984	35464	60539	39105	16811	5397
8	27521	29349	50865	68176	30423	38691	39443	52661	29218	25055	29553	27351	35687	36485	16022	3396
9	20142	15520	20892	33819	23844	17146	23171	19651	10857	11732	11750	14153	18854	13421	10931	2730
10	18036	11612	12264	14913	8762	16084	10984	12370	3825	4470	6393	7566	10492	7514	4637	1381
11	10444	8248	8698	6945	4528	5949	5591	6389	2000	2223	2987	3815	5818	2315	1462	532
12	9468	4204	6352	3729	2280	3367	5249	4479	1200	1287	1660	2153	2934	1179	631	296
13	7778	3942	4989	3948	1825	2108	1939	3004	507	1140	1388	1173	1078	808	292	149
14	5785	2933	4036	3730	1186	1529	1334	1557	224	720	725	450	652	372	251	75
15	4669	2928	2703	2722	967	685	818	622	214	355	748	278	249	165	100	42
16	3888	1737	1456	1859	806	424	610	567	244	474	606	309	338	82	50	21
17	3955	1263	1918	575	416	193	127	319	124	124	452	85	162	5	40	20
18	2161	1352	1154	971	279	107	89	100	32	128	136	27	113	8	64	14
19	232	328	501	183	486	72	83	46	10	148	195	38	45	22	30	2
20	403	182	312	226	178	211	26	99	34	78	36	8	20	1	20	6
Total	319457	355709	384538	353873	372659	432585	630339	517474	402816	383760	392153	291965	263216	179767	147797	139376

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
2	0	0	92	0	0	18	3	0	1	42	25	8	58	35	0	0
3	1323	1152	2554	2185	1702	2585	782	650	831	2329	2779	1696	7693	3111	430	940
4	17556	12361	12025	7172	31286	13616	14871	14824	15219	9217	14651	17639	40557	31654	3860	4993
5	39206	37493	28814	13191	19003	42602	31760	36614	44168	32340	20184	21150	36410	53805	14535	3343
6	20319	29202	30016	24800	14397	19028	38624	33922	45869	49061	47917	25212	22695	29553	12211	1940
7	7711	10982	18017	22014	25435	12044	12503	28006	26025	28469	45725	38708	16390	9064	4526	700
8	3078	3460	4830	11848	16930	14701	7246	7050	14722	19505	18608	28499	17940	6164	1372	147
9	1530	1300	1217	3175	11936	8934	8910	3836	3104	5818	9026	8696	9156	4745	376	21
10	1083	757	520	779	1923	6341	4227	5162	2000	1346	4337	3640	2865	1696	199	0
11	437	560	232	309	338	1018	2536	2905	1977	676	774	1695	1084	641	104	0
12	219	183	229	195	156	248	451	1681	1101	873	422	572	478	250	18	0
13	105	116	56	125	90	90	146	254	574	391	366	244	103	88	9	0
14	62	51	65	48	153	41	48	107	116	200	223	180	98	39	4	0
15	40	43	37	14	40	29	41	39	29	37	100	94	36	21	0	0
16	21	38	13	28	12	11	30	20	18	22	32	43	25	9	0	0
17	7	7	10	20	13	9	7	17	11	3	5	4	8	3	0	0
18	8	7	14	5	4	6	7	1	9	1	10	9	7	2	0	0
19	2	4	4	5	0	2	4	3	2	4	5	0	1	2	0	0
20	7	9	10	5	0	3	3	5	2	0	5	1	0	0	0	0
Total	92714	97725	98755	85918	123418	121326	122199	135096	155778	150334	165194	148090	155604	140882	37644	12084

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007*	2008
2	0	0	1	0	3	7	5	10	6	0	1	0	0	0	0
3	105	12	35	12	96	70	141	249	166	9	10	16	12	12	11
4	379	41	157	39	229	238	258	778	296	11	24	27	159	44	84
5	575	93	304	92	395	638	419	710	399	19	33	137	307	357	172
6	177	76	401	95	689	795	437	611	335	53	47	182	381	423	649
7	74	25	131	148	384	1157	328	365	235	44	59	101	168	178	422
8	22	10	24	35	236	370	294	190	124	28	32	51	79	69	147
9	2	2	7	5	74	253	151	272	77	22	14	19	30	21	37
10	0	0	2	2	10	52	136	80	113	9	7	7	13	8	12
11	0	0	0	0	5	13	33	117	50	32	3	4	5	5	6
12	0	0	0	0	2	3	5	33	52	20	5	2	2	2	2
13	0	0	0	0	1	0	3	3	10	27	2	2	1	1	1
14	0	0	0	0	0	0	1	1	2	7	2	1	2	1	1
15	0	0	0	0	0	0	0	0	0	3	0	1	1	1	1
16	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0
Total	1334	259	1062	429	2125	3596	2210	3418	1866	286	241	550	1161	1122	1549

*The 2007 values exclude the recreational fishery catch. Most of the catch in 2003 came from a mass mortality of cod in Smith Sound, Trinity Bay.

Table 5. Estimated average weight (kg), length (cm) and number (000’s, plus standard error and coefficient of variation) of cod for the 2008 catch-at-age from Div. 2J3KL for all gears combined, including the recreational catch.

	AVERAGE					
	WEIGHT	LENGTH	NUMBER			Percent of
AGE	(kg.)	(cm.)	(000'S)	STD ERR.	CV	total nos.
1	0.00	0.00	0.0	0.00		0.0
2	0.38	35.31	0.2	0.03	0.16	0.0
3	0.62	41.31	10.7	1.60	0.15	0.7
4	1.05	49.07	84.1	6.37	0.08	5.4
5	1.66	56.85	172.0	14.10	0.08	11.1
6	2.34	63.83	649.1	20.67	0.03	41.9
7	2.87	68.03	422.4	20.16	0.05	27.3
8	3.44	71.89	147.5	12.27	0.08	9.5
9	4.24	76.65	37.1	6.19	0.17	2.4
10	5.48	83.09	12.1	1.64	0.13	0.8
11	6.29	87.63	6.2	1.52	0.24	0.4
12	6.57	88.63	2.3	0.71	0.31	0.2
13	8.44	96.65	1.2	0.45	0.37	0.1
14	7.86	94.59	0.6	0.20	0.36	0.0
15	10.29	103.47	1.2	0.47	0.41	0.1
16	9.06	99.17	0.5	0.27	0.57	0.0
17	7.31	92.00	1.3	0.61	0.47	0.1
18	8.66	97.74	0.6	0.33	0.53	0.0
19	0.00	0.00	0.0	0.00		0.0
20	0.00	0.00	0.0	0.00		0.0

Table 6. Catch weights-at-age (kg) for cod caught in the fishery in NAFO Div. 2J+3KL from 1962 onward.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
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	0.26	0.25	0.09
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	0.45	0.45	0.45
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	0.63	0.61	0.60
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	0.96	0.93	0.97
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	1.18	1.32	1.66
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	1.39	1.75	2.33
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	1.74	2.07	2.82
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	2.21	2.24	3.46
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	2.61	2.99	3.88
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	3.34	3.67	4.78
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	3.66	4.56	6.13
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	4.78	6.18	7.31
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	5.20	8.19	8.40
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	5.20	9.77	8.81
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	5.46	11.23	11.75
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	8.51	12.44	10.63
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	9.24	11.16	12.27
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	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	17.46	17.46	17.46

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
2			0.41	0.00		0.31	0.34		0.21	0.32	0.29	0.26	0.29	0.17		
3	0.40	0.46	0.53	0.55	0.53	0.62	0.59	0.48	0.51	0.43	0.49	0.48	0.42	0.36	0.29	0.57
4	0.72	0.74	0.77	0.78	0.84	0.87	0.88	0.73	0.72	0.66	0.73	0.74	0.69	0.61	0.58	0.71
5	1.04	1.13	1.16	1.17	1.20	1.32	1.20	1.10	1.04	1.03	1.08	1.03	1.06	0.97	0.81	0.97
6	1.58	1.67	1.71	1.64	1.77	1.75	1.79	1.43	1.54	1.32	1.38	1.44	1.50	1.41	1.19	1.25
7	2.46	2.46	2.38	2.23	2.10	2.28	2.28	2.06	1.85	1.87	1.67	1.83	1.94	1.88	1.73	1.59
8	3.26	3.57	3.56	2.86	2.66	2.61	2.71	2.66	2.35	1.93	2.21	2.07	2.22	2.27	2.05	8.40
9	4.05	4.41	5.01	3.81	3.09	3.18	2.96	3.23	2.94	2.80	2.51	2.64	2.44	2.63	2.66	9.23
10	4.46	5.25	5.49	5.32	4.18	3.50	3.65	3.32	3.47	3.51	3.04	3.02	3.06	3.14	2.24	
11	5.02	5.80	6.72	6.29	6.16	4.79	4.28	4.06	3.80	4.80	4.37	3.96	3.58	3.80	2.68	
12	6.72	7.03	7.87	7.06	7.19	7.76	6.19	4.55	4.54	4.64	5.49	5.41	4.68	4.96	4.95	
13	8.10	8.96	8.38	7.32	8.00	9.07	8.39	7.03	5.34	5.74	6.55	7.50	6.23	5.49	5.34	
14	7.42	8.54	10.03	10.01	8.36	9.14	10.26	9.67	7.12	6.13	8.60	9.24	8.51	7.61	7.02	
15	8.20	9.46	11.31	8.99	7.86	10.62	11.44	11.37	11.77	8.53	9.76	10.05	9.78	11.58		
16	11.26	10.70	13.87	11.54	7.91	10.57	11.61	11.27	11.24	13.51	9.73	9.34	12.58	11.01		
17	11.61	13.12	10.68	10.48	9.58	13.13	17.47	12.68	14.15	9.10	12.58	15.74	15.45	12.82		
18	8.92	13.49	16.09	11.15	12.95	15.97	12.94	12.42	16.14	21.77	16.01	18.66	13.58	13.00		
19	10.57	15.51	12.04	9.82	0.00	9.73	15.21	14.38	12.30	17.66	16.60		17.26	13.10		
20	16.00	14.77	11.37	12.59	0.00	15.88	12.81	19.49	15.72	0.00	11.03	17.64				

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007*	2008
2		0.22	0.37	0.32	0.29	0.32	0.26	0.38	0.41	0.31	0.33	0.28	0.27	0.38	0.38
3	0.40	0.49	0.70	0.54	0.63	0.59	0.66	0.63	0.63	0.50	0.56	0.53	0.57	0.59	0.62
4	0.68	0.80	1.01	0.88	0.94	1.05	0.97	0.91	0.91	0.82	0.87	0.85	1.12	1.12	1.05
5	0.98	1.47	1.42	1.46	1.51	1.62	1.71	1.36	1.56	1.41	1.54	1.77	1.54	1.68	1.66
6	1.41	1.91	2.04	1.98	2.14	2.12	2.14	2.02	2.09	2.03	2.12	2.17	2.27	2.08	2.34
7	1.85	2.27	2.51	2.44	2.48	2.51	2.79	2.54	2.70	2.54	2.73	2.60	2.82	2.79	2.87
8	2.05	2.62	2.77	2.91	3.02	2.96	3.39	3.24	3.24	3.03	3.33	3.14	3.29	3.53	3.44
9	3.05	3.02	3.22	3.63	3.35	3.66	3.95	3.93	3.83	3.64	4.18	3.89	4.10	4.23	4.24
10		2.81	3.87	4.25	4.18	4.70	4.54	4.43	4.45	4.36	5.02	4.71	4.71	4.94	5.48
11		4.67	5.18	4.36	4.01	5.17	4.88	5.06	4.77	4.91	5.46	5.68	5.59	5.90	6.29
12			4.04	6.06	3.80	5.57	6.03	6.56	5.13	5.72	6.34	6.43	6.63	6.35	6.57
13			7.62	6.22	6.42	6.23	5.63	7.21	5.90	5.92	6.26	7.80	7.15	6.79	8.44
14			4.46			7.66	4.80	5.46	5.70	6.07	6.56	6.69	7.19	7.57	7.86
15							9.42	7.62	6.10	5.38	6.81	7.73	6.75	7.98	10.29
16												8.26	7.62	8.01	9.06
17							11.28			6.90		8.43	7.86	9.21	7.31
18									8.40				7.52	12.45	8.66
19														6.42	
20													7.62		

* note that 2007 values exclude the recreational fishery catch.

Table 7a. Estimates of cod abundance (000’s) from surveys in NAFO Div. 2J during 2000-08 (in Campelen units).

Stratum depth (meters)	Stratum number	Area sq. nautical miles	Tel. 340-343	Tel. 361 AN 399-400	Tel. 415,454, 457	Tel. 509-510	Tel. 537-539	Tel. 611,612 WT 632	Tel. 680-682	Tel. 802 752-753	Wt 839-840 Tel 820
			2000	2001	2002	2003	2004	2005-6	2006	2007	2008
Mean survey date			7-Nov-00	28-Nov-01	24-Dec-02	8-Dec-03	10-Nov-04	27-Nov-05	2-Nov-06	15-Nov-07	23-Nov-08
101-200	201	633	0	0	0	44	44	0	121	0	44
	205	1594	37	37	0	0	37	37	73	0	132
	206	1870	115	171	37	110	220	37	514	992	886
	207	2246	1280	447	1032	1122	623	623	835	2566	22946
	237	733	101	25	307	2041	178	7125	571	5042	134
	238	778	0	36	0	306	41	0	0	0	36
201-300	202	621	0	0	0	0	0	0	85	0	0
	209	680	187	28	218	258	234	31	699	1350	504
	210	1035	676	261	269	473	570	249	320	854	886
	213	1583	1161	416	954	1327	617	1716	2178	5807	5004
	214	1341	517	823	833	148	1402	369	221	2675	2324
	215	1302	609	191	466	1197	2006	1075	537	1648	1209
	228	2196	944	1847	1729	874	1284	2228	1020	1635	3428
	234	530	36	36	146	0	146	36	49	0	450
301-400	203	487	0	0	33	0	67	167	0	38	1191
	208	588	335	144	0	352	243	1213	324	337	1762
	211	251	533	78	72	104	138	173	104	161	2164
	216	360	198	303	297	57	371	891	297	322	338
	222	450	495	954	836	340	464	248	743	2569	990
	229	536	184	1180	885	442	332	1548	2618	221	655
401-500	204	288	0	0	20	0	0	0	198	20	95
	217	241	33	15	715	38	83	215	17	0	116
	223	158	**nf**	0	73	54	54	33	22	22	68
	227	598	55	0	329	0	247	247	165	370	146
	235	414	0	0	159	28	85	111	28	28	76
	240	133	18	42	125	0	18	146	0	0	0
total strata fished <= 500 m			7516	7033	9534	9315	9503	18519	11739	26656	45583
upper			10007	9222	12588	13125	11582	50073	19669	42992	95778
t-value			2.200	2.140	2.090	2.365	2.050	4.300	4.300	2.780	2.360
1 STD strata fished <= 500 m			1132	1023	1461	1611	1014	7338	1844	5876	21269
501-750	212	557	38	0	72	82	0	38	0	88	34
	218	362	0	0	100	0	25	0	0	0	0
	224	228	0	0	233	47	0	0	0	0	0
	230	185	13	0	480	0	0	0	0	0	0
	239	120	0	7	8	0	8	8	25	17	18
751-1000	219	283	0	0	0	0	0	0	0	0	nf
	231	186	0	0	0	0	0	0	0	0	0
	236	193	0	0	0	0	0	0	0	0	nf
1001-1250	220	330	nf	0	0	0	0	0	0	0	nf
	225	195	nf	0	0	0	0	0	0	0	0
	232	228	nf	0	0	0	0	0	0	0	0
1251-1500	221	330	0	0	0	0	0	0	0	0	nf
	226	201	0	0	0	0	0	0	0	0	nf
	233	237	0	0	0	0	0	0	0	0	0
total strata fished > 500 m			51	7	893	129	33	46	25	105	52
total all strata fished			7567	7040	10427	9445	9536	18465	11764	26760	45635
upper			10060	9230	13495	13254	11615	50120	19695	43098	95831
t-value			2.2	2.14	2.09	2.365	2.05	4.3	4.3	2.78	2.36
1 STD all strata fished			1133	1023	1468	1611	1014	7362	1844	5877	21269

Table 7b. Estimates of cod biomass (t) from surveys in NAFO Division 2J during 2000-08 (in Campelen units).

Stratum depth (meters)	Stratum number	Area sq. nautical miles	Tel. 340-343	Tel. 361 AN 399-400	Tel. 415,454, Tel.457	Tel. 509-510	Tel. 537-539	Tel. 611-612 WT 632	Tel. 680-682	Tel. 802 752-753	WT 839-840 Tel 820
			2000	2001	2002	2003	2004	2005-6	2006	2007	2008
Mean survey date			7-Nov-00	28-Nov-01	24-Dec-02	8-Dec-03	10-Nov-04	27-Nov-05	2-Nov-06	15-Nov-07	23-Nov-08
101-200	201	633	0	0	0	44	24	0	115	0	4
	205	1594	42	41	0	0	5	39	7	0	61
	206	1870	47	90	20	7	76	34	246	332	284
	207	2246	220	107	26	204	114	118	349	510	573
	237	733	3	8	2	23	22	65	252	40	40
	238	778	0	11	0	2	59	0	0	0	14
201-300	202	621	0	0	0	0	0	0	58	0	0
	209	680	60	7	56	82	79	19	458	794	123
	210	1035	271	77	72	121	254	59	193	145	409
	213	1583	398	208	389	715	410	817	956	2183	1708
	214	1341	303	355	460	122	878	194	111	817	1217
	215	1302	436	88	371	646	1207	736	378	822	718
	228	2196	433	514	613	329	572	924	667	1070	1462
	234	530	3	17	31	0	54	3	11	0	203
301-400	203	487	0	0	23	0	26	148	0	19	747
	208	588	268	63	0	149	142	229	206	31	533
	211	251	208	36	17	27	43	60	30	59	605
	216	360	95	148	134	33	186	515	298	300	219
	222	450	193	363	374	257	297	142	412	1300	696
	229	536	63	469	339	216	190	984	1760	109	321
401-500	204	288	0	0	25	0	0	0	118	1	79
	217	241	7	10	401	37	40	121	12	0	144
	223	158	nf	0	47	43	42	28	22	35	66
	227	598	23	0	146	0	115	224	102	165	71
	235	414	0	0	58	8	74	121	57	26	130
	240	133	10	32	77	0	13	140	0	0	0
total strata fished <= 500 m			3082	2646	3680	3065	4921	5719	6818	8755	10429
upper			4171	3345	4790	4226	5996	7650	26037	12633	13742
t-value			2.23	2.09	2.13	2.262	2.07	2.26	12.71	2.57	2.12
1 STD strata fished <= 500 m			488	334	521	513	519	854	1512	1509	1563
501-750	212	557	10	0	45	115	0	63	0	5	2
	218	362	0	0	77	0	31	0	0	0	0
	224	228	0	0	152	68	0	0	0	0	0
	230	185	6	0	307	0	0	0	0	0	0
	239	120	0	1	7	0	1	11	15	8	7
751-1000	219	283	0	0	0	0	0	0	0	0	nf
	231	186	0	0	0	0	0	0	0	0	0
	236	193	0	0	0	0	0	0	0	0	nf
1001-1250	220	330	nf	0	0	0	0	0	0	0	nf
	225	195	nf	0	0	0	0	0	0	0	0
	232	228	nf	0	0	0	0	0	0	0	0
1251-1500	221	330	0	0	0	0	0	0	0	0	nf
	226	201	0	0	0	0	0	0	0	0	nf
	233	237	0	0	0	0	0	0	0	0	0
total strata fished > 500 m			16	1	588	183	32	74	15	13	9
total all strata fished			3098	2647	4270	3248	4953	5793	6833	8768	10439
upper			4187	3346	5387	4411	6028	7730	26053	12646	13750
t-value			2.23	2.09	2.12	2.262	2.07	2.26	12.71	2.57	2.12
1 STD all strata fished			488	334	527	514	519	857	1512	1509	1562

Table 8a. Estimates of cod abundance (000's) from surveys of NAFO Division 3K during 2000-08 (in Campelen units).

Depth range meters	Stratum number	Stratum area sq. mi.	Tel. 340-343	WT 376, 398 Tel. 362, 397 AN 399	Tel. 415,457 WT431, 455 WT 456	Tel. 509,510 513,514 WT 511, 515	Tel. 539-542 WT 588	Tel. 611, 662 WT 631-632 WT 660	Tel. 681-682 684, 733 WT 707-708	Tel. 755,802 WT 774	Wt 838-841 An 868-869 Tel 821
			2000	2001	2002-3	2003-4	2004-5	2005-6	2006	2007	2008
Mean survey date			23-Nov-00	8-Dec-01	20-Dec-02	15-Jan-04	14-Dec-04	24-Dec-05	30-Nov-06	6-Dec-07	1-Dec-08
101-200	618	1347	2038	812	388	1346	1544	813	1746	1863	3533
	619	1753	2097	1021	512	1131	693	586	5899	864	586
201-300	620	2545	3383	3172	1246	3214	2976	1641	2741	3701	3151
	621	2736	1700	1196	988	979	3403	761	966	748	1835
	624	1105	456	1277	924	213	730	790	517	1009	1115
	634	1555	616	1497	937	299	1176	4054	250	3212	297
	635	1274	361	70	257	70	0	208	nf	1928	136
	636	1455	291	392	371	272	534	271	4937	9807	7628
	637	1132	nf	352	775	436	799	1017	1393	3956	2876
301-400	617	593	1332	2882	236	109	1224	979	1097	530	2202
	623	494	136	1446	755	442	1665	238	815	748	4153
	625	888	275	912	1000	92	1530	366	702	580	1032
	626	1113	1217	3253	2927	1654	7196	2616	1014	732	2812
	628	1085	2478	1791	2047	1944	2158	1970	1918	3134	1488
	629	495	393	230	847	306	180	613	375	454	163
	630	332	95	15	0	0	23	0	20	0	180
	633	2067	853	876	2428	903	2514	2537	2085	1294	1580
	638	2059	7308	5119	13407	3191	3682	5490	9045	10284	12742
	639	1463	786	690	7864	973	738	993	14960	8151	6574
401-500	622	691	665	602	383	289	475	2743	475	634	444
	627	1255	9091	699	1746	886	863	3061	623	345	2494
	631	1321	54	99	199	346	91	1296	683	30	5723
	640	69	47	19	71	100	20	394	0	28	4
	645	216	104	66	45	178	193	158	15	15	92
	650	134	nf	46	1501	535	65	238	9	74	8
total strata fished <= 500 m			35776	28534	41854	19908	34468	33834	52285	54122	62848
upper			59488	35927	64414	23813	41996	41953	97712	72011	84018
t-value			2.78	2.13	2.2	2.017	2.12	2.06	3.18	2.18	2.57
1 STD strata fished <= 500 m			8529	3471	10255	1936	3551	3941	14285	8206	8237
501-750	641	230	nf	16	662	158	16	253	0	0	0
	646	325	0	0	45	224	1565	0	0	0	0
	651	359	nf	28	85	1580	0	25	0	0	0
751-1000	642	418	0	0	0	0	0	0	0	0	0
	647	360	0	0	0	0	0	0	0	0	nf
	652	516	0	0	0	0	0	0	0	0	0
1001-1250	643	733		0	0	0	0	0	0	0	nf
	648	228		16	0	0	0	0	0	0	nf
	653	531		0	0	0	0	0	0	0	0
1251-1500	644	474	0	0	0	0	0	0	0	0	nf
	649	212	0	0	0	0	0	0	0	0	nf
	654	479	0	0	0	0	0	0	0	0	nf
total strata fished > 500 m			0	60	792	1962	1581	278	0	0	0
total all strata fished			39110	28595	42644	21868	36049	34112	52285	54122	62848
upper			61174	35987	65206	25860	44372	42248	97712	72011	84018
t-value			2.57	2.13	2.2	2.014	2.14	2.06	3.18	2.18	2.57
1 STD all strata fished			8585	3470	10255	1982	3889	3950	14285	8206	8237

Table 8b. Estimates of cod biomass (t) from surveys of NAFO Division 3K during 2000-08 (in Campelen units).

Depth range meters	Stratum number	Stratum area sq. mi.	Tel. 340-343	WT 376, 398 Tel. 362 397 AN 399	Tel. 415,457 WT 431,455 WT 456	Tel. 509,510 513,514 WT 511, 515	Tel. 539-542 WT 588	Tel. 611, 662 WT 631-632 WT 660	Tel. 681-682 684, 733 WT 707-708	Tel. 755,802 WT 774	WT 838-841 AN 868-869 Tel 821
			2000	2001	2002-3	2003-4	2004-5	2005-6	2006	2007	2008
Mean survey date			23-Nov-00	8-Dec-01	20-Dec-02	15-Jan-04	14-Dec-04	24-Dec-05	30-Nov-06	6-Dec-07	1-Dec-08
101-200	618	1347	252	99	72	85	170	138	166	246	366
	619	1753	154	97	101	38	80	82	178	73	108
201-300	620	2545	415	649	164	595	671	443	364	659	481
	621	2736	397	169	186	44	567	129	254	100	542
	624	1105	225	492	364	64	342	430	191	263	320
	634	1555	152	637	424	219	481	2400	48	1354	408
	635	1274	104	17	82	6	0	122	nf	1056	118
	636	1455	260	96	93	49	131	107	4136	16783	14582
	637	1132	nf	168	235	109	253	410	1127	5855	4155
301-400	617	593	237	748	97	53	306	407	212	145	867
	623	494	41	309	153	107	272	119	115	177	853
	625	888	173	296	342	75	658	192	226	311	372
	626	1113	259	716	543	156	1366	574	347	197	1040
	628	1085	524	953	588	171	554	837	2116	2381	2620
	629	495	192	97	176	69	21	220	266	236	335
	630	332	38	8	0	0	3	0	9	0	210
	633	2067	615	543	1105	534	1114	1833	1280	1116	1255
	638	2059	3974	2863	3385	1080	1691	3259	9824	14139	22570
	639	1463	780	418	2542	422	265	550	16979	12753	13695
401-500	622	691	138	214	70	218	106	1580	143	78	101
	627	1255	2917	135	438	194	166	1295	335	244	1604
	631	1321	27	59	36	218	36	827	340	15	4607
	640	69	37	13	35	58	29	275	0	49	6
	645	216	84	63	48	111	254	220	46	31	110
	650	134	nf	30	613	236	72	245	8	166	6
total strata fished <= 500 m			11994	9890	11889	4912	9609	16696	38709	58427	71329
upper			19284	12834	18138	6118	11713	21527	104979	85973	100136
t-value			2.45	2.14	2.18	2.023	2.05	2.07	4.3	2.26	2.45
1 STD strata fished <= 500 m			2976	1376	2867	596	1026	2334	15412	12188	11758
501-750	641	230	nf	14	438	175	17	329	0	0	0
	646	325	0	0	41	208	749	0	0	0	0
	651	359	nf	35	78	1274	0	12	0	0	0
751-1000	642	418	0	0	0	0	0	0	0	0	0
	647	360	0	0	0	0	0	0	0	0	nf
	652	516	0	0	0	0	0	0	0	0	0
1001-1250	643	733	0	0	0	0	0	0	0	0	nf
	648	228	0	7	0	0	0	0	0	0	nf
	653	531	0	0	0	0	0	0	0	0	0
1251-1500	644	474	0	0	0	0	0	0	0	0	nf
	649	212	0	0	0	0	0	0	0	0	nf
	654	479	0	0	0	0	0	0	0	0	nf
total strata fished > 500 m			0	56	557	1657	766	341	0	0	0
total all strata fished			12585	9946	12446	6569	10375	17038	38709	58427	71329
upper			19889	12892	18696	8435	13381	21904	104979	85973	100136
t-value			2.45	2.14	2.18	2.365	2.36	2.07	4.3	2.26	2.45
1 STD all strata fished			2981	1377	2867	789	1274	2351	15412	12188	11758

Table 9a. Estimates of cod abundance (000's) from surveys of NAFO Division 3L during 2000-08 in depths <= 200 fathoms (in Campelen units).

Stratum depth (fath)	Stratum number	Area sq. nautical miles	WT 321-323 Tel 342-343	AN 399, WT 373-376, Tel. 357-358, 361	Tel 412 ,413 Tel 415 WT 428-431	Tel 513 WT 487-489 WT 511	WT 558-559 WT 587 Tel 540	Tel 662 WT 628-630, 637 AN 657-658	Tel 682-684 WT 705-707	WT 772-773, 804, Tel 751 Tel 752, 803	Wt 837-838 AN 867-868
			2000	2001	2002-03	2003	2004	2005-06	2006	2007	2008
Mean survey date			28-Nov-00	15-Nov-01		5-Dec-03	5-Dec-04	14-Nov-05	10-Nov-06	21-Nov-07	7-Nov-08
31-50	350	2071	936	1420	512	692	1750	163	413	2754	624
	363	1780	184	245	408	245	542	77	740	77	1777
	371	1121	0	0	77	77	77	0	121	154	59
	372	2460	1523	926	550	296	296	254	350	1747	338
	384	1120	77	0	39	0	77	0	0	0	103
51-100	328	1519	209	5391	775	3636	1319	251	478	4681	1562
	341	1574	476	1261	558	693	1291	396	173	2737	179
	342	585	201	188	40	201	483	0	40	1006	0
	343	525	397	36	36	144	144	29	217	253	100
	348	2120	292	1333	287	329	1280	208	833	542	826
	349	2114	614	706	291	706	1015	412	83	831	339
	364	2817	1163	388	172	400	2177	560	301	464	678
	365	1041	nf	95	239	0	nf	143	143	180	48
	370	1320	257	45	40	52	nf	0	0	45	0
	385	2356	0	162	0	0	41	41	0	0	41
	390	1481	0	0	0	41	41	0	0	0	51
101-150	344	1494	2023	968	1219	2089	4091	1169	1878	3863	7351
	347	983	371	496	225	406	406	90	1467	135	4804
	366	1394	671	5420	3209	920	nf	107	2685	17148	18856
	369	961	0	176	44	176	nf	32	157	416	365
	386	983	0	45	45	0	nf	0	0	85	240
	389	821	113	38	0	0	225	38	33	38	56
	391	282	19	0	17	19	39	39	190	205	1138
151-200	345	1432	4436	3467	1055	1435	2272	630	4982	5117	8405
	346	865	4557	3570	806	535	801	920	1446	3799	2935
	368	334	9396	694	184	436	nf	49	296	431	435
	387	718	494	329	88	99	nf	0	88	280	1207
	388	361	472	221	50	0	199	3129	1473	221	1280
	392	145	130	104	18	9	38	44	124	40	160
total strata fished <= 200 fath.			29010	27724	10984	13638	18605	8780	18711	47249	53957
upper			52913	42861	15550	18275	22936	49867	25842	62123	109902
t-value			4.3	2.23	2.36	2.365	2.06	12.71	2.2	2.36	3.18
1 STD strata fished <= 200 fath.			5559	6788	1935	1961	2102	3233	3241	6303	17593

Table 9b. Estimates of cod biomass (t) from surveys of NAFO Division 3L during 2000-08 in depths <= 200 fathoms (in Campelen units).

Stratum depth (fath)	Stratum number	Area sq. nautical miles	WT 321-323 Tel 342-343	AN 399 WT 373-376 TEL 357-358 361	Tel 412 ,413 Tel 415 WT 428-431	Tel 513 WT 487-489 WT 511	WT 558,559 WT 587 Tel 540	Tel 662 WT 628-630, 637, AN 657-658	Tel 682-684 Wt 705-707	Wt 772-773, 804 , Tel 751 Tel 752 , 803	Wt 837-838 An 867-868
			2000	2001	2002-3	2003	2004	2005/6	2006	2007	2008
Mean survey date			28-Nov-00	15-Nov-01	12-Nov-02	5-Dec-03	5-Dec-04	14-Nov-05	10-Nov-06	21-Nov-07	7-Nov-08
31-50	350	2071	842	2442	367	1181	179	39	299	1595	266
	363	1780	28	588	1230	232	42	36	301	62	1953
	371	1121	0	0	73	51	11	0	42	70	9
	372	2460	66	1303	1074	49	127	165	201	208	577
	384	1120	4	0	0	0	33	0	0	0	7
51-100	328	1519	41	3995	145	407	394	190	609	370	1519
	341	1574	120	475	272	304	181	101	160	136	172
	342	585	135	79	13	74	54	0	40	73	0
	343	525	130	5	6	44	31	10	51	11	20
	348	2120	55	583	174	122	300	123	1207	315	869
	349	2114	228	658	114	88	313	254	61	892	164
	364	2817	403	59	82	97	712	325	276	102	333
	365	1041	nf	72	72	0		35	11	155	3
	370	1320	107	17	22	2		0	0	10	0
	385	2356	0	77	0	0	2	13	0	0	7
	390	1481	0	0	0	8	16	0	0	0	38
101-150	344	1494	908	274	601	765	1343	741	1987	3425	12809
	347	983	87	224	175	109	144	22	1483	32	6152
	366	1394	321	2527	1572	292		57	2242	17434	20062
	369	961	0	64	15	71		17	29	864	72
	386	983	0	18	10	0		0	0	112	94
	389	821	54	9	0	0	102	37	3	2	163
	391	282	1	0	31	6	4	16	45	51	266
151-200	345	1432	1299	2178	709	658	627	449	5312	3559	14501
	346	865	1359	2350	394	77	618	487	1701	5328	4459
	368	334	8268	290	169	201		97	158	268	460
	387	718	227	180	30	2		0	99	430	695
	388	361	335	140	97	0	23	1887	571	221	662
	392	145	51	97	10	7	11	16	97	47	69
total strata fished <= 200 fathoms			15070	18706	7460	4849	5266	5118	16985	35772	66401
upper			83892	27204	10528	7539	6640	29932	23443	54137	121799
t-value			12.71	2.12	2.13	2.228	2.09	12.71	2.2	2.57	2.78
1 STD strata fished <= 200 fathoms			5415	4008	1440	1207	657	1952	2935	7146	19927

Table 10. Estimates of cod abundance (000's) and biomass (t) from surveys of NAFO Division 3L during 2000-08 in depths >200 fathoms (in Campelen units).

Stratum depth (fathoms)	Stratum number	Area sq. nautical miles	WT 321-323 Tel 342-343	AN 399 WT 373-376 TEL 357-358 361	Tel 412 ,413 Tel 415 WT 428-431	Tel 513 WT 487-489 WT 511	WT 558-559 WT 587 Tel 540	Tel 662, WT 628-630, 637 AN 657-658	Tel 682-684 WT 705-707	WT 772-773, 804, Tel 751 Tel 752 , 803	WT 837-838 AN 867-868
			2000	2001	2002-3	2003	2004	2005/6	2006	2007	2008
Mean survey date			28-Nov-00	15-Nov-01	12-Nov-02	5-Dec-03	5-Dec-04	14-Nov-05	10-Nov-06	21-Nov-07	7-Nov-08
								ABUNDANCE			
201-300	729	186	0	38	0	13	36	0	0	23	0
	731	216	208	106	0	0	17	0	0	0	0
	733	468	101	444	29	322	0	0	0	0	86
	735	272	3528	692	83	337	nf	33	50	0	0
301-400	730	170	0	0	0	0	0	0	0	0	0
	732	231	0	0	0	0	0	0	0	0	0
	734	228	0	0	0	0	nf	0	0	0	0
	736	175	0	12	0	139	nf	0	0	0	0
401-500	737	227	0	0	0	0	nf	0	0	0	nf
	741	223	0	0	0	0	nf	nf	0	0	nf
	745	348	0	0	0	0	nf	nf	0	0	nf
	748	159	0	0	0	0	nf	nf	0	0	nf
501-600	738	221	0	0	0	0	nf	nf	0	0	nf
	742	206	0	0	0	0	nf	nf	0	0	nf
	746	392	0	0	0	0	nf	nf	0	0	nf
	749	126	0	0	0	0	nf	nf	nf	0	nf
601-700	739	254	0	0	0	0	nf	0	0	0	nf
	743	211	0	0	0	0	nf	nf	0	0	nf
	747	724	0	0	0	0	nf	nf	0	0	nf
	750	556	0	0	0	0	nf	nf	nf	0	nf
701-800	740	264	0	0	0	0	nf	0	0	0	nf
	744	280	0	0	0	0	nf	nf	0	0	nf
	751	229	0	0	0	0	nf	nf	nf	0	nf
total strata fished > 200 fathoms			3837	1292	112	811	53	33	50	23	86
total all strata fished offshore			32846	29017	11096	14448	18657	8813	18761	47271	54044
upper			58560	44211	15667	19068	22989	49903	25892	62145	109989
t-value			4.3	2.23	2.36	2.306	2.06	12.71	2.2	2.36	3.18
1 STD all strata fished offshore			5980	6813	1937	2003	2103	3233	3241	6303	17593
								BIOMASS			
201-300	729	186	0	45	0	42	30	0	0	23	0
	731	216	165	108	0	0	4	0	0	0	0
	733	468	110	261	36	156	0	0	0	0	113
	735	272	3973	697	155	226	nf	43	87	0	0
301-400	730	170	0	0	0	0	0	0	0	0	0
	732	231	0	0	0	0	0	0	0	0	0
	734	228	0	0	0	0	nf	0	0	0	0
	736	175	0	7	0	164	nf	0	0	0	0
401-500	737	227	0	0	0	0	nf	0	0	0	nf
	741	223	0	0	0	0	nf	nf	0	0	nf
	745	348	0	0	0	0	nf	nf	0	0	nf
	748	159	0	0	0	0	nf	nf	0	0	nf
501-600	738	221	0	0	0	0	nf	nf	0	0	nf
	742	206	0	0	0	0	nf	nf	0	0	nf
	746	392	0	0	0	0	nf	nf	0	0	nf
	749	126	0	0	0	0	nf	nf	nf	0	nf
601-700	739	254	0	0	0	0	nf	0	0	0	nf
	743	211	0	0	0	0	nf	nf	0	0	nf
	747	724	0	0	0	0	nf	nf	0	0	nf
	750	556	0	0	0	0	nf	nf	nf	0	nf
701-800	740	264	0	0	0	0	nf	0	0	0	nf
	744	280	0	0	0	0	nf	nf	0	0	nf
	751	229	0	0	0	0	nf	nf	nf	0	nf
total strata fished > 200 fathoms			4248	1118	191	588	34	43	87	23	113
total all strata fished offshore			19318	19824	7652	5438	5300	5161	17072	35794	66513
upper			91155	28382	10721	8157	6675	29981	23533	54160	121913
t-value			12.71	2.12	2.12	2.201	2.09	12.71	2.2	2.57	2.78
1 STD all strata fished offshore			5652	4037	1448	1235	658	1953	2937	7146	19928

Table 11. Autumn bottom-trawl mean number of cod per tow at age in the index strata (adjusted for missing strata) from 1983 onwards. The 2J3KL total is the mean of the Divisional means, weighted by the Divisional survey areas.

2J

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
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	0.05	0.00	0.00	0.00	0.01	0.02	0.00	0.33	0.74	0.00	2.43	0.00	1.66	7.12
1	46.58	7.57	1.71	0.65	1.46	20.52	4.86	2.75	0.37	0.00	0.00	0.18	2.46	0.52	0.00	0.10	0.21	0.57	0.16	0.43	0.66	0.38	0.27	0.06	1.56	1.48
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	2.15	0.41	0.19	0.79	0.66	0.69	0.76	0.47	1.22	0.80	0.90	2.65	1.98
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	1.24	1.42	0.72	0.56	0.77	1.25	0.80	0.79	0.70	1.69	1.27	1.73	3.18
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	0.39	0.89	0.30	0.45	0.19	0.78	0.31	0.58	0.80	1.17	0.63	0.97
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	0.11	0.29	0.17	0.04	0.06	0.10	0.13	0.24	0.17	0.45	0.55	0.40
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	0.02	0.02	0.00	0.04	0.00	0.04	0.01	0.01	0.02	0.06	0.04	0.07	0.16	0.13
7	4.87	2.87	9.75	29.99	9.98	42.71	17.99	1.44	0.70	0.01	0.02	0.02	0.00	0.02	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.03
8	12.46	1.83	1.35	10.84	6.58	6.93	11.13	2.35	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
9	5.05	3.46	0.83	0.70	2.64	4.27	1.45	1.08	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
10	2.87	1.49	1.14	0.64	0.41	2.06	0.77	0.23	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.58	0.54	0.39	0.55	0.04	0.28	0.35	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.04	0.12	0.17	0.29	0.16	0.11	0.12	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.03	0.02	0.03	0.07	0.06	0.08	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.02	0.00	0.00	0.02	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sum	379.11	252.19	207.46	421.13	138.45	175.48	218.36	87.76	109.11	10.44	5.91	2.74	4.96	4.57	2.33	2.24	2.04	2.55	2.37	3.21	3.12	3.18	6.20	3.94	8.95	15.30

3K

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
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	0.04	0.00	0.08	0.15	0.28	0.71	0.05	0.04	0.54	0.03	0.28	1.47	0.17	0.01
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	2.77	0.70	0.07	1.13	1.07	2.61	1.46	2.09	2.35	2.58	0.73	1.06	1.67	2.58
2	32.49	32.45	5.07	18.35	6.63	29.28	111.95	32.45	15.74	2.85	4.67	0.39	1.56	2.28	0.92	0.80	2.71	2.33	2.22	5.19	0.88	4.04	1.97	1.94	2.58	2.72
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	0.98	1.20	0.85	0.92	2.01	2.24	2.37	2.03	0.85	1.10	3.68	2.49	2.40	2.90
4	15.09	22.21	12.39	65.26	10.01	8.40	44.92	48.74	70.05	2.33	1.27	0.38	0.34	0.34	0.20	0.59	0.87	1.17	0.71	0.92	0.27	0.66	1.35	3.61	1.92	2.47
5	17.24	11.98	10.93	56.87	17.27	6.92	25.69	23.11	37.29	4.01	0.30	0.14	0.10	0.10	0.09	0.20	0.36	0.27	0.30	0.21	0.10	0.17	0.44	2.28	3.13	1.48
6	4.39	8.97	4.13	29.01	11.21	7.54	17.17	12.35	9.09	1.16	0.34	0.02	0.02	0.00	0.00	0.06	0.03	0.05	0.03	0.02	0.00	0.04	0.04	0.77	1.45	2.03
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	0.01	0.00	0.00	0.00	0.02	0.00	0.06	0.32	1.09
8	4.26	1.41	0.86	6.66	2.67	1.00	7.06	7.62	1.03	0.03	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.04	0.06	0.20
9	2.98	2.12	0.65	2.41	1.21	0.44	2.54	2.35	0.56	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.13
10	0.91	1.06	0.55	0.64	0.52	0.22	1.41	0.68	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00
11	0.22	0.34	0.40	0.79	0.21	0.04	0.65	0.22	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.12	0.11	0.09	0.58	0.08	0.04	0.16	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
13	0.02	0.05	0.01	0.09	0.06	0.01	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.01	0.02	0.00	0.07	0.02	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sum	131.02	116.45	51.91	223.09	69.75	113.64	321.74	241.51	161.39	15.31	9.20	2.34	5.82	4.63	2.21	3.91	7.36	9.39	7.16	10.50	4.99	8.66	8.49	13.72	13.72	15.62

Table 11 (Cont'd.)

3L

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.30	0.04	0.03	0.03	0.17	0.27	0.02	0.03	0.69	0.01
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	0.14	0.79	1.18	0.67	0.30	1.54	0.98	0.07	0.06	1.76	0.36
2	27.24	75.48	11.11	9.71	22.54	12.57	5.36	6.54	5.27	3.25	1.66	0.19	0.34	0.21	0.64	0.17	1.51	1.59	1.66	0.90	0.32	2.64	0.25	0.67	1.78	1.43
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	0.32	1.86	1.62	1.49	0.37	0.40	0.33	0.99	0.78	1.58	2.64
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	0.17	0.20	0.98	0.95	0.31	0.13	0.12	0.31	1.13	1.43	2.07
5	9.21	6.44	13.18	13.13	10.93	5.57	2.17	11.06	5.59	5.64	0.79	0.09	0.15	0.19	0.15	0.04	0.15	0.31	0.45	0.18	0.06	0.08	0.05	0.72	1.38	1.32
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	0.03	0.08	0.09	0.10	0.05	0.03	0.03	0.03	0.18	0.45	1.79
7	1.45	1.48	3.04	2.97	2.86	4.19	2.20	3.21	0.44	0.79	0.05	0.02	0.03	0.05	0.07	0.01	0.01	0.03	0.02	0.01	0.01	0.02	0.00	0.05	0.16	0.56
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	0.05	0.02	0.03	0.01	0.00	0.00	0.01	0.01	0.01	0.04	0.17
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	0.02	0.03	0.01	0.02	0.00	0.00	0.01	0.00	0.02	0.02	0.08
10	0.44	0.94	0.35	0.32	0.09	0.46	0.17	0.51	0.09	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.00
11	0.13	0.38	0.25	0.41	0.12	0.12	0.06	0.24	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.06	0.00	0.01	0.00	0.00	0.00	0.00	0.04
12	0.06	0.22	0.11	0.22	0.19	0.10	0.03	0.15	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.01	0.01	0.02
13	0.02	0.04	0.04	0.09	0.10	0.12	0.03	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01
14	0.05	0.03	0.01	0.03	0.03	0.07	0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
15	0.00	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.01	0.03	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.02	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sum	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	1.28	4.98	5.88	5.48	2.18	2.69	4.49	1.73	3.68	9.32	10.50

2J3KL

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
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	0.03	0.00	0.03	0.18	0.22	0.26	0.03	0.11	0.43	0.12	0.70	0.50	0.76	1.76
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	0.46	0.74	1.51	0.81	0.93	1.59	1.37	0.34	0.39	1.68	1.38
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	1.38	0.68	0.39	1.73	1.61	1.61	2.30	0.54	2.76	0.96	1.15	2.26	2.00
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	0.86	0.89	0.62	1.59	1.62	1.72	1.03	0.65	0.68	2.06	1.47	1.89	2.86
4	24.08	31.67	32.81	55.20	9.25	7.51	21.96	29.59	41.55	4.54	1.72	0.31	0.30	0.41	0.28	0.49	0.45	0.91	0.68	0.63	0.22	0.41	0.78	1.97	1.40	1.93
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	0.15	0.23	0.23	0.30	0.17	0.09	0.15	0.21	1.17	1.76	1.15
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	0.04	0.04	0.06	0.05	0.03	0.02	0.04	0.04	0.35	0.71	1.46
7	2.67	2.37	4.76	13.08	5.05	13.51	10.34	4.29	1.29	0.39	0.06	0.02	0.01	0.03	0.03	0.02	0.01	0.02	0.01	0.00	0.00	0.02	0.00	0.04	0.18	0.61
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	0.02	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.02	0.04	0.14
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	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.08
10	1.20	1.12	0.61	0.51	0.31	0.77	0.73	0.50	0.15	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
11	0.27	0.41	0.33	0.57	0.13	0.13	0.33	0.19	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.02
12	0.07	0.16	0.12	0.36	0.15	0.08	0.10	0.10	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
13	0.02	0.04	0.03	0.09	0.08	0.07	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.03	0.02	0.00	0.04	0.03	0.04	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.02	0.00	0.01	0.00	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sum	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	3.25	2.10	2.21	5.05	6.23	5.28	5.21	3.56	5.56	5.09	7.10	10.70	13.39

Table 12. By-catch of cod in the turbot gillnet test fishery (160-300 fathoms) in northern 3L during 2004-08.

			Maximum cod by-catch/trip (lb)				
Year	**Total fishers***	**Max. nets Z1, Z2, Z3**	**Zone 1****	**Zone 2****	**Zone 3****	**Cod as % total turbot**	**Turbot landings (t)**
2004 (Aug 18-Nov 1)	13	100,100,125	461	419	229	1.9	387
2005 (Aug 5-Sept 5)	46	100,125,150	1,162	457	339	1.9	1,305
2006 (Aug 1-10)	64	75,125,150	1,160	2,768	578	1.5	1,476
2007 (Aug 1 – 6)	86	60,105,125	11,135	11,801	8,878	18.0	1,080
2008-p1 (Aug 4-12)	6,7,8	50,75,100	26,550 (av-13,281)	12,710 (av-5,310)	4,912 (av-2,659)	24.0	645
2008-p2 (Sep 9-27)	7	max 100 nets zone 3	closed	closed	2,008 (av-1,250)	5.3	

*Observer coverage was 72% in 2004 (44 of 61 trips), 61% in 2005 (151 of 248), 24% in 2006 (44 of 182), 30% in 2007 (39 of 132 trips), 100% in 2008 (28 of 28 trips).
** The northern and southern boundaries of the test fishery Zones were all between 49°15’N and 48°30N. The western and eastern boundaries were as follows: Zone 1 from 49°15N and 52°51W southeast east to 48°30N and 52°30.7W and east to 52°00W; Zone 2 52°00W east to 51°00 W, and Zone 3 51°00W east to 49°00 W.

Table 13. Sentinel survey standardized catch rate-at-age indices (fish per net) for 5½" mesh gillnets for three inshore areas.

Inshore Northern area

Yr\Age	3	4	5	6	7	8	9	10
1995	0.00	0.05	0.63	0.20	0.08	0.03	0.01	0.00
1996	0.02	0.04	0.68	3.13	0.55	0.10	0.02	0.00
1997	0.04	0.07	0.40	1.15	1.10	0.13	0.01	0.02
1998	0.02	0.10	0.46	1.50	1.37	0.43	0.09	0.02
1999	0.01	0.06	0.61	0.98	0.90	0.35	0.10	0.08
2000	0.05	0.09	0.29	0.82	0.69	0.34	0.06	0.01
2001	0.02	0.08	0.24	0.32	0.29	0.11	0.07	0.02
2002	0.13	0.22	0.35	0.32	0.18	0.10	0.02	0.01
2003	0.06	0.12	0.35	0.63	0.47	0.13	0.09	0.00
2004	0.04	0.10	0.36	0.71	0.61	0.20	0.05	0.02
2005	0.06	0.26	2.03	3.01	2.02	0.60	0.25	0.04
2006	0.03	0.50	1.85	3.55	1.81	0.66	0.29	0.10
2007	0.04	0.12	1.75	3.82	2.10	0.79	0.16	0.10
2008	0.04	0.20	0.61	5.28	4.69	1.41	0.34	0.14

Inshore Central area

Yr\Age	3	4	5	6	7	8	9	10
1995	0.00	0.05	1.90	1.85	0.86	0.22	0.03	0.00
1996	0.05	0.16	1.45	7.56	1.87	0.40	0.05	0.03
1997	0.01	0.09	1.18	3.44	6.61	1.07	0.10	0.03
1998	0.07	0.11	1.32	5.79	5.68	3.57	0.77	0.07
1999	0.02	0.16	1.44	2.28	3.52	1.11	0.74	0.16
2000	0.02	0.10	1.13	1.89	1.08	1.52	0.70	0.41
2001	0.02	0.08	0.49	1.29	0.77	0.28	0.45	0.14
2002	0.01	0.05	0.59	0.95	0.79	0.25	0.18	0.28
2003	0.05	0.13	0.56	1.42	1.00	0.29	0.12	0.06
2004	0.02	0.17	1.18	1.74	1.12	0.41	0.17	0.06
2005	0.03	0.09	2.41	3.38	1.25	0.47	0.16	0.07
2006	0.02	0.50	1.65	4.01	1.89	0.49	0.16	0.09
2007	0.05	0.10	3.78	4.76	2.27	0.64	0.19	0.08
2008	0.04	0.12	0.70	7.48	4.23	1.29	0.32	0.10

Inshore Southern area

Yr\Age	3	4	5	6	7	8	9	10
1995	0.01	0.06	0.80	2.98	0.96	1.21	0.35	0.08
1996	0.04	0.26	1.04	6.70	5.04	1.71	0.44	0.09
1997	0.03	0.14	3.17	2.50	4.35	1.82	0.29	0.13
1998	0.01	0.09	1.88	10.57	4.20	1.87	0.82	0.14
1999	0.02	0.10	2.03	3.90	4.89	1.28	0.51	0.14
2000	0.02	0.08	0.86	1.32	1.27	1.39	0.61	0.16
2001	0.01	0.06	0.35	0.87	0.55	0.42	0.58	0.16
2002	0.01	0.05	0.55	0.66	0.60	0.36	0.15	0.10
2003	0.01	0.05	0.29	2.70	1.41	0.67	0.30	0.11
2004	0.01	0.16	0.82	1.85	3.07	0.86	0.26	0.06
2005	0.02	0.05	0.85	1.53	1.49	1.09	0.41	0.08
2006	0.00	0.27	0.94	2.20	1.14	0.61	0.41	0.07
2007	0.00	0.04	1.32	2.34	1.01	0.46	0.18	0.10
2008	0.00	0.03	0.36	3.75	2.75	0.77	0.26	0.05

Table 14. Sentinel survey standardized catch rate-at-age indices for line-trawl (fish per 1000 hooks) and 3¼" gillnet (fish per net) for the inshore central area.

Linetrawl

Yr\Age	3	4	5	6	7	8	9	10
1995	10.45	59.00	52.29	16.27	4.46	0.41	0.37	
1996	24.50	40.76	52.22	25.27	2.85	0.40	0.05	
1997	14.39	57.47	73.92	48.46	33.02	3.99	1.08	
1998	18.44	32.55	26.06	20.63	6.52	8.37	1.21	
1999	11.15	23.77	30.29	14.56	9.86	2.52	4.05	
2000	14.94	54.22	26.00	17.43	8.30	4.56	3.04	
2001	29.44	40.46	13.94	3.63	1.19	0.48	0.36	
2002	16.60	27.23	16.36	6.77	1.34	0.19	1.48	
2003	31.78	70.50	32.94	6.29	2.73	0.83	0.50	
2004	32.66	53.16	35.32	21.55	1.42	1.04	0.00	
2005	35.08	57.14	46.88	14.73	4.23	1.30	0.49	
2006	14.87	51.08	32.82	17.74	3.38	1.54	0.10	
2007	5.97	25.28	80.59	43.53	16.94	6.14	0.49	
2008	9.11	41.43	49.51	50.93	34.93	7.45	0.48	

3 1/4" Gillnet

Yr\Age	2	3	4	5	6	7	8	9	10
1996	0.02	9.52	20.36	8.13	8.54	0.34	0.04	0.00	0.00
1997	0.01	5.57	12.62	4.84	4.62	3.74	0.39	0.02	0.00
1998	0.08	6.49	3.76	4.27	7.62	3.94	1.65	0.38	0.01
1999	0.37	8.20	5.57	3.98	1.65	1.74	0.32	0.19	0.05
2000	0.28	8.29	6.78	3.17	1.64	0.47	0.44	0.18	0.13
2001	0.23	8.02	7.19	2.50	1.25	0.30	0.08	0.12	0.02
2002	0.63	11.20	5.46	1.79	0.97	0.33	0.04	0.03	0.04
2003	0.44	18.98	8.55	2.54	1.24	0.49	0.08	0.03	0.01
2004	0.85	7.67	8.93	4.65	1.66	0.53	0.10	0.04	0.02
2005	0.21	16.48	9.54	5.02	2.09	0.33	0.11	0.02	0.00
2006	0.26	6.73	10.04	5.24	2.76	0.73	0.11	0.02	0.02
2007	0.33	7.03	6.73	10.14	5.70	1.19	0.32	0.01	0.01
2008	0.50	6.38	7.68	3.41	8.62	2.64	0.57	0.10	0.01

Table 15. Estimates of exploitation rate (harvest rate, in percent) for cod tagged in NAFO Div. 3KL during 1997-2008. Shaded cells represent partial estimates as fishery in that year was already in progress. Boxed columns of cells indicate values used to compute annual means, weighted by numbers released. See text for details.

Unit area	Expt. number	Release dates First	Release dates Last	Area of release	Nos tagged (totals)	2005	2006	2007	2008
3KI	2005002	28-Jun-05	29-Jun-05	TOO GOOD ARM (HL)	190	7.6	11.2	0.0	
3KI	2006006	15-Jun-06	23-Jun-06	TOO GOOD ARM	488		30.1	10.8	9.0
3KI	2006007	27-Jun-06	8-Jul-06	TWILLINGATE	1282		23.4	3.4	1.6
3KI	2006008	5-Jul-06	7-Jul-06	FOGO	941		9.0	8.6	2.8
3KI	2007-006	3-Jul-07	6-Jul-07	TOO GOOD ARM	505			7.7	3.8
3KI	2008-007	3-Jul-08	18-Jul-08	TOO GOOD ARM	539				10.8
3KI	2008-008	23-Jul-08	25-Jul-08	FOGO NORTH	325				2.6
3KI	2008-010	21-Aug-08	21-Aug-08	TWILLINGATE	200				11.8
					Annual means	**7.6**	**19.0**	**7.3**	**4.3**
3LA	2006005	4-Jun-06	10-Jun-06	BONAVISTA	1345		4.7	5.2	2.5
3LA	2007012	26-Jun-07	26-Jun-07	DEER HARBOUR BB	54			7.1	6.5
3LA	2007015	7-Nov-07	8-Nov-07	BONAVISTA BAY	137			0.0	0.0
3LA	2008-003	19-Jun-08	15-Jul-08	BONAVISTA	611				3.5
					Annual means	**.**	**4.7**	**5.2**	**2.7**
3LB	2004001	1-Dec-04	2-Dec-04	SMITH SOUND (HL)	932	5.8	7.7	4.4	
3LB	2005-001	5-May-05	19-May-05	SMITH SOUND (HL)	667	3.6	7.2	4.8	
3LB	2005-003	16-Nov-05	16-Nov-05	SMITH SOUND (HL)	110	0.0	11.7	7.6	9.0
3LB	2005-009	13-Dec-05	13-Dec-05	SMITH SOUND (HL)	51	0.0	17.6	9.0	0.0
3LB	2006-001	26-Apr-06	29-Apr-06	SMITH SOUND (HL)	384		8.5	4.5	2.5
3LB	2006-003	30-Apr-06	1-May-06	SMITH SOUND (OT)	25		32.8	0.0	0.0
3LB	2006-004	9-May-06	25-May-06	SMITH SOUND HL	390		8.8	5.4	4.7
3LB	2006009	8-Nov-06	16-Nov-06	SMITH SOUND HL	472		0.0	9.7	3.7
3LB	2006010	16-Nov-06	22-Nov-06	SMITH SND CP	264		0.0	14.0	5.5
3LB	2006011	25-Nov-06	30-Nov-06	SMITH SND CP	319		0.0	6.6	9.3
3LB	2006012	26-Nov-06	30-Nov-06	SMITH SND HL	637		0.0	5.1	2.8
3LB	2007-002	6-May-07	7-May-07	SMITH SOUND OT	110			6.2	7.3
3LB	2007-003	30-May-07	31-May-07	SMITH SOUND HL	272			1.9	2.3
3LB	2007-016	16-Nov-07	26-Nov-07	SMITH SND CP	977			0.0	7.2
3LB	2007-017	16-Nov-07	26-Nov-07	SMITH SND HL	59			0.0	7.8
3LB	2008-002	9-May-08	22-Jul-08	SMITH SOUND	112				5.1
3LB	2008-011	7-Oct-08	16-Oct-08	SMITH SOUND CP	373				2.5
3LB	2008-012	10-Nov-08	12-Nov-08	SMITH SOUND CP	425				0.0
3LB	2008-013	10-Nov-08	11-Nov-08	SMITH SOUND HL	115				0.0
					Annual means	**4.9**	**8.5**	**7.1**	**5.1**
3LJ	2007-009	18-Jul-07	20-Jul-07	PETTY HARBOUR	553			7.4	6.7
3LJ	2008-009	21-Aug-08	4-Sep-08	PETTY HARBOUR	454				7.4
					Annual means			**7.4**	**7.0**
3KG	2008-001	3-Mar-08	6-Mar-08	OFFSHORE 3K	2268				**5.6**

Table 16. Summary of cod catches by stratum for the DFO-industry inshore mobile gear survey of three near-shore areas of NAFO Div. 2J3KL in 2006-08 (nf=not fished).

Inshore northern area

Div	Strat	Depth	AREA	Mean N			MeanW (kg)			Abundance			Biomass (kg)			No_Sets		
		range(m)	sq n mi	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008
3K	21	<=50	13	3.9	3.5	4.3	0.3	10.5	0.5	4,578	4,162	5,086	305	12,346	593	2	2	2
3K	22	30 - 50	85	0.5	121.0	0.0	1.3	12.4	0.0	3,837	928,644	0	9,593	95,359	0	2	2	2
3K	23	30 - 100	196	13.3	4.2	0.0	2.9	3.1	0.0	235,223	73,959	0	51,801	54,850	0	4	4	4
3K	24	<=50	13	54.5	28.8	5.2	38.8	2.2	0.2	63,971	33,746	6,055	45,484	2,554	212	2	2	2
3K	25	<=50	53	3.5	4.3	115.1	0.2	2.4	20.9	16,849	20,577	550,563	1,089	11,246	100,221	2	2	2
3K	26	<=50	20	35.6	nf	nf	38.4	nf	nf	64,232	nf	nf	69,367	nf	nf	2	nf	nf
3K	27	30 - 100	60	12.0	0.0	0.0	8.5	0.0	0.0	65,010	0	0	46,048	0	0	2	2	2
3K	28	<=50	185	0.3	0.3	11.7	0.1	0.0	0.5	4,176	4,524	195,435	1,670	588	7,962	4	4	4
2J	29	<=30	153	2.1	0.0	0.0	1.8	0.0	0.0	28,780	0	0	25,212	0	0	3	2	3
2J	30	<=50	221	0.4	0.0	0.0	0.2	0.0	0.0	7,861	0	0	3,930	0	0	3	3	3
2J	31	30 - 50	37	0.5	0.0	0.0	0.2	0.0	0.0	1,670	0	0	501	0	0	2	2	2
2J	32	30 - 100	160	0.4	0.0	nf	0.9	0.0	nf	6,260	0	nf	12,520	0	nf	3	3	nf
			1196	4.7	10.0	8.3	2.5	1.7	1.2	502,448	1,065,612	757,140	267,522	176,943	108,989			
3K	616	101 - 200	250	1.5	1.3	0.5	1.6	0.1	0.2	33,859	29,345	11,286	36,116	2,934	4,740	2	2	2
3K	618	101 - 200	1347	4.0	0.2	1.9	4.4	0.2	2.2	486,488	27,403	231,082	529,925	27,096	264,441	7	7	7
3K	619	101 - 200	1753	0.9	4.0	0.9	1.3	4.1	0.8	138,495	628,881	147,893	207,743	653,370	131,046	8	7	8
2J	207	101 - 200	2264	2.2	0.5	1.6	2.4	0.0	1.3	457,155	103,807	321,340	480,570	1,661	266,434	11	8	11
			5614	2.2	1.6	1.4	2.5	1.4	1.3	1,115,998	789,436	711,602	1,254,354	685,062	666,661			

Table 16. (Cont'd.)

Inshore central area

Div	Strat	Depth	AREA	Mean N			MeanW (kg)			Abundance			Biomass (kg)			No_Sets		
		range(m)	sq n mi	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008
3L	7	<=50	97	976.1	19.3	97.5	417.7	2.6	46.9	8,548,473	168,715	853,928	3,658,314	22,771	410,755	2	2	2
3L	8	<=200	54	20.9	45.0	36.5	62.5	88.2	46.5	101,943	219,407	177,964	304,509	429,835	226,721	2	2	2
3L	9	<=50	51	9.4	3.9	31.0	11.6	8.6	48.4	43,401	17,959	142,750	53,577	39,659	223,047	2	2	2
3L	10	<=50	39	485.6	17.0	201.3	180.0	20.8	108.4	1,709,983	59,863	708,672	633,733	73,350	381,538	2	2	2
3L	11	<=50	294	100.9	175.6	408.7	72.7	200.0	55.2	2,679,328	4,660,985	10,850,404	1,929,608	5,309,391	1,465,861	6	6	6
3L	12	<=30	51	5.2	0.0	55.3	0.1	0.0	3.5	24,052	0	254,418	417	0	15,914	2	2	2
3L	13	30 - 50	34	33.5	10.8	0.5	5.9	22.2	0.2	102,860	33,257	1,663	18,173	68,011	665	2	2	2
3K	14	<=30	259	5.7	32.4	28.4	0.7	19.0	3.5	133,764	758,347	664,730	17,329	444,210	82,638	5	5	5
3K	15	<=50	91	79.3	3.9	6.6	11.8	2.1	16.3	651,567	32,044	54,149	97,201	17,090	133,889	2	2	2
3K	16	30 - 50	181	46.0	8.3	25.3	38.2	8.3	9.1	751,686	135,582	414,015	624,466	136,433	148,514	3	3	3
3K	17	30 - 100	504	5.5	3.4	9.0	8.2	9.1	5.7	250,847	153,275	409,019	373,652	412,440	261,393	10	10	10
3K	18	<=200	342	4.9	3.4	0.0	4.9	4.6	0.0	151,334	104,812	0	151,334	140,730	0	6	6	6
3K	19	30 - 50	40	5656.4	60.7	42.3	559.0	11.3	126.8	nf	219,106	152,853	nf	40,803	458,115	1	2	2
3K	20	30 - 50	44	4311.7	0.0	0.0	1272.4	0.0	0.0	17,129,418	0	0	5,054,900	0	0	2	2	2
			2081	175.2	34.9	78.2	70.1	38.0	20.3	32,278,656	6,563,352	14,684,562	12,917,212	7,134,723	3,809,050			
3L	790	93 - 183	89	35.0	2.6	49.9	30.9	2.2	83.9	281,480	20,759	401,293	248,109	17,411	674,263	2	2	2
3L	793	93 - 183	72	1.7	63.1	10.0	0.9	82.7	13.0	10,933	409,885	65,010	5,747	537,710	84,512	2	2	2
3L	794	93 - 183	216	2.0	3.5	3.9	1.8	15.7	3.6	39,006	68,260	76,061	34,130	305,220	69,723	2	2	2
3L	797	93 - 183	98	6.1	36.5	35.0	7.7	42.7	29.0	53,976	322,971	309,698	67,912	377,390	256,607	2	2	2
3L	799	93 - 183	72	1.8	5.1	3.0	1.4	4.6	7.8	11,702	33,317	19,503	9,101	30,067	50,382	2	2	2
3K	608	101 - 200	798	0.5	1.6	0.8	0.3	2.4	1.0	36,026	112,582	54,039	24,318	170,374	72,052	4	4	4
3K	612	101 - 200	445	4.1	4.5	2.4	8.9	2.8	4.0	163,229	180,808	94,970	359,104	110,494	161,449	2	2	2
			1790	3.7	7.1	6.3	4.6	9.6	8.5	596,352	1,148,583	1,020,574	748,422	1,548,665	1,368,988			

Inshore southern area

Div.	Strat	Depth	AREA	Mean N			MeanW (kg)			Abundance			Biomass (kg)			No_Sets		
		range(m)	sq n mi	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008
3L	1	<=30	98	0.0	2.4	1467.8	0.0	0.3	1853.8	0	20,998	12,987,421	0	2,374	16,403,217	2	2	2
3L	2	30 - 50	262	33.0	38.1	173.9	31.5	62.3	344.7	781,560	902,092	4,113,936	746,236	1,472,715	8,154,791	5	5	7
3L	3	<=50	71	339.0	4014.0	3232.7	40.5	420.5	243.8	2,173,216	25,732,410	20,723,544	259,632	2,695,428	1,562,600	2	2	2
3L	4	<=50	47	36.8	11.4	1.0	56.7	12.2	1.8	155,975	48,272	4,244	240,732	51,720	7,426	2	2	2
3L	5	<=50	71	842.5	26.9	447.7	202.2	12.8	245.5	5,400,985	172,447	2,870,055	1,296,023	82,057	1,573,498	2	2	2
3L	6	<=50	13	nf	6.7	28.3	nf	9.1	50.9	nf	7,861	33,159	nf	10,635	59,687	nf	2	2
			562	171.7	529.8	802.7	51.3	85.0	547.1	8,511,735	26,884,080	40,732,359	2,542,624	4,314,928	27,761,218			
3L	785	57 - 92	465	34.0	2.6	16.0	5.7	3.1	13.5	1,427,502	110,212	671,765	239,316	132,079	566,802	2	2	2
3L	786	93 - 183	84	22.0	3.5	0.5	4.5	0.8	0.4	166,858	26,275	3,792	34,130	5,829	2,655	2	2	2
3L	787	93 - 183	613	1.3	1.9	0.3	0.4	2.0	0.3	73,798	102,790	18,449	21,217	111,356	18,449	3	3	3
3L	788	93 - 183	261	2.2	3.3	3.6	2.0	4.5	2.3	52,369	77,431	84,837	46,150	106,888	53,966	2	2	2
			1423	13.4	2.5	6.1	2.7	2.8	5.0	1,720,526	316,707	778,845	340,813	356,152	641,872			

Table 17. Estimated proportions mature for female cod from NAFO Div. 2J+3KL from DFO autumn bottom trawl surveys from 1963 to 2008 projected forward to 2010 and back to 1958. Estimates were obtained from a probit model fitted by cohort to observed proportions mature at age. Lightly shaded cells are averages of the first or last three estimates extrapolated back or forward. Darkly shaded cells are the average of adjacent estimates for the same age group.

Year/Age	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1958	0.0000	0.0000	0.0000	0.0007	0.0112	0.1576	0.7634	0.9875	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
1959	0.0000	0.0000	0.0000	0.0007	0.0112	0.1576	0.7634	0.9875	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
1960	0.0000	0.0000	0.0000	0.0007	0.0112	0.1576	0.7634	0.9875	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
1961	0.0000	0.0000	0.0000	0.0000	0.0112	0.1576	0.7634	0.9875	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
1962	0.0000	0.0000	0.0001	0.0008	0.0009	0.1576	0.7634	0.9875	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
1963	0.0001	0.0002	0.0003	0.0012	0.0130	0.0396	0.7634	0.9875	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
1964	0.0002	0.0004	0.0015	0.0035	0.0197	0.1863	0.6493	0.9875	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
1965	0.0003	0.0010	0.0026	0.0098	0.0402	0.2468	0.7986	0.9881	0.9994	1.0000	1.0000	1.0000	1.0000	1.0000
1966	0.0000	0.0017	0.0054	0.0160	0.0659	0.3347	0.8422	0.9856	0.9997	1.0000	1.0000	1.0000	1.0000	1.0000
1967	0.0000	0.0001	0.0081	0.0275	0.0917	0.3598	0.8579	0.9886	0.9992	1.0000	1.0000	1.0000	1.0000	1.0000
1968	0.0000	0.0000	0.0011	0.0389	0.1290	0.3848	0.8264	0.9864	0.9993	1.0000	1.0000	1.0000	1.0000	1.0000
1969	0.0001	0.0000	0.0003	0.0086	0.1664	0.4403	0.7949	0.9732	0.9989	1.0000	1.0000	1.0000	1.0000	1.0000
1970	0.0002	0.0006	0.0000	0.0037	0.0657	0.4959	0.8120	0.9600	0.9961	0.9999	1.0000	1.0000	1.0000	1.0000
1971	0.0086	0.0012	0.0035	0.0003	0.0446	0.3638	0.8290	0.9599	0.9933	0.9994	1.0000	1.0000	1.0000	1.0000
1972	0.0170	0.0217	0.0069	0.0187	0.0085	0.3678	0.8231	0.9599	0.9925	0.9989	0.9999	1.0000	1.0000	1.0000
1973	0.0000	0.0421	0.0539	0.0371	0.0924	0.2004	0.8787	0.9743	0.9916	0.9986	0.9998	1.0000	1.0000	1.0000
1974	0.0000	0.0000	0.1008	0.1298	0.1764	0.3718	0.8800	0.9890	0.9968	0.9983	0.9997	1.0000	1.0000	1.0000
1975	0.0002	0.0002	0.0003	0.2224	0.2990	0.5432	0.8743	0.9954	0.9991	0.9996	0.9997	1.0000	1.0000	1.0000
1976	0.0001	0.0009	0.0018	0.0036	0.4217	0.5967	0.8685	0.9844	0.9998	0.9999	1.0000	0.9999	1.0000	1.0000
1977	0.0000	0.0008	0.0052	0.0150	0.0430	0.6502	0.8471	0.9735	0.9975	1.0000	1.0000	1.0000	1.0000	1.0000
1978	0.0000	0.0003	0.0051	0.0285	0.1136	0.3554	0.8258	0.9485	0.9951	0.9996	1.0000	1.0000	1.0000	1.0000
1979	0.0000	0.0000	0.0024	0.0308	0.1400	0.5188	0.8713	0.9236	0.9818	0.9991	0.9999	1.0000	1.0000	1.0000
1980	0.0000	0.0000	0.0002	0.0173	0.1655	0.4748	0.9007	0.9881	0.9686	0.9933	0.9998	1.0000	1.0000	1.0000
1981	0.0002	0.0002	0.0003	0.0031	0.1129	0.5530	0.8339	0.9871	0.9990	0.9874	0.9974	1.0000	1.0000	1.0000
1982	0.0000	0.0010	0.0022	0.0042	0.0436	0.4788	0.8852	0.9654	0.9984	0.9999	0.9950	0.9990	1.0000	1.0000
1983	0.0000	0.0000	0.0049	0.0186	0.0588	0.3980	0.8689	0.9796	0.9936	0.9998	1.0000	0.9980	0.9996	1.0000
1984	0.0000	0.0000	0.0004	0.0241	0.1417	0.4805	0.9055	0.9795	0.9967	0.9988	1.0000	1.0000	0.9992	0.9998
1985	0.0000	0.0001	0.0002	0.0045	0.1114	0.5898	0.9320	0.9928	0.9971	0.9995	0.9998	1.0000	1.0000	0.9997
1986	0.0000	0.0001	0.0014	0.0027	0.0533	0.3885	0.9260	0.9951	0.9995	0.9996	0.9999	1.0000	1.0000	1.0000
1987	0.0000	0.0003	0.0013	0.0139	0.0394	0.4114	0.7631	0.9909	0.9997	1.0000	0.9999	1.0000	1.0000	1.0000
1988	0.0000	0.0002	0.0022	0.0127	0.1223	0.3800	0.8966	0.9423	0.9989	1.0000	1.0000	1.0000	1.0000	1.0000
1989	0.0000	0.0001	0.0019	0.0150	0.1151	0.5798	0.9015	0.9908	0.9881	0.9999	1.0000	1.0000	1.0000	1.0000
1990	0.0000	0.0000	0.0010	0.0168	0.0976	0.5691	0.9318	0.9927	0.9993	0.9976	1.0000	1.0000	1.0000	1.0000
1991	0.0001	0.0001	0.0005	0.0179	0.1302	0.4338	0.9306	0.9927	0.9995	0.9999	0.9995	1.0000	1.0000	1.0000
1992	0.0023	0.0010	0.0014	0.0131	0.2500	0.5674	0.8444	0.9927	0.9993	1.0000	1.0000	0.9999	1.0000	1.0000
1993	0.0000	0.0082	0.0086	0.0365	0.2756	0.8591	0.9200	0.9746	0.9993	0.9999	1.0000	1.0000	1.0000	1.0000
1994	0.0000	0.0002	0.0291	0.0711	0.5105	0.9160	0.9911	0.9902	0.9963	0.9999	1.0000	1.0000	1.0000	1.0000
1995	0.0001	0.0001	0.0029	0.0980	0.4045	0.9663	0.9968	0.9995	0.9989	0.9995	1.0000	1.0000	1.0000	1.0000
1996	0.0020	0.0008	0.0020	0.0336	0.2825	0.8576	0.9987	0.9999	1.0000	0.9999	0.9999	1.0000	1.0000	1.0000
1997	0.0006	0.0079	0.0078	0.0292	0.2944	0.5877	0.9816	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1998	0.0000	0.0029	0.0303	0.0763	0.3112	0.8336	0.8377	0.9979	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1999	0.0000	0.0003	0.0142	0.1091	0.4636	0.8716	0.9837	0.9492	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
2000	0.0001	0.0001	0.0035	0.0669	0.3246	0.9004	0.9903	0.9986	0.9854	1.0000	1.0000	1.0000	1.0000	1.0000
2001	0.0011	0.0012	0.0014	0.0396	0.2630	0.6536	0.9895	0.9993	0.9999	0.9959	1.0000	1.0000	1.0000	1.0000
2002	0.0001	0.0054	0.0102	0.0283	0.3249	0.6399	0.8810	0.9990	1.0000	1.0000	0.9989	1.0000	1.0000	1.0000
2003	0.0000	0.0010	0.0255	0.0802	0.3797	0.8487	0.8985	0.9667	0.9999	1.0000	1.0000	0.9997	1.0000	1.0000
2004	0.0005	0.0003	0.0076	0.1125	0.4253	0.9279	0.9849	0.9778	0.9913	1.0000	1.0000	1.0000	0.9999	1.0000
2005	0.0000	0.0031	0.0045	0.0560	0.3801	0.8627	0.9963	0.9987	0.9955	0.9978	1.0000	1.0000	1.0000	1.0000
2006	0.0002	0.0005	0.0202	0.0722	0.3153	0.7478	0.9816	0.9998	0.9999	0.9991	0.9994	1.0000	1.0000	1.0000
2007	0.0002	0.0013	0.0064	0.1217	0.5755	0.7816	0.9348	0.9978	1.0000	1.0000	0.9998	0.9999	1.0000	1.0000
2008	0.0002	0.0013	0.0104	0.0755	0.4821	0.9594	0.9653	0.9858	0.9997	1.0000	1.0000	1.0000	1.0000	1.0000
2009	0.0002	0.0013	0.0104	0.0898	0.5074	0.8622	0.9976	0.9954	0.9970	1.0000	1.0000	1.0000	1.0000	1.0000
2010	0.0002	0.0013	0.0104	0.0898	0.5217	0.9286	0.9768	0.9999	0.9994	0.9994	1.0000	1.0000	1.0000	1.0000

Table 18. Mean length (cm) at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-2008. Highlighted entries are based on fewer than 5 aged fish. There were no surveys in Div. 3L in 1978-1980 and 1984.

2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																		20.2	19.1		21.9	20.8	22.0	23.0	21.1	20.2	22.6	22.7	**22.0**	22.0	22.1
2	29.3	30.1	30.6	29.9	29.8	26.6	27.6	27.0	28.2	29.5	30.4	28.1	26.5	28.1	26.6	26.3	25.8	26.2	28.8	30.6	25.3	27.6	27.8	29.6	28.0	31.6	31.1	28.9	27.4	27.4	27.9
3	38.0	41.4	39.4	38.8	38.2	38.9	34.5	33.6	35.7	36.5	37.6	37.3	34.0	33.4	34.1	32.2	36.4	33.3	35.0	37.6	38.8	33.7	37.8	35.1	37.5	38.2	38.1	36.5	35.6	36.5	35.8
4	45.9	47.8	49.5	47.1	47.2	46.2	44.6	40.3	41.2	43.3	44.2	43.7	42.2	38.7	38.9	40.2	42.6	42.5	43.5	43.0	44.4	42.1	44.0	44.1	43.6	43.2	45.7	43.3	43.6	43.3	45.0
5	54.1	55.7	54.7	54.6	53.5	53.9	51.1	48.6	47.8	49.0	48.6	50.1	46.9	44.0	41.8	44.6	47.0	47.4	49.4	48.2	47.8	52.4	**54.3**	50.0	45.9	50.7	50.3	51.1	48.2	52.2	43.8
6	59.7	61.3	60.7	58.2	59.6	60.2	56.7	53.5	52.8	52.5	53.8	53.9	53.3	51.2	47.3	47.0	**56.6**	**57.0**	**56.0**		**52.8**	**69.0**	**62.3**	**55.0**	**41.0**	61.4	55.7	**52.8**	57.9	57.2	59.2
7	66.4	68.1	64.4	63.1	61.5	62.9	63.5	57.5	56.6	57.4	55.9	57.1	56.6	56.9	**57.1**	**47.0**	**55.8**		**69.0**		**51.0**			**57.0**				**66.0**		**62.0**	**59.4**
8	69.6	74.0	69.5	66.9	64.5	64.7	65.8	64.3	59.5	58.9	59.8	59.7	59.3	58.7								**79.0**							**74.0**		
9	79.4	69.3	82.2	73.6	68.9	68.6	66.9	67.2	67.7	61.9	63.9	62.9	61.0	63.8																	**67.0**
10	80.4	76.9	83.5	84.1	76.9	73.5	71.6	70.3	68.4	67.8	66.2	64.8	65.4	65.6																	
11	87.9	87.7	86.5	90.5	85.5	74.9	78.4	72.8	72.3	77.6	74.2	69.7	71.5	**72.7**																	
12	91.4	85.9	87.8	88.6	94.8	94.5	83.5	75.9	75.9	75.7	80.6	69.3	73.0	**66.2**																	

3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																		19.0	19.1	21.8	19.5	20.5	20.9	20.1	22.1	19.4	20.9	20.4	17.9	20.6	20.8
2	27.9	29.8	30.8	31.3	29.4	28.6	26.5	28.7	29.5	29.7	25.7	27.5	28.2	29.3	28.7	28.4	28.5	25.7	28.8	29.7	25.6	29.2	27.9	28.2	28.5	30.5	28.1	29.1	25.1	27.4	27.9
3	37.7	42.0	40.1	42.3	40.4	40.8	37.0	36.0	36.7	38.3	36.7	37.5	36.2	36.4	36.6	37.4	36.9	34.5	35.0	39.3	39.2	36.8	37.1	34.9	35.5	39.0	35.0	38.3	37.1	37.9	37.5
4	47.2	49.5	47.4	50.4	50.3	48.3	47.2	44.0	44.1	45.0	44.5	45.3	44.0	43.2	42.7	43.9	41.7	42.2	43.5	48.2	45.4	45.8	45.9	42.7	41.7	45.4	43.7	44.5	47.0	47.9	46.4
5	55.1	55.5	54.9	56.4	54.2	56.6	54.5	51.9	50.2	51.3	52.0	51.9	49.7	48.0	47.1	49.7	51.4	47.4	49.4	56.4	51.9	52.6	51.9	52.7	47.6	53.8	49.4	51.6	52.5	57.2	55.2
6	62.7	63.0	62.0	60.4	60.7	62.5	61.9	57.3	56.4	54.3	56.2	56.2	56.4	54.9	51.6	51.4	**54.2**	**53.8**	**56.0**		57.9	**55.8**	61.0	**55.4**	**56.7**		57.4	60.4	56.2	61.2	64.0
7	69.7	70.0	69.7	65.3	64.5	67.0	64.5	62.6	58.9	60.2	58.7	60.4	58.9	59.7	57.9	51.1	**58.5**		**69.0**		62.6	**72.9**			**57.0**		**60.5**		**71.1**	66.9	67.8
8	74.3	76.8	76.5	69.2	69.2	67.8	68.9	69.5	64.3	63.3	66.4	63.6	61.2	62.8	65.2	**64.0**	**61.2**			**68.0**	**83.0**			**73.0**			**81.0**		**65.6**	**74.0**	66.7
9	76.7	83.4	85.7	81.9	74.8	72.3	73.1	70.3	67.4	69.6	73.1	67.7	62.8	65.5	**64.0**			**68.0**			**80.0**	**81.0**		**74.0**						**90.0**	71.3
10	81.9	78.1	87.8	90.2	79.7	76.4	78.0	73.3	76.8	75.5	78.6	73.8	64.7	69.2								**89.0**					**58.0**			**80.0**	
11	**88.4**	86.0	**104.5**	92.0	89.8	84.4	85.4	79.1	76.0	80.8	84.2	74.7	71.2	**80.5**																	
12	91.7	**78.9**	94.5	92.1	97.0	85.2	90.8	86.9	73.7	86.6	89.3	82.9	68.0	**68.4**																	**102.0**

3L

Age				1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																		16.6	17.3	21.5	18.4	19.3	19.4	18.4	20.6	17.7	20.1	18.6	18.1	18.2	19.2
2				28.5	28.8	30.1		26.9	27.9	27.5	28.7	28.5	27.0	29.9	27.9	29.7	28.5	27.9	29.7	30.5	31.2	30.0	28.5	29.0	29.6	29.1	29.0	29.8	28.2	26.8	29.4
3				40.0	38.3	39.7		36.1	35.5	35.0	37.4	37.9	35.5	36.6	38.6	38.1	34.8	36.9	38.8	37.2	39.8	39.9	39.8	36.7	38.8	39.8	37.3	38.6	38.9	38.6	36.9
4				44.9	50.4	48.1		43.7	44.0	44.1	45.3	44.9	44.8	44.7	44.6	45.7	45.3	41.6	44.3	44.3	47.8	47.4	45.9	45.0	47.3	50.1	48.0	43.9	46.5	47.3	46.6
5				53.0	56.4	57.0		52.4	50.7	52.5	53.2	52.3	52.9	51.2	50.7	52.1	52.2	49.7	49.5	53.6	**54.2**	55.4	53.3	51.5	56.5	51.0	50.1	49.6	51.0	55.1	53.9
6				60.6	63.8	62.3		58.1	58.3	59.3	58.8	59.4	59.6	56.5	54.9	56.1	58.6	58.6	58.9	**61.7**	**59.0**	60.3	58.0	58.4	63.0	**60.5**	**58.9**	**59.5**	54.3	59.9	62.1
7				66.9	69.8	64.8		65.5	62.6	65.2	62.6	64.0	66.5	61.1	56.7	61.7	**70.0**	**66.7**	66.7	68.2	**78.0**	**64.0**	**65.4**	**65.9**	**68.0**	**70.0**	**72.0**	**61.0**	**72.0**	67.1	67.6
8				73.1	73.9	69.7		73.3	70.1	69.0	66.7	68.8	71.0	68.0	66.1	**75.0**	**67.0**	**74.0**	**70.0**	72.8	**75.8**	**72.9**	**77.9**	**67.9**			**57.0**	**65.7**	**63.0**	**78.1**	67.8
9				82.3	83.2	73.6		72.7	73.2	75.3	69.6	74.9	75.2	71.4	77.4				**66.0**	**74.0**	**79.0**	**86.3**	**81.0**	**75.1**		**71.0**	**69.0**		**87.7**	**93.6**	
10				91.1	92.9	76.2		82.5	77.7	80.8	74.3	84.1	76.3	73.3	70.3	**87.0**						**90.7**					**82.0**		**81.5**	**90.0**	64.5
11				**103.7**	94.2	90.5		86.8	81.5	88.0	88.9	87.7	82.6	74.5	**73.7**						**77.0**	**79.0**		**91.0**		**89.0**					**75.8**
12				**119.2**	110.1	85.0		97.8	86.8	85.6	96.7	94.2	86.9	81.7	**94.5**							**100.0**		**101.0**	**97.0**				**75.0**	**100.0**	**103.3**

Table 19. Mean weight (kg) at age of cod sampled during autumn bottom-trawl surveys in Divisions 2J, 3K and 3L in 1978-2008. Highlighted entries are based on fewer than 5 aged fish. There were no surveys in Div. 3L in 1978-1980 and 1984.

2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																		0.07	0.19		0.08	0.08	0.09	0.10	0.09	0.07	0.09	0.10	**0.08**	0.09	0.09
2	0.20	0.26	0.24	0.22	0.21	0.17	0.15	0.19	0.25	0.27	0.25	0.20	0.15	0.18	0.14	0.15	0.15	0.17	0.37	0.26	0.14	0.20	0.19	0.22	0.19	0.27	0.29	0.22	0.18	0.20	0.20
3	0.46	0.63	0.52	0.55	0.50	0.58	0.38	0.36	0.36	0.50	0.54	0.50	0.36	0.31	0.31	0.29	0.41	0.33	0.71	0.48	0.51	0.37	0.47	0.41	0.47	0.50	0.51	0.45	0.41	0.46	0.41
4	0.96	1.02	1.04	1.08	0.95	0.96	0.81	0.63	0.62	0.87	0.81	0.82	0.70	0.52	0.51	0.57	0.68	0.70	1.20	0.73	0.82	0.72	0.80	0.77	0.77	0.75	0.88	0.80	0.77	0.75	0.85
5	1.54	1.57	1.36	**1.67**	1.55	1.51	1.32	1.12	1.07	1.32	1.12	1.23	1.02	0.79	0.63	0.79	0.93	1.00	1.39	1.05	1.05	1.44	**1.42**	1.15	0.92	1.24	1.25	1.40	1.09	1.31	0.93
6	2.22	2.30	2.02	1.96	1.90	1.94	1.81	1.49	1.59	1.52	1.53	1.52	1.46	1.13	0.90	0.89	**1.63**	**1.78**	**2.19**		**1.46**	**3.21**	**2.46**	**1.49**	**0.58**	**2.16**	1.82	**1.32**	1.85	1.85	1.89
7	2.69	2.97	2.65	2.49	2.33	**2.18**	2.42	1.95	1.98	2.17	1.75	1.94	1.82	1.57	**1.65**	**0.86**	**1.76**		**2.15**		**1.53**			**1.64**				**2.67**		**2.54**	**1.94**
8	3.80	3.38	**3.07**	3.19	2.79	2.69	2.59	2.41	2.60	2.50	2.43	2.37	2.13	1.76								**5.18**							**3.82**		
9	4.45	5.84	5.68	4.39	4.17	3.31	3.01	3.02	**3.75**	1.80	2.42	2.72	2.46	2.40																	**2.40**
10	5.94	**6.05**	8.12	6.55	6.58	4.31	3.56	3.36	4.48	4.80	3.49	3.25	3.10	2.87																	
11	6.41	7.41	7.08	**7.75**	**7.23**	4.73	5.68	4.43	4.62	**4.34**	4.13	3.91	4.21	**4.07**																	
12	**9.19**	**6.24**	7.67	**10.95**	**10.18**	9.09	6.81	4.27	6.12	**4.71**	7.09	3.61	4.70	**3.12**																	

3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																		0.05	0.06	0.09	0.06	0.07	0.07	0.07	0.09	0.06	0.08	0.07	0.05	0.07	0.07
2	0.16	0.21	0.23	0.27	0.23	0.23	0.14	0.20	0.19	0.19	0.17	0.19	0.18	0.21	0.20	0.20	0.20	0.15	0.21	0.23	0.16	0.23	0.20	0.19	0.21	0.25	0.21	0.22	0.14	0.18	0.21
3	0.38	0.52	0.59	0.70	0.73	0.55	0.39	0.44	0.43	0.47	0.47	0.49	0.41	0.41	0.41	0.46	0.43	0.37	0.39	0.56	0.53	0.48	0.46	0.38	0.40	0.52	0.43	0.51	0.46	0.52	0.48
4	0.83	1.18	0.87	1.25	1.22	1.08	0.86	0.87	0.80	0.89	0.84	0.88	0.77	0.70	0.69	0.76	0.67	0.68	0.73	0.99	0.89	0.90	0.86	0.72	0.65	0.87	0.83	0.86	0.96	1.06	1.01
5	1.48	1.60	1.36	**1.73**	1.50	1.70	1.37	1.22	1.18	1.31	1.37	1.37	1.14	1.05	0.97	1.12	1.25	1.01	1.15	1.66	1.33	1.42	1.23	1.28	1.00	1.44	1.20	1.36	1.36	1.77	1.68
6	2.37	2.25	2.00	1.94	1.94	2.08	2.08	1.79	1.93	1.51	1.74	1.83	1.61	1.55	1.37	1.33	**1.50**	**1.50**	**1.64**		1.94	**1.56**	**2.09**	**1.77**	**1.52**		1.91	2.32	1.78	2.41	2.64
7	3.12	3.33	3.41	2.77	2.47	2.92	2.35	2.56	2.52	2.40	2.37	2.29	1.92	2.02	1.84	1.39	**1.99**		**3.24**		2.61	**3.74**			**1.71**		**2.55**		**3.40**	3.11	3.24
8	**5.51**	4.40	3.49	5.12	3.11	3.36		3.45	3.46	2.89	3.04	2.70	2.32	2.33	2.75	**2.40**	**2.36**			**2.61**	**6.32**			**3.45**			**4.57**		**2.84**	**4.21**	3.02
9	4.64	4.81	5.88	6.85	4.46	3.77	3.60	4.02	3.54	3.52	4.35	3.37	2.56	2.72	**2.19**			**3.28**			**5.31**	**6.13**		**3.71**						**7.65**	4.05
10	6.76	4.64	7.84	6.69	6.38	4.81	5.05	5.05	5.01	5.46	4.91	4.27	2.71	3.53								**7.27**					**2.00**			**5.57**	
11	**6.08**	8.86	**11.92**	9.46	6.91	7.20	6.39	6.47	5.97	**10.69**	5.94	4.63	3.68	**5.79**																	
12	**8.67**	**10.41**	7.46	8.25	**9.95**	**####**	6.25	6.35	**6.48**	7.31	7.98	6.00	3.45	**3.22**																	**12.15**

3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																		0.11	0.04	0.09	0.05	0.06	0.06	0.05	0.08	0.05	0.07	0.05	0.05	0.05	0.07
2				**0.20**	0.17	0.22		0.15	0.22	0.18	0.22	0.19	0.16	0.23	0.19	0.23	0.20	0.23	0.24	0.26	0.26	0.26	0.21	0.22	0.24	0.22	0.24	0.23	0.20	0.18	0.24
3				0.55	0.38	0.54		0.42	0.45	0.35	0.43	0.44	0.38	0.45	0.55	0.48	0.37	0.46	0.49	0.51	0.57	0.61	0.55	0.50	0.55	0.56	0.53	0.54	0.55	0.53	0.48
4				0.82	**0.48**	1.08		0.77	0.78	0.74	0.75	0.79	0.80	0.80	0.87	0.84	0.84	0.68	0.79	0.86	1.05	0.97	0.92	0.87	0.97	1.12	1.00	0.80	0.97	1.02	0.99
5				1.26		1.44		1.34	1.15	1.25	1.31	1.52	1.35	1.28	1.29	1.34	1.34	1.15	1.20	1.55	**1.58**	1.56	1.53	1.36	1.73	1.23	1.26	1.16	1.31	1.64	1.55
6				1.94		2.05		2.15	1.84	1.79	1.79	1.85	1.91	1.84	1.77	1.84	2.01	2.06	2.07	**2.47**	**1.94**	2.23	1.83	1.92	2.54	**2.17**	**2.39**	**2.05**	1.50	2.23	2.32
7				2.67		2.21		2.45	2.60	2.43	2.13	2.59	2.72	2.21	1.98	2.61	**3.34**	**3.34**	3.14	3.40	**4.25**	**2.62**	**2.92**	2.92	**3.02**	**2.94**	**3.14**	**2.53**	**3.74**	3.13	3.02
8				5.09	**5.44**	2.93		3.47	2.80	2.89	3.13	3.74	3.52	3.11	3.04	**4.30**	**3.16**	**4.20**	**5.04**	4.54	**4.70**	**3.90**	**4.84**	**3.43**			**1.67**	**2.83**	**2.67**	4.89	3.44
9				6.01	6.16	4.18		3.90	4.42	3.84	3.08	3.95	4.38	3.79	4.85				**3.20**		4.96	**6.63**	**5.43**	**3.88**		**3.64**	**3.87**		**6.95**	**8.45**	2.79
10				11.42	8.34	4.55		6.31	5.28	**6.71**	3.64	6.98	4.75	4.06	3.59	**6.44**						**8.28**					**5.81**		**6.06**	**8.07**	
11				**11.67**	7.84	8.70		5.69	4.64	7.43	7.25	7.53	6.07	4.81	**4.53**						**5.25**	**5.63**		8.26		**7.70**					**4.41**
12				**17.44**	**11.31**	**8.75**		####	10.88	6.08	9.48	**10.20**	7.29	6.06	**8.81**							**10.05**		**12.80**	**9.95**				**4.90**	**10.90**	**11.31**

Table 20. Mean Fulton's condition (gutted weight) at age of cod sampled during autumn bottom-trawl surveys in divisions 2J, 3K and 3L in 1978-2008. Highlighted entries are based on fewer than 5 aged fish. There were no surveys in Div. 3L in 1978-1980 and 1984.

2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
2	0.70	0.71	0.74	0.76	0.74	0.73	0.71	0.69	0.70	0.73	0.75	0.73	0.68	0.69	0.66	0.74	0.80	0.75	0.73	0.71	0.75	0.71	0.70	0.69	0.70	0.66	0.77	0.75	0.68	0.77	0.72
3	0.71	0.73	0.78	0.82	0.78	0.76	0.76	0.73	0.79	0.80	0.78	0.78	0.76	0.72	0.69	0.76	0.72	0.76	0.77	0.76	0.74	0.78	0.74	0.78	0.70	0.72	0.78	0.78	0.76	0.77	0.78
4	0.77	0.76	0.71	0.81	0.76	0.81	0.77	0.76	0.82	0.74	0.79	0.78	0.76	0.75	0.69	0.74	0.78	0.75	0.81	0.79	0.77	0.74	0.78	0.73	0.74	0.79	0.79	0.79	0.76	0.76	0.78
5	0.77	0.74	0.77	**0.79**	0.78	0.76	0.79	0.76	0.81	0.76	0.77	0.74	0.77	0.75	0.74	0.76	0.76	0.79	0.82	0.81	0.79	0.81	**0.78**	0.78	0.56	0.79	0.81	0.77	0.80	0.75	0.74
6	0.75	0.79	0.74	0.80	0.74	0.76	0.78	0.77	0.80	0.81	0.77	0.76	0.76	0.71	0.72	0.76	**0.74**	**0.79**	**0.83**		**0.79**	**0.82**	**0.82**	**0.79**	**0.71**	**0.77**	0.89	**0.82**	0.77	0.80	0.78
7	0.78	0.81	0.77	0.81	0.76	**0.68**	0.77	0.77	0.84	0.77	0.83	0.80	0.75	0.72	**0.77**	**0.84**	**0.81**		**0.82**		**0.80**			**0.75**				**0.83**		**0.86**	**0.87**
8	0.73	0.88	**0.79**	0.81	0.78	0.78	0.74	0.74	0.85	0.84	0.79	0.85	0.78	0.74								**0.84**							**0.79**		
9	0.79	0.80	0.80	0.83	0.78	0.78	0.77	0.75	**0.85**	0.82	0.82	0.81	0.83	0.74																	**0.85**
10	0.79	**0.84**	0.85	0.85	0.81	0.82	0.78	0.75	0.78	0.81	0.87	0.91	0.81	0.83																	
11	0.85	0.83	0.83	**0.92**	**0.83**	0.86	0.81	0.77	0.86	**0.76**	0.87	0.85	0.83	**0.88**																	
12	**0.86**	**0.83**	0.85	**0.85**	**0.86**	0.80	0.81	0.81	0.82	**0.78**	0.90	0.80	0.89	**0.83**																	

3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
2	0.65	0.69	0.69	0.78	0.72	0.72	0.68	0.73	0.74	0.77	0.74	0.69	0.70	0.72	0.70	0.72	0.73	0.74	0.73	0.74	0.69	0.72	0.75	0.62	0.74	0.72	0.75	0.73	0.70	0.76	0.74
3	0.70	0.68	0.80	0.78	0.78	0.74	0.71	0.72	0.71	0.73	0.78	0.76	0.71	0.71	0.69	0.73	0.75	0.75	0.77	0.78	0.74	0.79	0.76	0.71	0.73	0.75	0.79	0.77	0.74	0.78	0.80
4	0.73	0.75	0.78	0.78	0.77	0.74	0.73	0.74	0.73	0.76	0.80	0.77	0.73	0.73	0.70	0.74	0.78	0.77	0.77	0.74	0.79	0.78	0.74	0.63	0.72	0.76	0.79	0.79	0.77	0.75	0.84
5	0.75	0.78	0.72	**0.80**	0.74	0.78	0.75	0.77	0.81	0.76	0.78	0.77	0.74	0.76	0.73	0.72	0.78	0.80	0.81	0.79	0.78	0.79	0.77	0.69	0.72	0.77	0.80	0.81	0.79	0.78	0.81
6	0.74	0.75	0.73	0.76	0.74	0.76	0.76	0.77	0.81	0.82	0.82	0.79	0.73	0.77	0.77	0.78	**0.77**	**0.79**	**0.83**		0.80	**0.82**	0.78	0.82	0.72		0.81	0.83	0.82	0.83	0.81
7	0.79	0.77	0.71	0.80	0.74	0.74	0.79	0.76	0.82	0.77	0.83	0.79	0.74	0.76	0.77	0.75	**0.77**		**0.80**		0.88	**0.78**	**0.74**		0.83		**0.84**		**0.80**	0.87	0.89
8	**0.69**	0.76	0.75	0.76	0.74	0.75		0.78	0.75	0.83	0.86	0.79	0.77	0.77	0.79	**0.82**	**0.82**			**0.71**	**0.87**			**0.75**			**0.73**		**0.85**	**0.82**	0.83
9	0.80	0.78	0.77	0.77	0.73	0.81	0.76	0.83	0.84	0.83	0.82	0.84	0.77	0.78	**0.84**			**0.80**			**0.87**	**0.90**		**0.75**						**0.85**	0.87
10	0.79	0.80	0.82	0.83	0.78	0.78	0.81	0.77	0.86	0.83	0.84	0.81	0.72	0.83								**0.82**					**0.87**			**0.89**	
11	**0.81**	0.79	**0.77**	0.90	0.78	0.82	0.82	0.77	0.85	**0.83**	0.86	0.82	0.80	**0.77**																	
12	**0.81**	**0.85**	0.83	0.83	**0.86**	**0.83**	0.81	0.85	**0.84**	0.83	0.91	0.89	0.81	**0.80**																	**0.89**

3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
2				**0.73**	0.70	0.68		0.65	0.75	0.72	0.74	0.72	0.66	0.70	0.72	0.67	0.74	1.36	0.75	0.74	0.74	0.72	0.72	0.72	0.72	0.64	0.78	0.71	0.72	0.71	0.75
3				0.76	0.81	0.73		0.72	0.73	0.73	0.75	0.76	0.70	0.71	0.74	0.69	0.76	0.76	0.75	0.80	0.75	0.82	0.73	0.77	0.74	0.73	0.80	0.76	0.75	0.72	0.82
4				0.80	**0.88**	0.71		0.76	0.75	0.75	0.75	0.76	0.71	0.74	0.75	0.72	0.74	0.78	0.77	0.79	0.79	0.79	0.80	0.76	0.74	0.75	0.75	0.81	0.78	0.74	0.79
5				0.79		0.73		0.74	0.78	0.72	0.74	0.77	0.76	0.77	0.78	0.74	0.76	0.78	0.80	0.78	**0.85**	0.75	0.80	0.79	0.74	0.76	0.74	0.82	0.81	0.78	0.80
6				0.73		0.74		0.74	0.79	0.73	0.77	0.77	0.76	0.80	0.83	0.79	0.82	0.83	0.80	**0.81**	**0.78**	0.84	0.74	0.80	0.82	**0.79**	**0.87**	**0.78**	0.80	0.81	0.81
7				0.75		0.77		0.79	0.81	0.71	0.78	0.78	0.75	0.77	0.84	0.77	**0.76**	**0.86**	0.86	0.81	**0.75**	**0.80**	**0.81**	**0.80**	**0.80**	**0.70**	**0.72**	**0.88**	**0.77**	0.85	0.84
8				0.84	**0.77**	0.78		0.74	0.79	0.81	0.78	0.81	0.80	0.80	0.79	**0.71**	**0.72**	**0.84**	**0.99**	0.90	**0.83**	**0.82**	**0.80**	**0.85**			**0.74**	**0.85**	**0.85**	0.84	0.83
9				0.83	0.75	0.77		0.80	0.83	0.77	0.86	0.78	0.83	0.81	0.83				**0.94**		**0.83**	**0.79**	**0.76**	**0.74**		**0.77**	**0.83**		**0.84**	**0.79**	0.82
10				**0.86**	0.82	0.79		0.82	0.84	**0.79**	0.77	0.83	0.82	0.84	0.84	**0.79**						**0.89**					**0.85**		**0.87**	**0.90**	
11				**0.87**	0.85	0.85		0.80	0.80	0.80	0.77	0.81	0.84	0.86	**0.91**						**0.94**	**0.91**		0.81		**0.90**					**0.87**
12				**0.83**	**0.84**	**0.74**		0.79	0.84	0.85	0.84	**0.80**	0.85	0.90	**0.84**							**0.82**		**0.96**	**0.81**				**0.91**	**0.85**	**0.83**

Table 21. Mean liver index at age of cod sampled during autumn bottom-trawl surveys in Divisions 2J, 3K and 3L in 1978-2008. Highlighted entries are based on fewer than 5 aged fish. (cells where fewer than 5 aged fish were available are not indicated for years prior to 1995.) There were no surveys in Div. 3L in 1978-1980 and 1984.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
2		0.04	0.04	0.04	0.02	0.03	0.03	0.02	0.04	0.03	0.04	0.01	0.03	0.03	0.02	0.03	0.03	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.03	0.03	0.05	0.03	0.03	0.04	0.04
3		0.05	0.05	0.05	0.05	0.05	0.05	0.03	0.05	0.05	0.04	0.04	0.05	0.03	0.03	0.04	0.04	0.05	0.04	0.04	0.04	0.05	0.04	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.05
4		0.06	0.03	0.06	0.05	0.08	0.05	0.05	0.07	0.05	0.05	0.05	0.06	0.05	0.03	0.04	0.04	0.04	0.04	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
5		0.06	0.05	**0.05**	0.05	0.07	0.07	0.05	0.07	0.06	0.06	0.04	0.07	0.05	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	**0.04**	0.04	0.05	0.05	0.06	0.05	0.06	0.04	0.04
6		0.07	0.05	0.05	0.04	0.07	0.07	0.06	0.08	0.08	0.06	0.05	0.06	0.04	0.05	0.05	**0.05**	**0.04**	**0.05**		**0.09**	**0.07**	**0.05**	**0.04**	**0.03**	**0.05**	0.07	0.06	0.05	0.05	0.04
7		0.09	0.06	0.07	0.06	**0.05**	0.07	0.07	0.10	0.07	0.08	0.07	0.06	0.03	**0.06**	**0.05**	**0.08**		**0.05**		**0.08**			**0.04**	0.04			**0.03**		**0.06**	**0.06**
8		0.10	**0.07**	0.07	0.06	0.08	0.06	0.06	0.12	0.09	0.08	0.08	0.07	0.04								**0.09**							**0.05**		
9		0.07	0.07	0.07	0.06	0.08	0.07	0.06	**0.08**	0.10	0.07	0.06	0.09	0.04																	**0.08**
10		**0.08**	0.09	0.08	0.06	0.07	0.08	0.07	0.08	0.07	0.09	0.06	0.08	0.05																	
11		0.09	0.10	**0.09**	**0.07**	0.11	0.07	0.08	0.10	**0.06**	0.10	0.07	**0.09**	**0.05**																	
12		**0.09**	0.09	**0.08**	**0.09**	0.06	0.08	0.09	0.09	**0.08**	0.10	0.05	0.10	**0.04**																	

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
2	0.02	0.02	0.02	0.04	0.02	0.02	0.01	0.02	0.03	0.03	0.02	0.01	0.03	0.03	0.03	0.04	0.03	0.04	0.04	0.04	0.05	0.05	0.04	0.03	0.05	0.05	0.05	0.04	0.04	0.04	0.03
3	0.02	0.02	0.04	0.04	0.03	0.04	0.03	0.05	0.04	0.04	0.04	0.02	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.04	0.06	0.05	0.04	0.05	0.04	0.06	0.05	0.05	0.05	0.04
4	0.03	0.05	0.04	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.04	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.06	0.06	0.05	0.04	0.05	0.04	0.06	0.05	0.05	0.05	0.05
5	0.04	0.06	0.04	**0.04**	0.05	0.05	0.04	0.06	0.08	0.05	0.06	0.06	0.06	0.07	0.06	0.05	0.06	0.06	0.06	0.05	0.06	0.06	0.05	0.04	0.05	0.05	0.06	0.06	0.06	0.05	0.05
6	0.04	0.06	0.05	0.04	0.05	0.04	0.04	0.06	0.08	0.07	0.07	0.07	0.05	0.06	0.07	0.06	**0.06**	**0.06**	**0.04**		0.07	**0.07**	0.04	**0.07**	**0.05**	0.05	**0.06**	0.06	0.07	0.07	0.05
7	0.05	0.07	0.05	0.06	0.05	**0.02**	0.06	0.05	0.09	0.05	0.07	0.07	0.06	0.06	0.08	0.08	0.06		**0.06**		0.08	**0.06**			**0.04**		**0.09**	0.07	**0.06**	0.07	0.07
8	**0.04**	0.06	0.06	0.05	0.05	0.05		0.06	0.06	0.08	0.08	0.08	0.07	0.06	0.08	**0.05**	0.07			**0.03**	**0.14**			**0.03**	0.05		**0.07**		**0.08**	**0.08**	0.07
9	0.06	0.07	0.05	0.06	0.05	0.06	0.04	0.07	0.08	0.07	0.06	0.09	0.09	0.07	**0.11**			**0.04**			**0.07**	**0.11**		**0.04**						**0.07**	0.06
10	0.06	0.07	0.05	0.07	0.06	0.06	0.06	0.06	0.09	0.08	0.08	0.08	0.11	0.07								**0.10**					**0.10**			**0.06**	
11	**0.06**	0.08	**0.05**	0.08	0.06	0.07	0.06	0.07	0.09	**0.09**	0.09	0.08	0.11	**0.08**																	
12	**0.08**	**0.10**	0.07	0.08	**0.07**	**0.07**	0.06	0.06	**0.08**	0.08	0.09	0.08	**0.11**	**0.11**																	**0.07**

Division 3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
2				**0.02**	0.01	0.02		0.01	0.03	0.03	0.02	0.02	0.03	0.04	0.04	0.03	0.03	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.05	0.03	0.04	0.05	0.04
3				0.03	0.03	0.02		0.03	0.02	0.03	0.03	0.03	0.04	0.05	0.06	0.05	0.05	0.04	0.04	0.05	0.04	0.06	0.04	0.05	0.05	0.04	0.06	0.05	0.04	0.04	0.05
4				0.04	**0.04**	0.02		0.03	0.03	0.03	0.03	0.04	0.04	0.06	0.07	0.06	0.05	0.06	0.05	0.06	0.06	0.05	0.05	0.06	0.05	0.04	0.04	0.07	0.05	0.05	0.05
5				0.05		0.03		0.04	0.04	0.03	0.04	0.04	0.05	0.06	0.07	0.07	0.06	0.06	0.06	0.06	**0.07**	0.05	0.06	0.06	0.06	0.06	0.05	0.07	0.06	0.06	0.05
6				0.04		0.03		0.04	0.04	0.03	0.05	0.05	0.05	0.07	0.09	0.08	0.08	0.07	0.06	**0.06**	**0.07**	0.06	0.06	0.06	0.07	**0.05**	**0.08**	**0.06**	0.07	0.07	0.05
7				0.04		0.03		0.05	0.05	0.04	0.04	0.05	0.05	0.07	0.08	0.07	**0.04**	**0.09**	0.09	0.06	**0.04**	**0.09**	**0.08**	**0.07**	**0.07**	**0.03**	**0.05**	**0.09**	**0.05**	0.07	0.06
8				0.06	0.04	0.04		0.05	0.05	0.04	0.05	0.06	0.06	0.07	0.10	**0.05**	**0.03**	**0.08**	**0.10**	0.08	0.08	**0.07**	**0.08**	**0.07**			**0.06**	**0.07**	**0.07**	0.07	0.07
9				0.06	0.05	0.05		0.06	0.05	0.05	0.07	0.06	0.07	0.08	0.07				**0.14**	**0.09**	**0.09**	**0.07**	**0.07**	**0.05**		**0.04**	**0.09**		**0.07**	**0.06**	0.07
10				0.07	0.05	0.05		0.07	0.06	**0.05**	0.08	0.07	0.07	0.09	0.09	**0.10**						**0.04**					**0.07**		**0.07**	**0.09**	
11				**0.07**	0.08	0.06		0.07	0.06	0.06	0.06	0.07	0.09	0.09	**0.11**						**0.08**	**0.08**		0.07		**0.10**					
12				**0.06**	**0.08**	**0.05**		0.06	0.08	0.07	0.07	**0.06**	0.09	0.10	**0.07**							**0.07**		**0.15**	**0.09**				**0.08**	**0.08**	

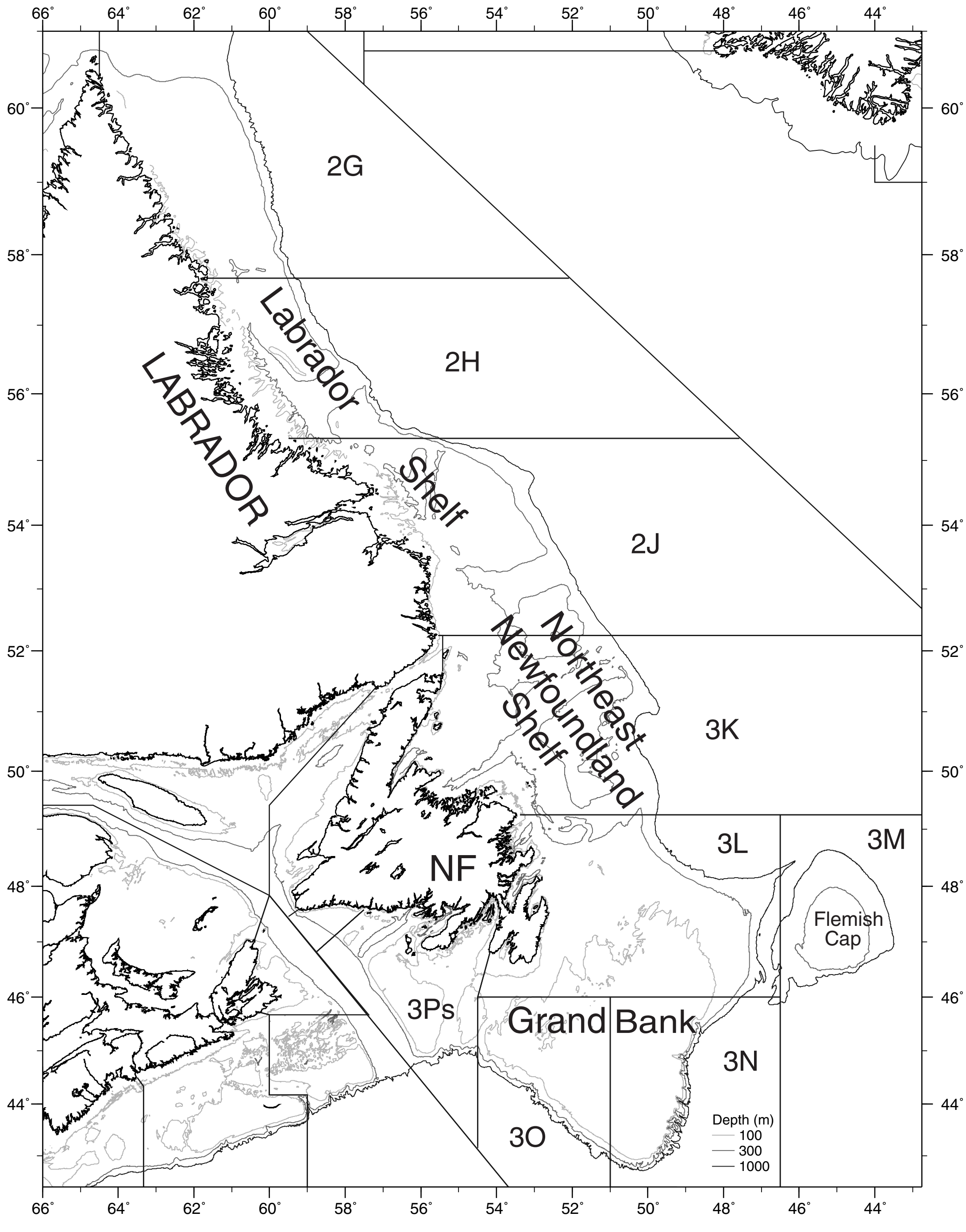


Figure 1a. Major geographic features and NAFO Division and Subdivision boundaries around Newfoundland and Labrador.

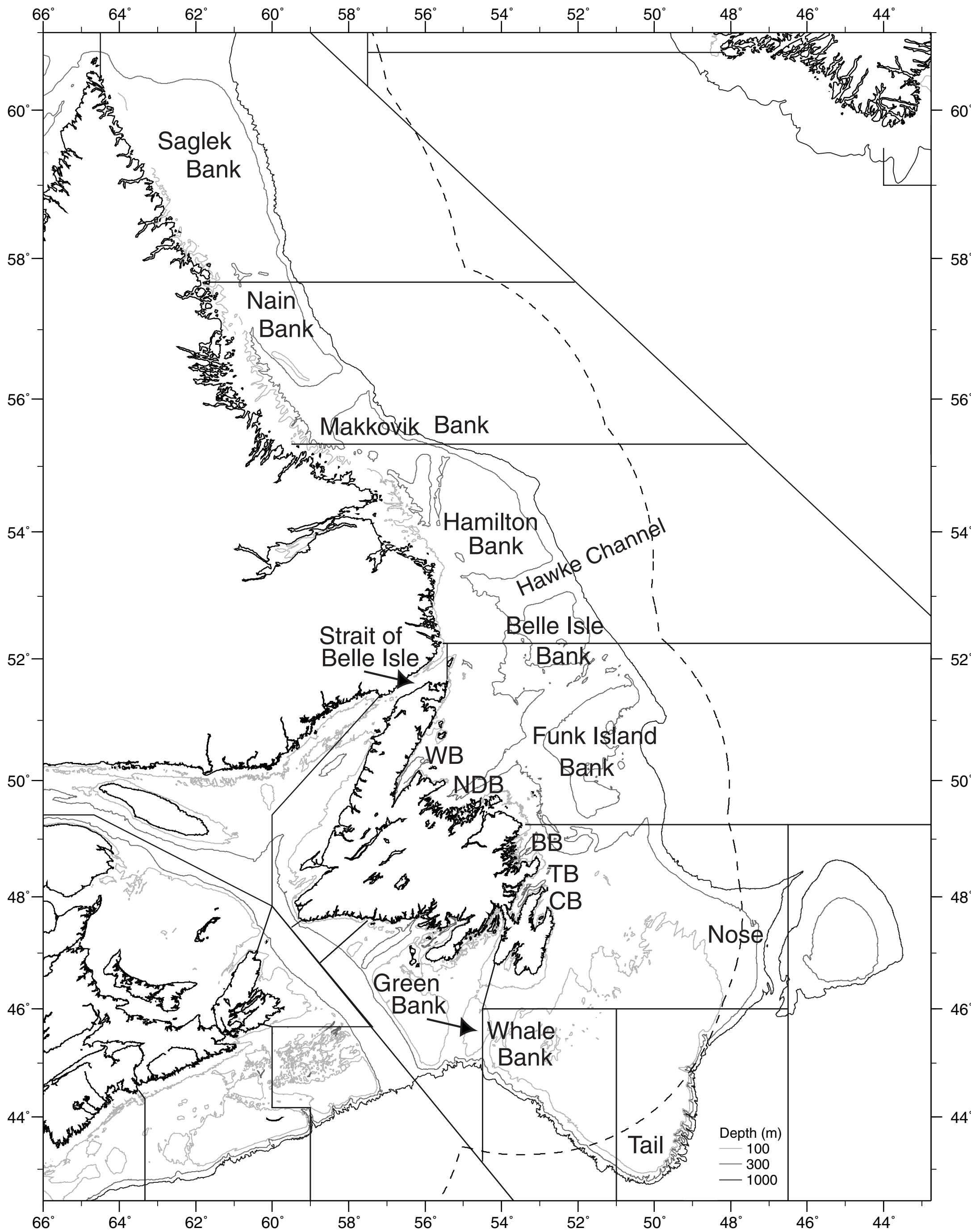


Figure 1b. Bathymetry, fishing banks, and major bays around eastern Newfoundland and Labrador. The dashed line is Canada's 200 nautical mile limit. WB=White Bay, NDB=Notre Dame Bay, BB=Bonavista Bay, TB=Trinity Bay, and CB=Conception Bay.

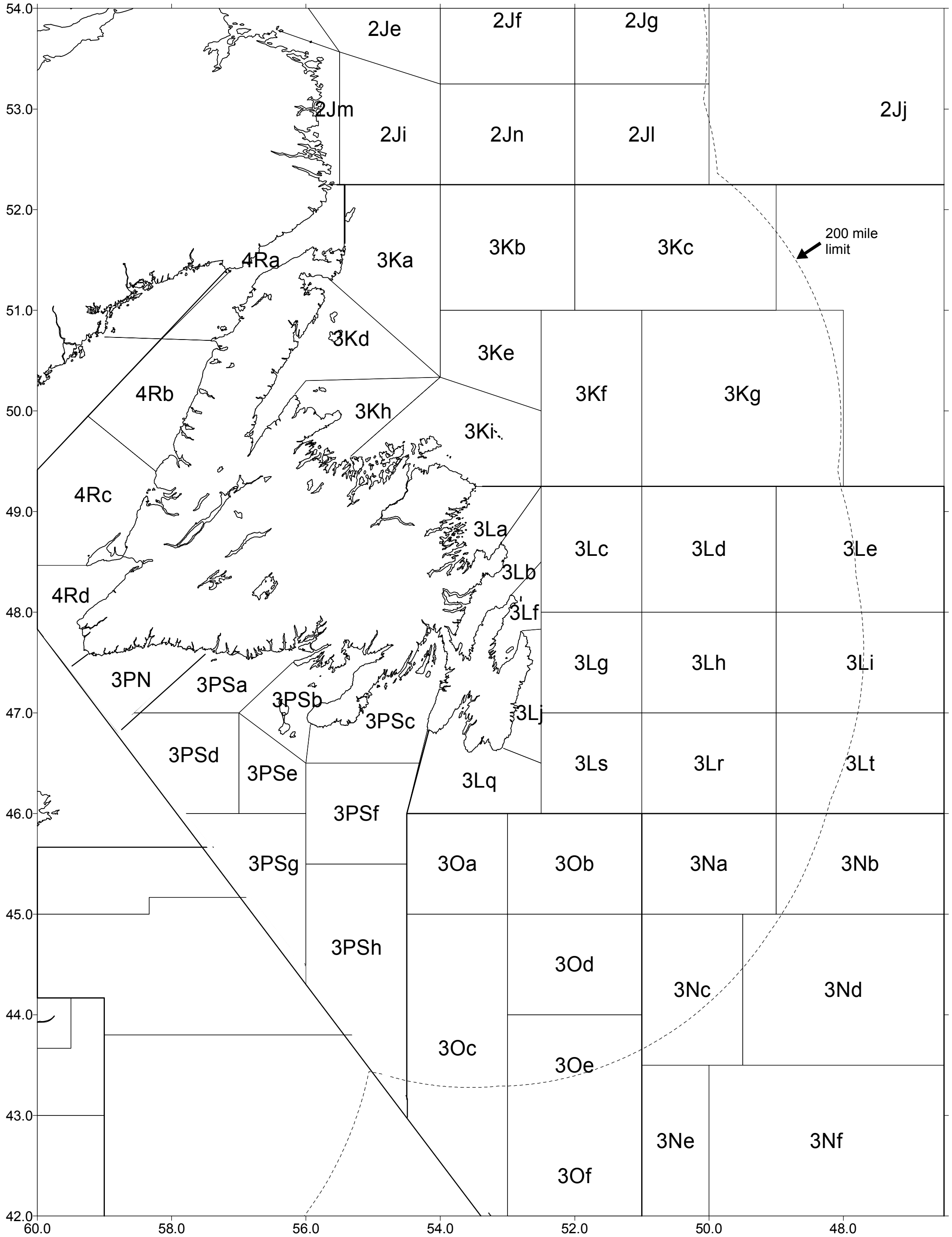


Figure 1c. Boundaries of commercial fishery statistical unit areas and Canada's 200 nautical mile limit (dotted line).

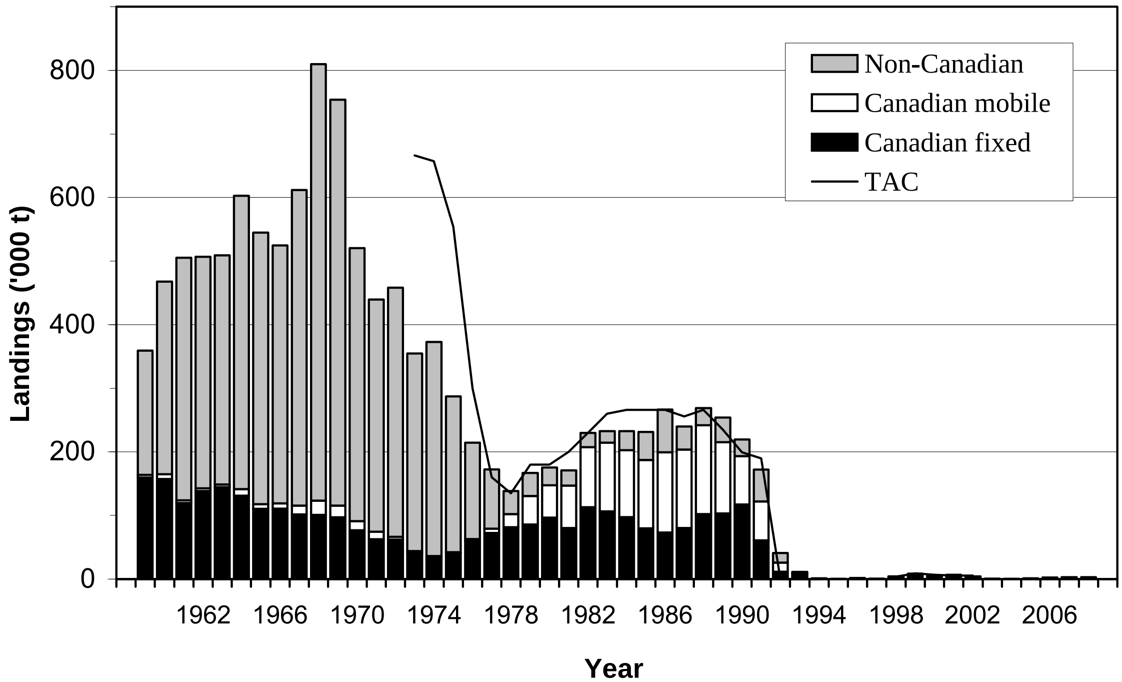


Figure 2. Total allowable catches (TACs) and reported landings (thousands of tons) of cod from 2J3KL by non-Canadian fleets and Canadian mobile gear (offshore) and Canadian fixed gear (mainly inshore).

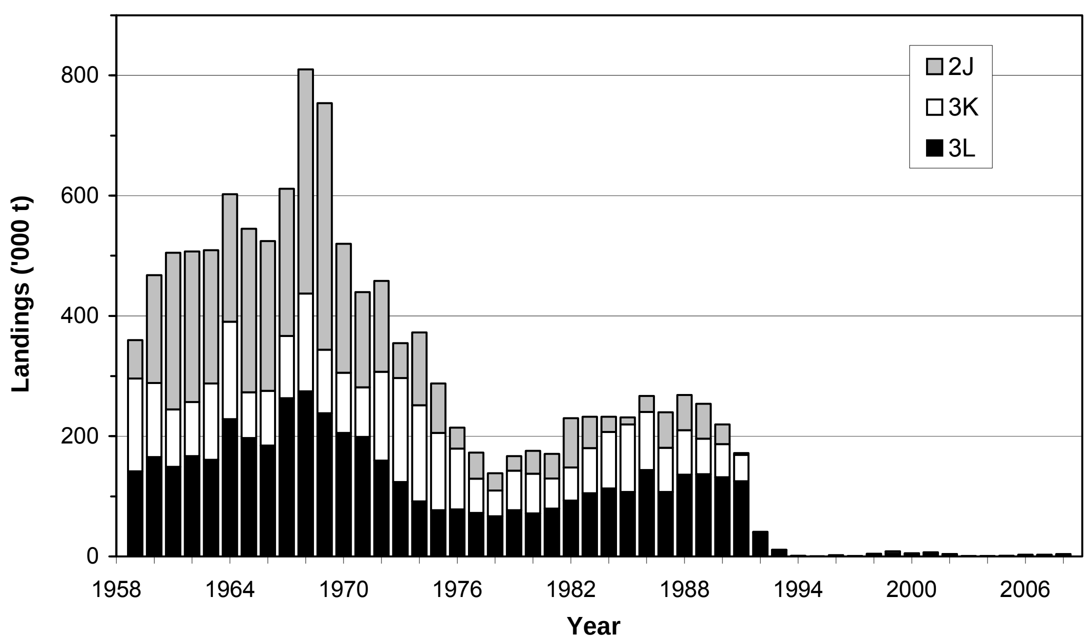


Figure 3. Reported landings of cod (thousands of tons) from 2J3KL by NAFO Division.

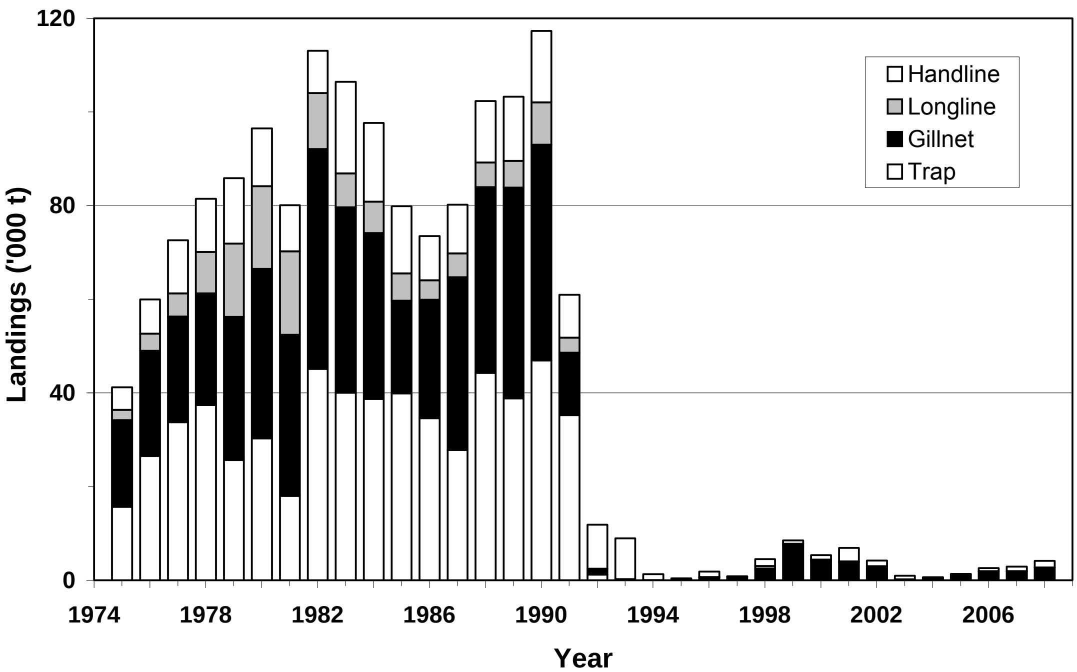


Figure 4. Reported fixed gear landings (thousands of tons) of cod from 2J3KL by gear type.

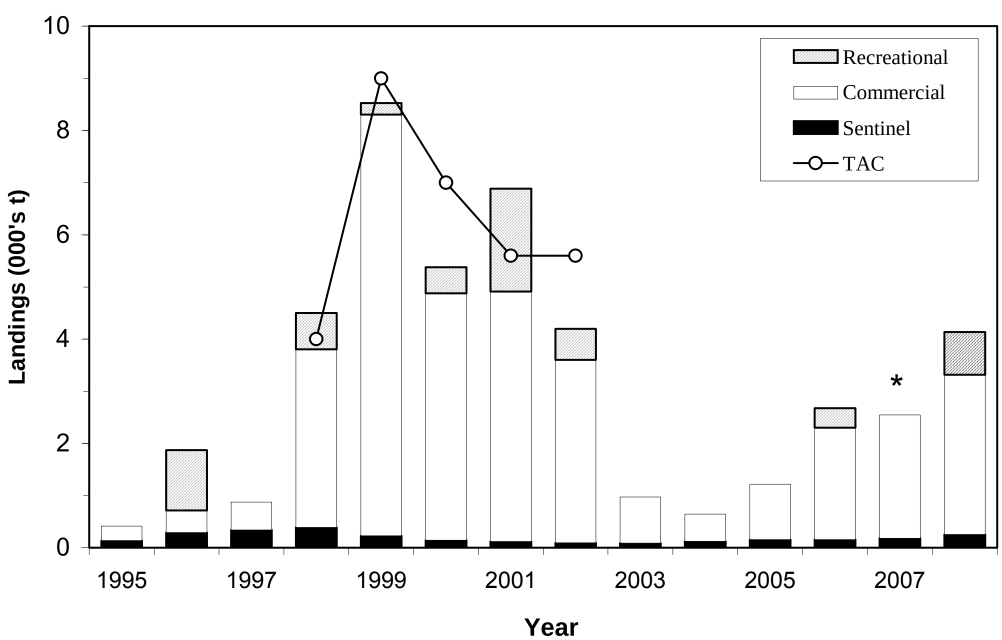


Figure 5. Total allowable catches (TACs) and reported inshore fixed-gear landings (thousands of tons) of cod from 2J3KL for the inshore fishery (1995-2008). Most of the landings in 2003 came from a mass mortality of cod in Smith Sound, Trinity Bay in April. The asterisk indicates that the 2007 value excludes the recreational catch which has not been determined.

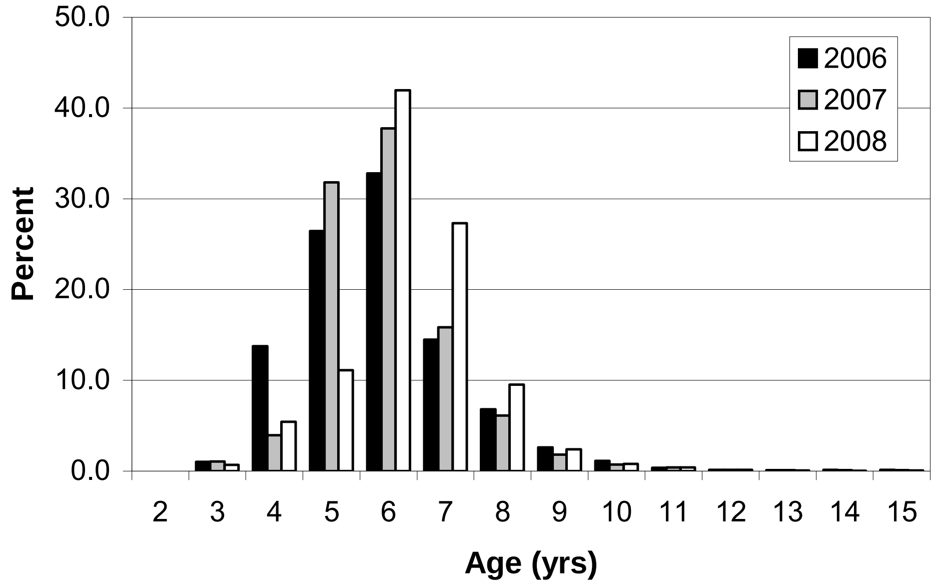


Figure 6. Catch at age (in percents) for cod in 2J3KL during 2006-08.

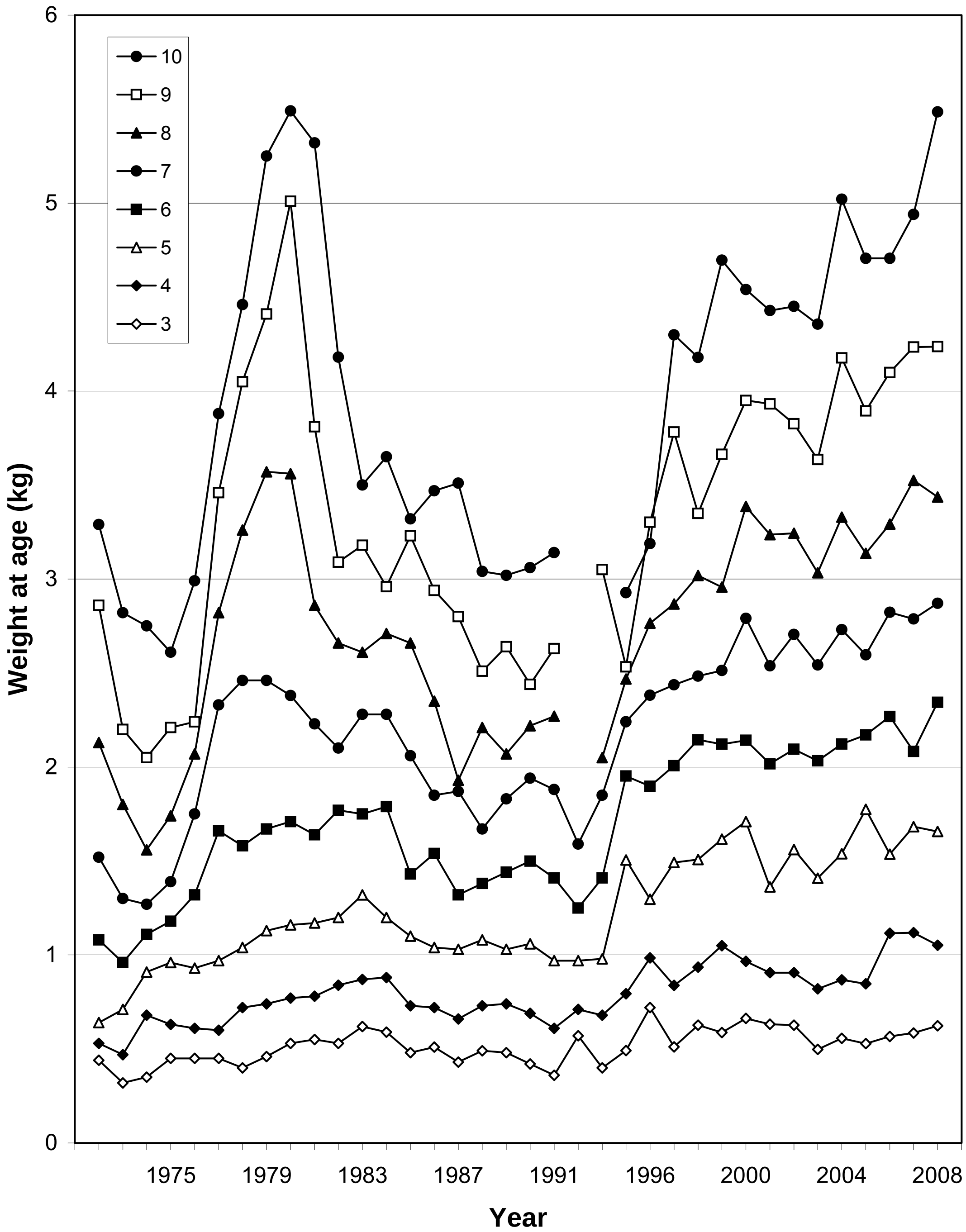


Figure 7. Mean weights-at-age of cod from 2J3KL calculated from mean lengths-at-age in the catch from 1972 onwards. Values for 8 and 9 yrs in 1993 were anomalous and are omitted. Landings prior to the 1993 moratorium otter trawling offshore early in the year; since the moratorium most of the catch has come from fixed gear inshore in the second half of the year.

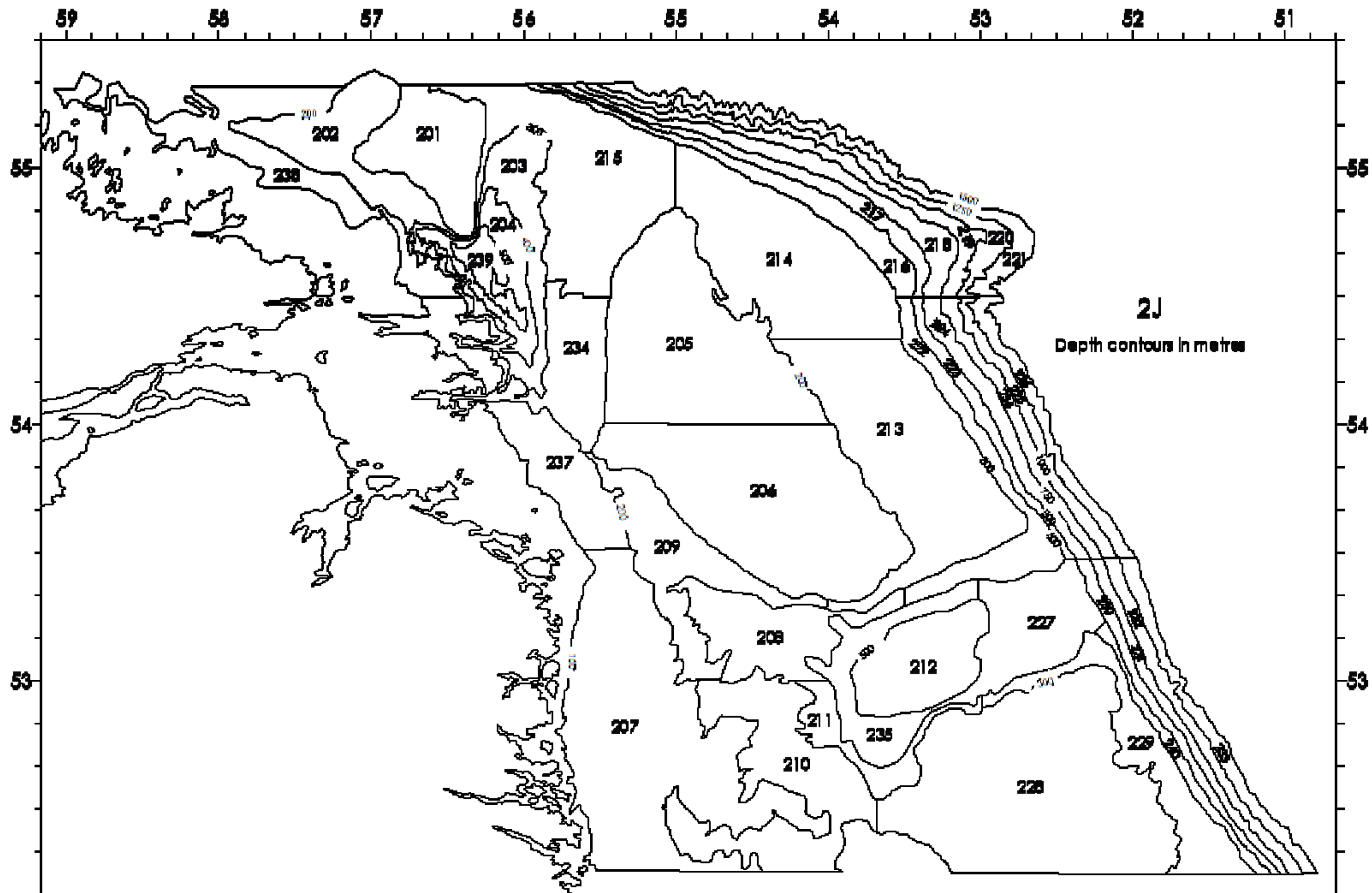


Figure 8. Boundaries and of strata used in research bottom-trawl surveys in NAFO Division 2J.

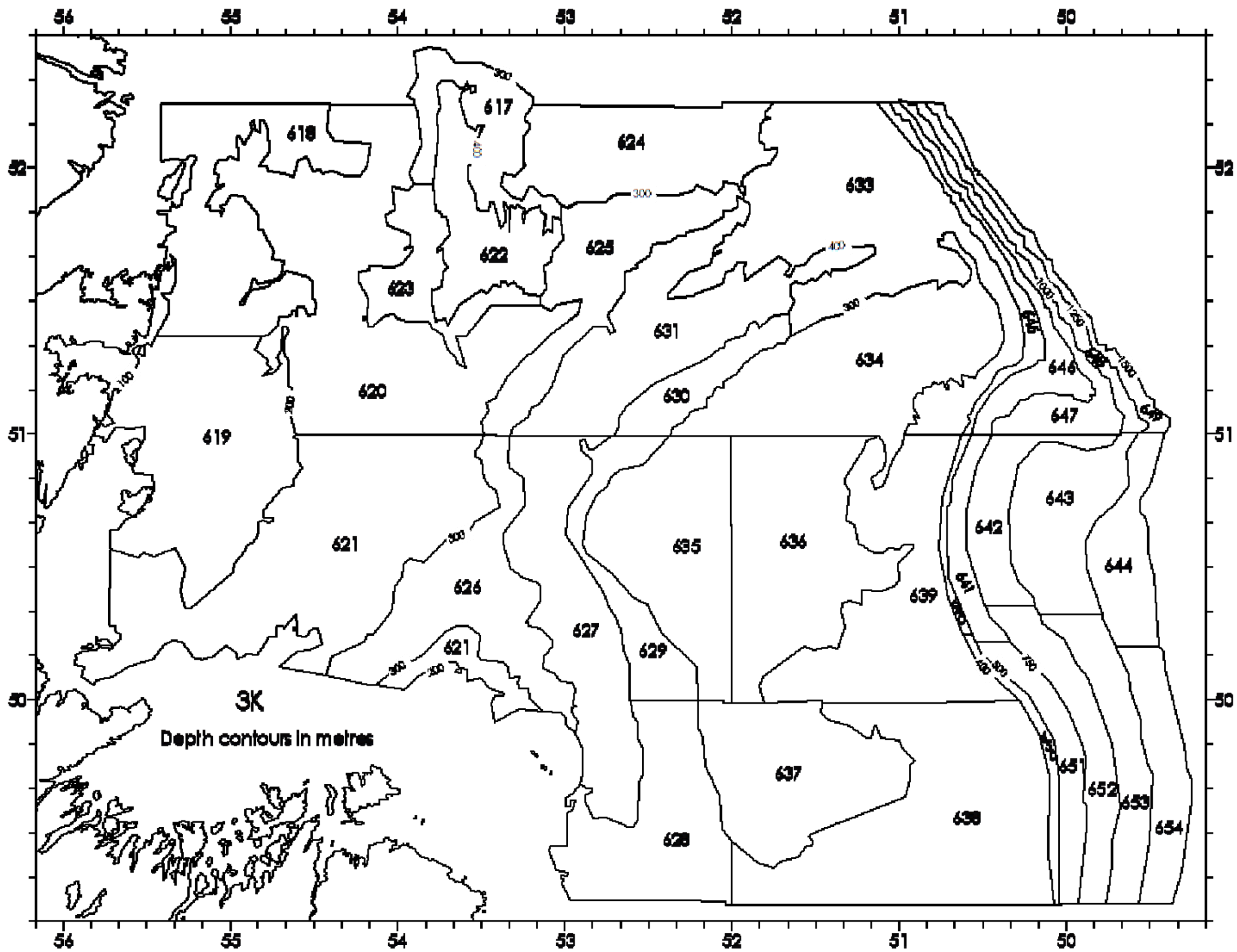


Figure 9. Boundaries of strata used in research bottom-trawl surveys in NAFO Division 3K.

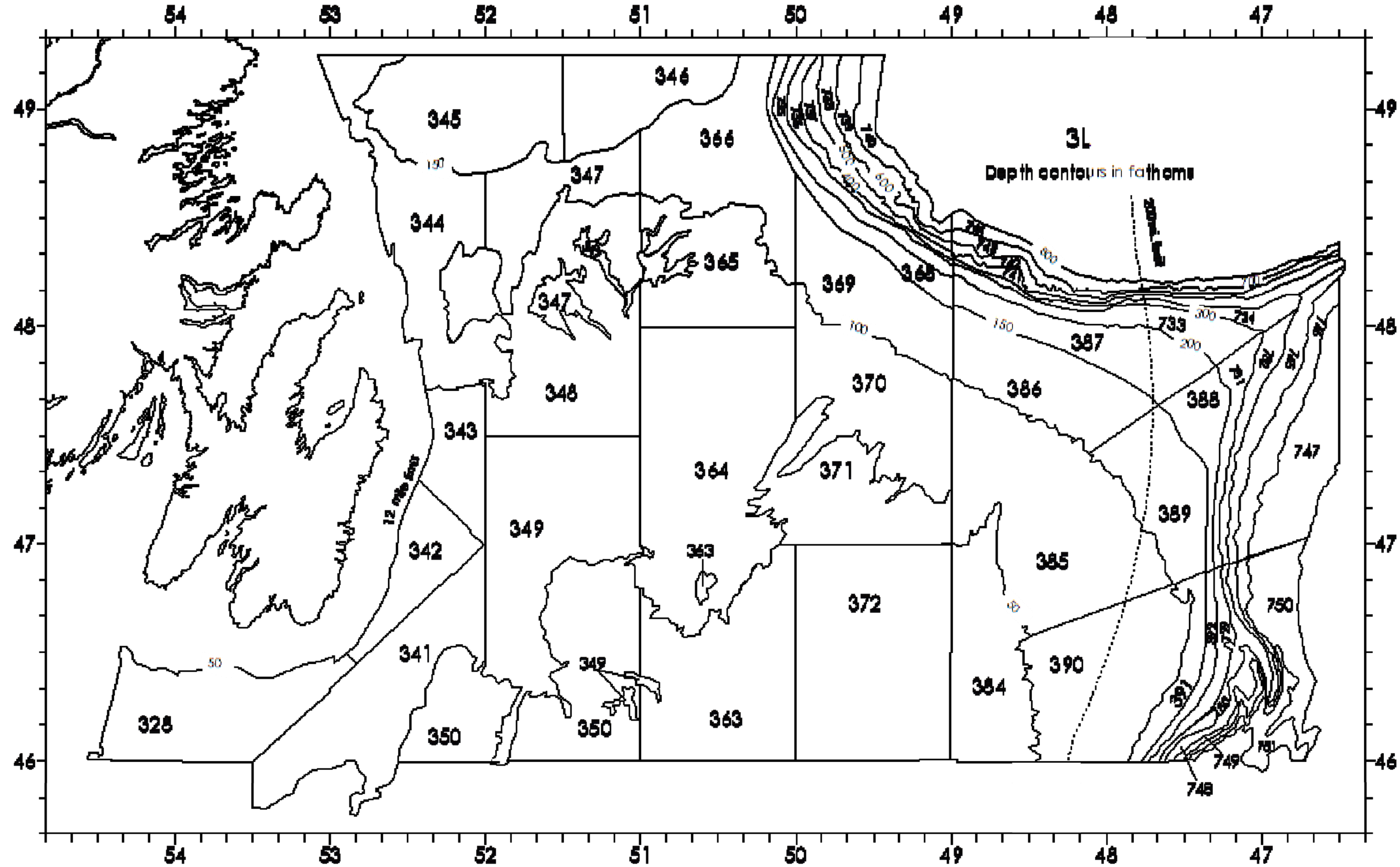


Figure 10. Boundaries of strata used in research bottom-trawl surveys in NAFO Division 3L.

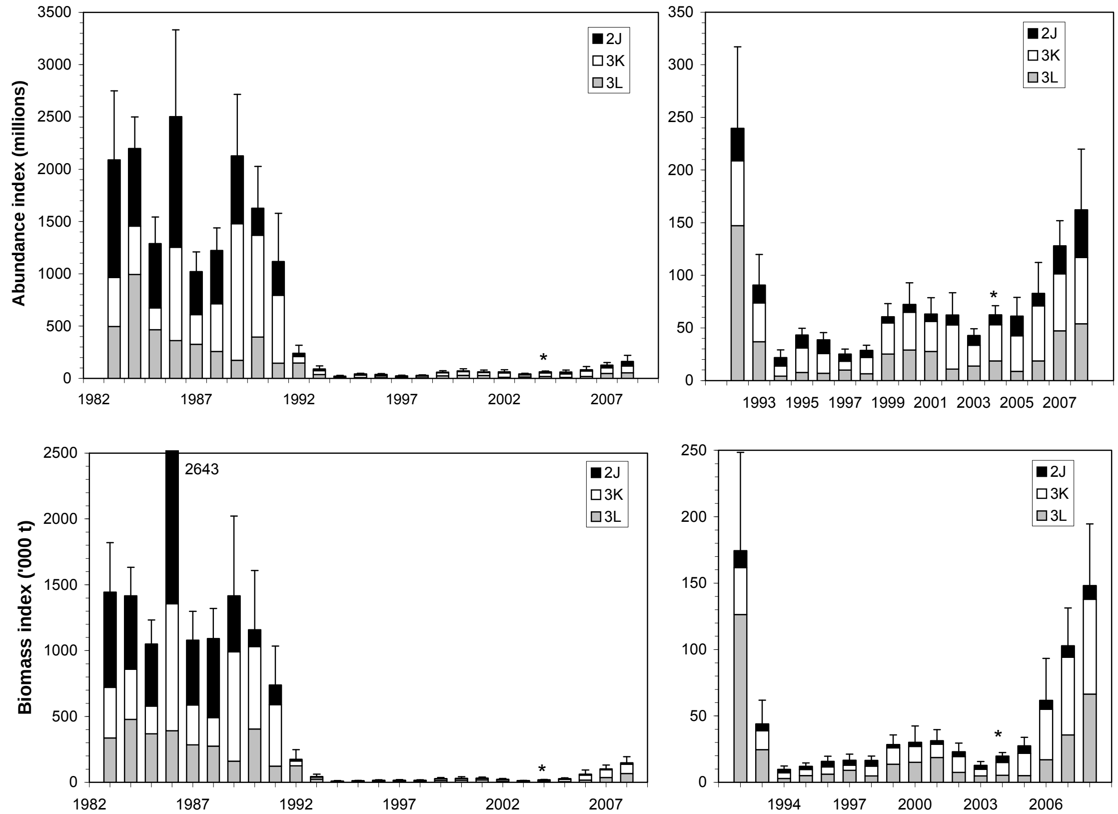


Figure 11. Trends in offshore indices of abundance (upper panels) and biomass (lower panels) of cod in NAFO Divs 2J3KL from autumn bottom trawl surveys. The right panels are expanded to show trends from 1992 onwards. Asterisks indicate partial estimates from incomplete survey coverage in 3L in 2004.

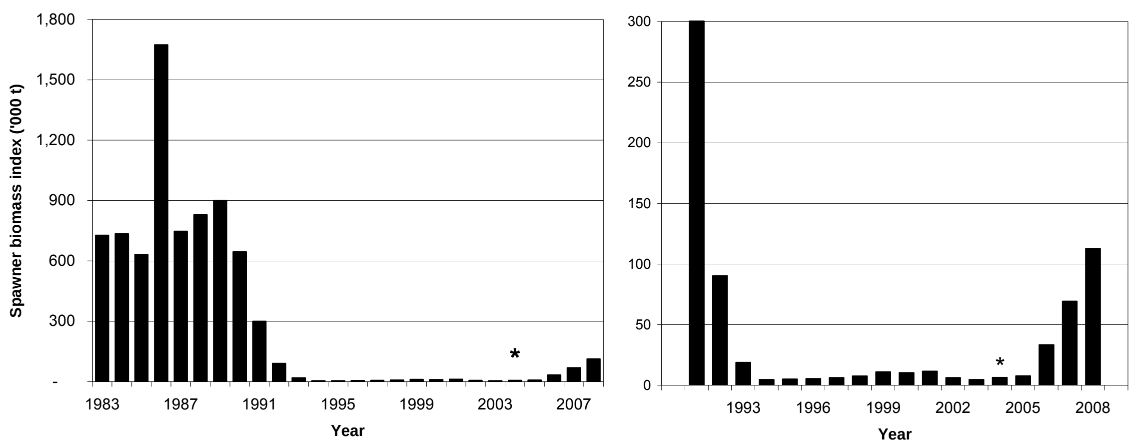


Figure 12. Trends in offshore spawner biomass index for cod in NAFO Divs 2J3KL from autumn bottom trawl surveys. The right panels are expanded to show trends from 1991 onwards. Asterisks indicate partial estimates from incomplete survey coverage in 3L in 2004.

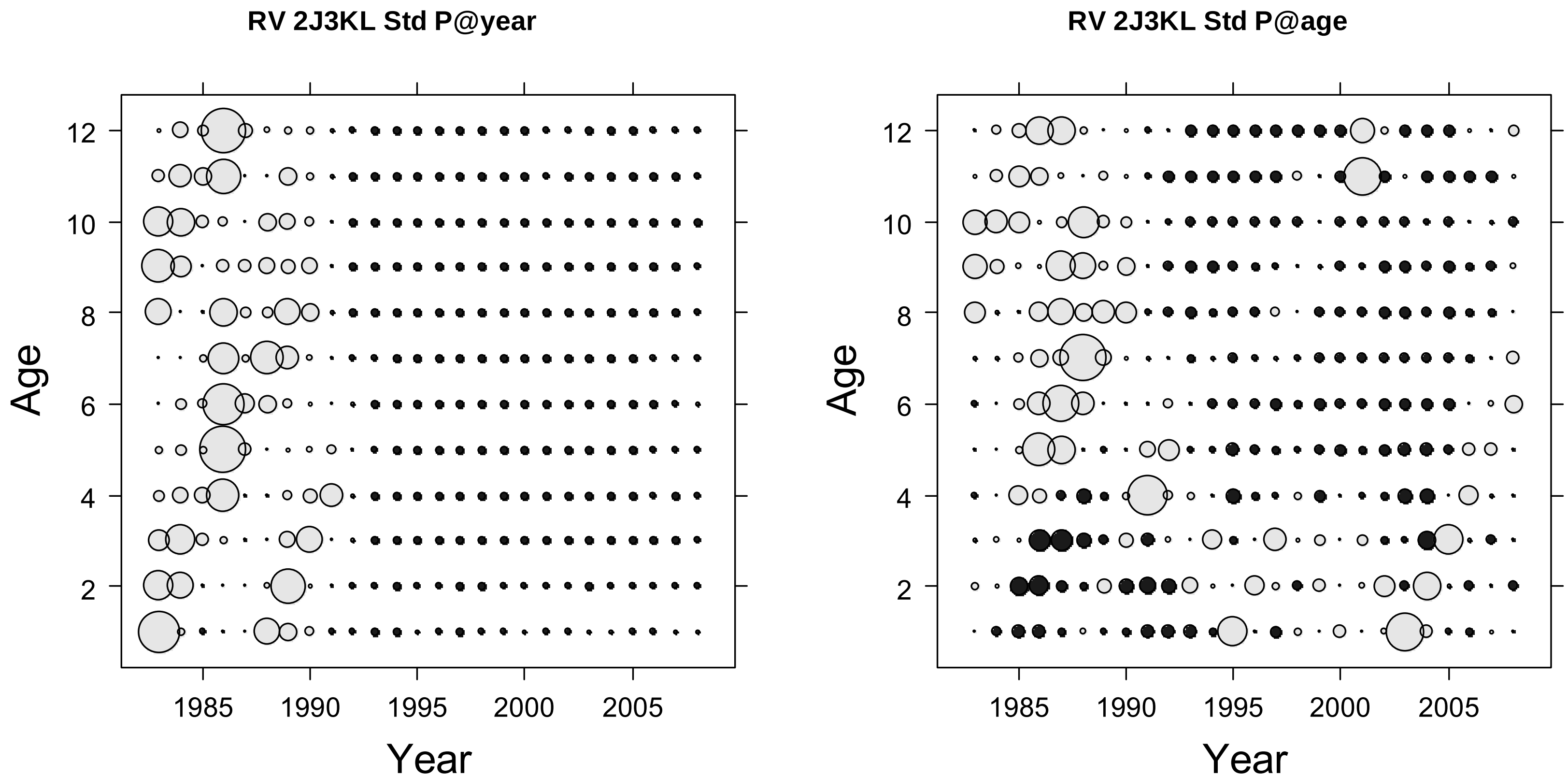


Figure 13. Standardized age-disaggregated catch rates from the autumn bottom trawl survey of 2J3KL. Catch rates (mean nos per tow) were converted to proportions within an age (left panel) or within a year (right panel). Values were standardized by subtracting the mean proportion and dividing by the standard deviation of the proportions computed across years. Symbol sizes are scaled and values greater than average are shown as grey circles, average values are shown as small dots, and less than average values are shown as black circles.

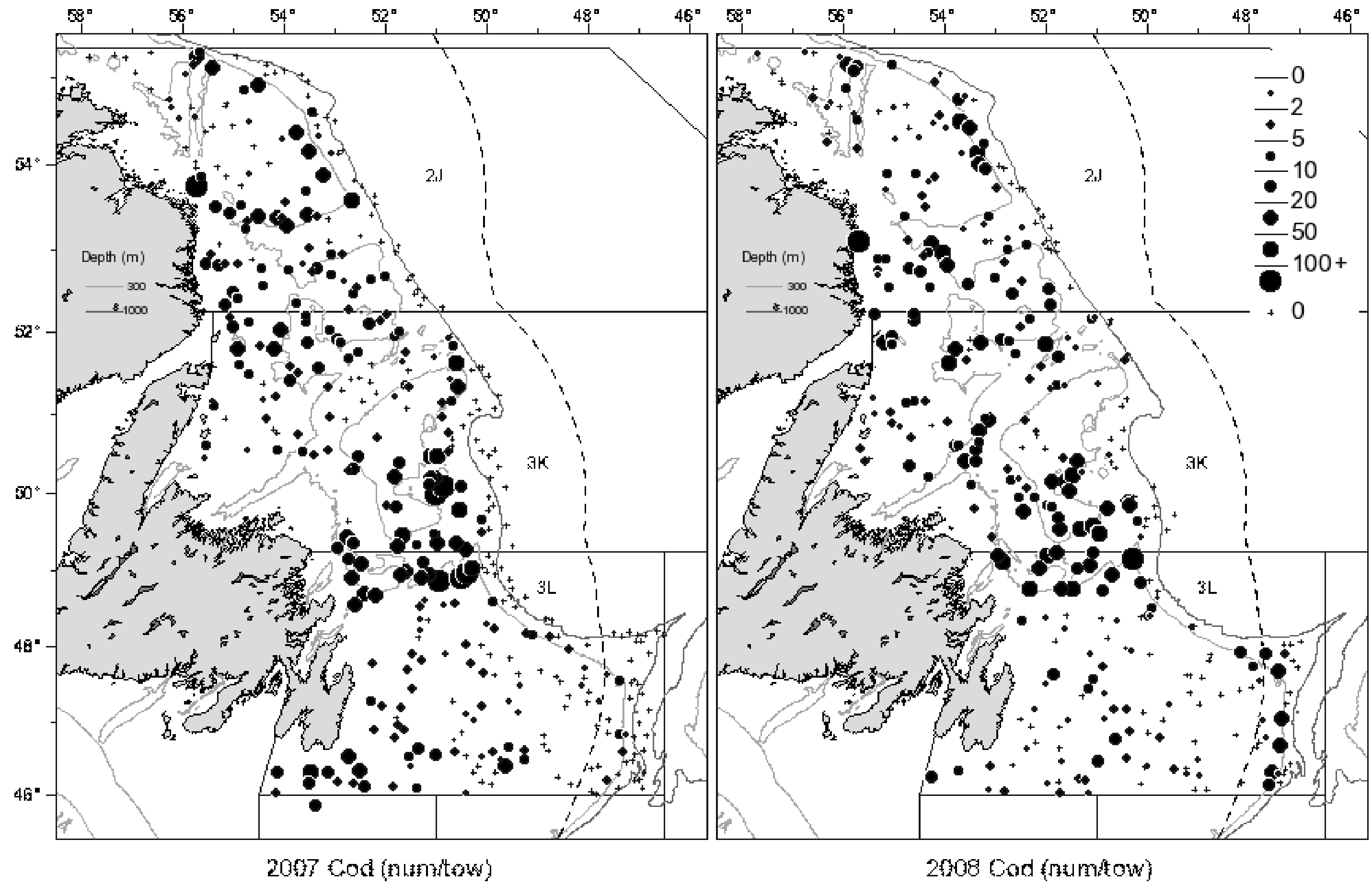


Figure 14. Cod distribution (number per standard tow) during the autumn research survey in NAFO Divisions 2J+3KL in 2007 and 2008.

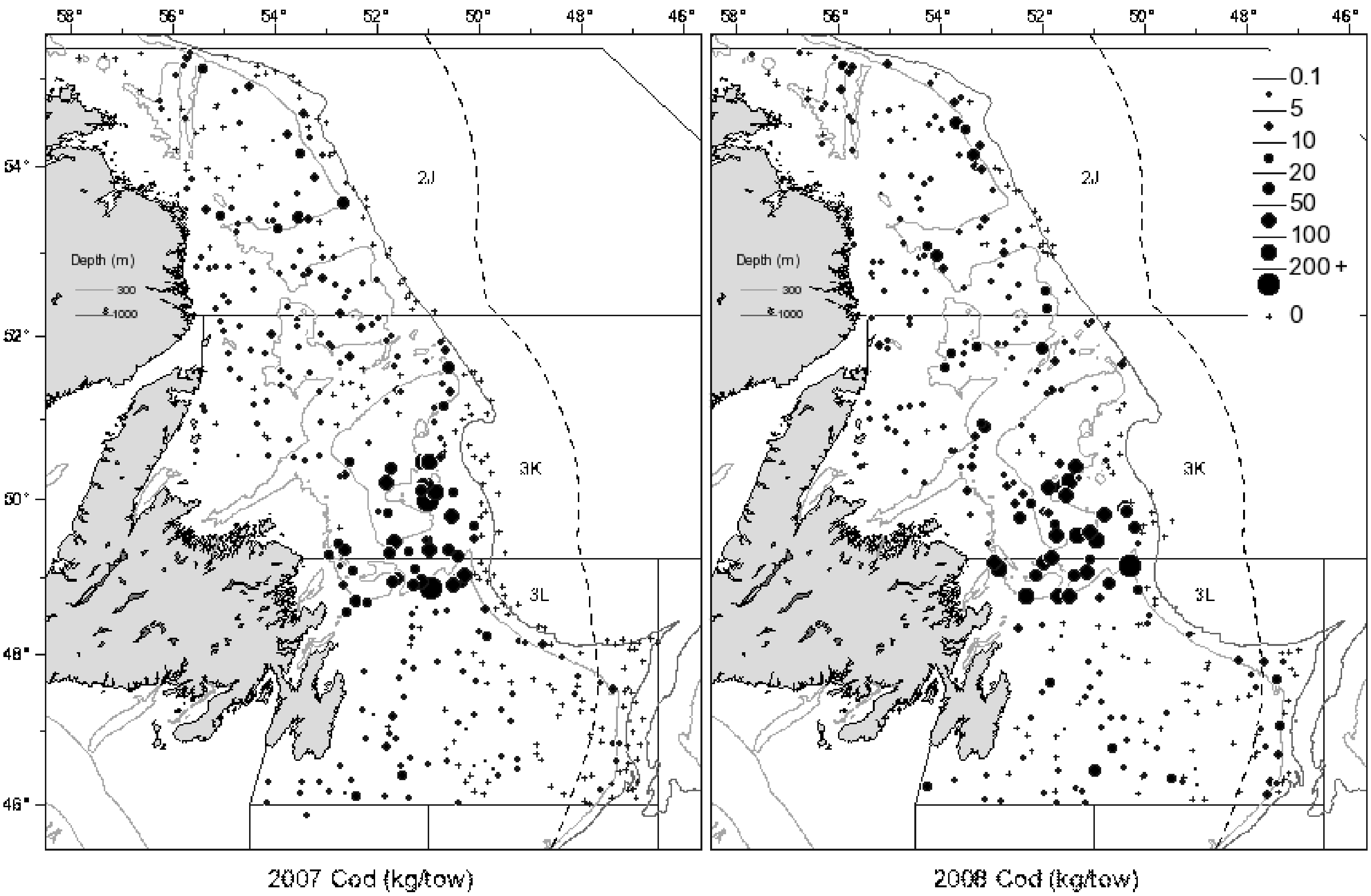


Figure 15. Cod distribution (total weight [kg] per standard tow) during the autumn research survey in NAFO Divisions 2J+3KL in 2007 and 2008.

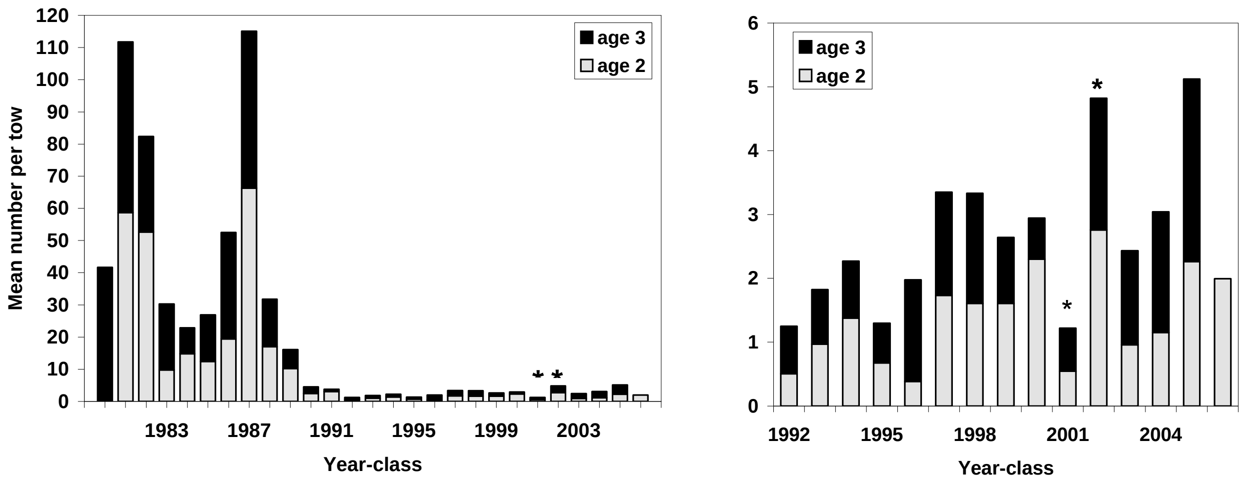


Figure 16. Abundance of the 1980-2006 year-classes at age 2 and age 3 in the offshore of 2J3KL from the autumn RV surveys. The right panel is expanded to show trends for the 1992 year-class onwards. Asterisks indicate partial estimates from incomplete survey coverage of 3L in 2004.

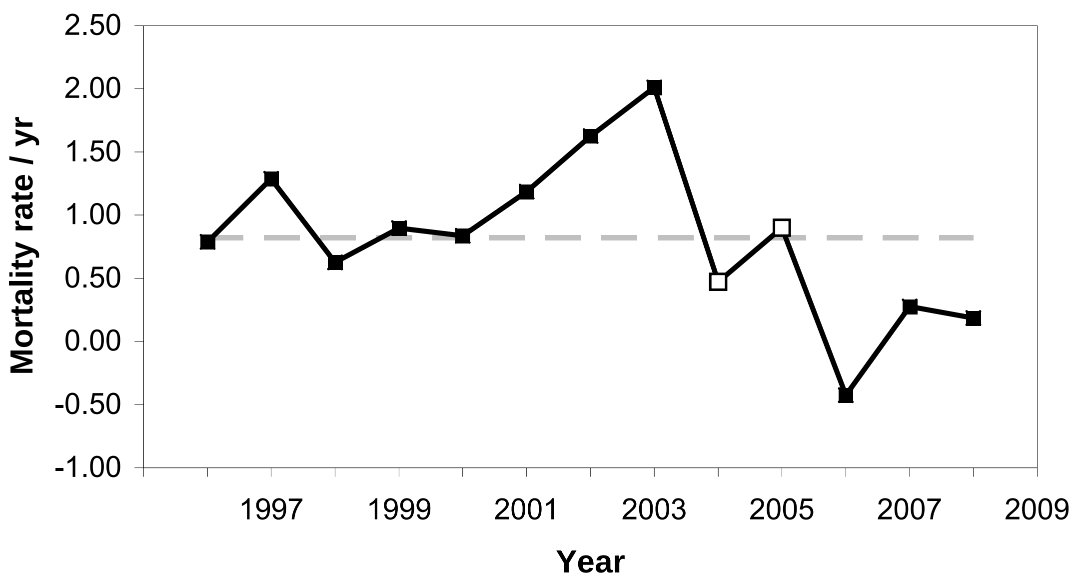


Figure 17. Total mortality rate (Z) of cod aged 4-6 calculated using data from the autumn RV surveys in the offshore of 2J3KL. For example, the value in 1996 is the mortality experienced by the 1991-1989 year-classes from ages 4-6 in 1995 to ages 5-7 in 1996. The dashed line is the time-series average (Z=0.82, which corresponds to 56% mortality each year). Open symbols indicate estimates based on an incomplete survey in 2004.

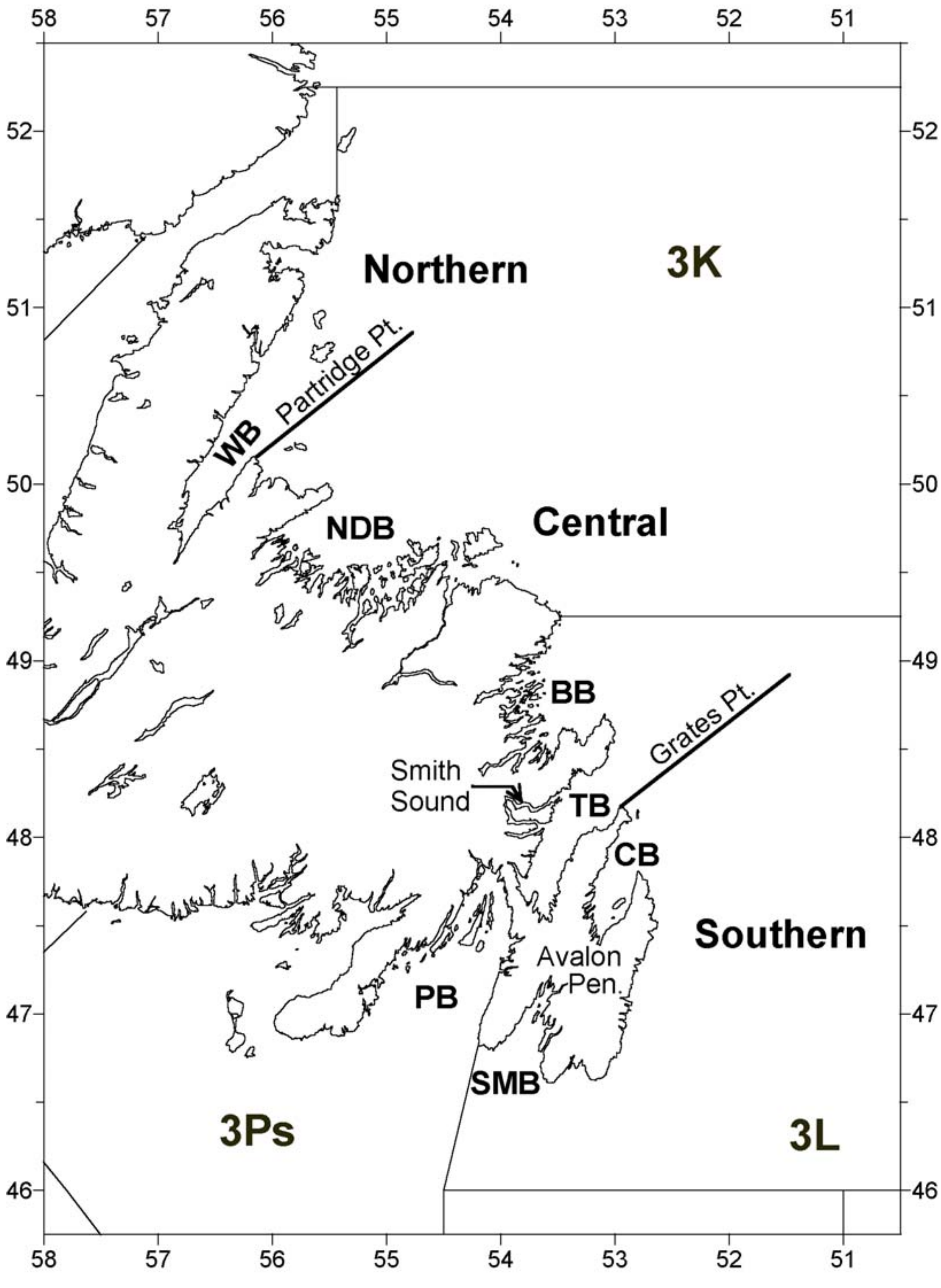


Figure 18. Eastern Newfoundland showing the boundaries of the inshore northern, inshore central and inshore southern areas as defined for the present assessment. WB=White Bay, NDB=Notre Dame Bay, BB=Bonavista Bay, TB=Trinity Bay, CB=Conception Bay and SMB=St. Mary’s Bay; PB=Placentia Bay which is in Subdiv. 3Ps

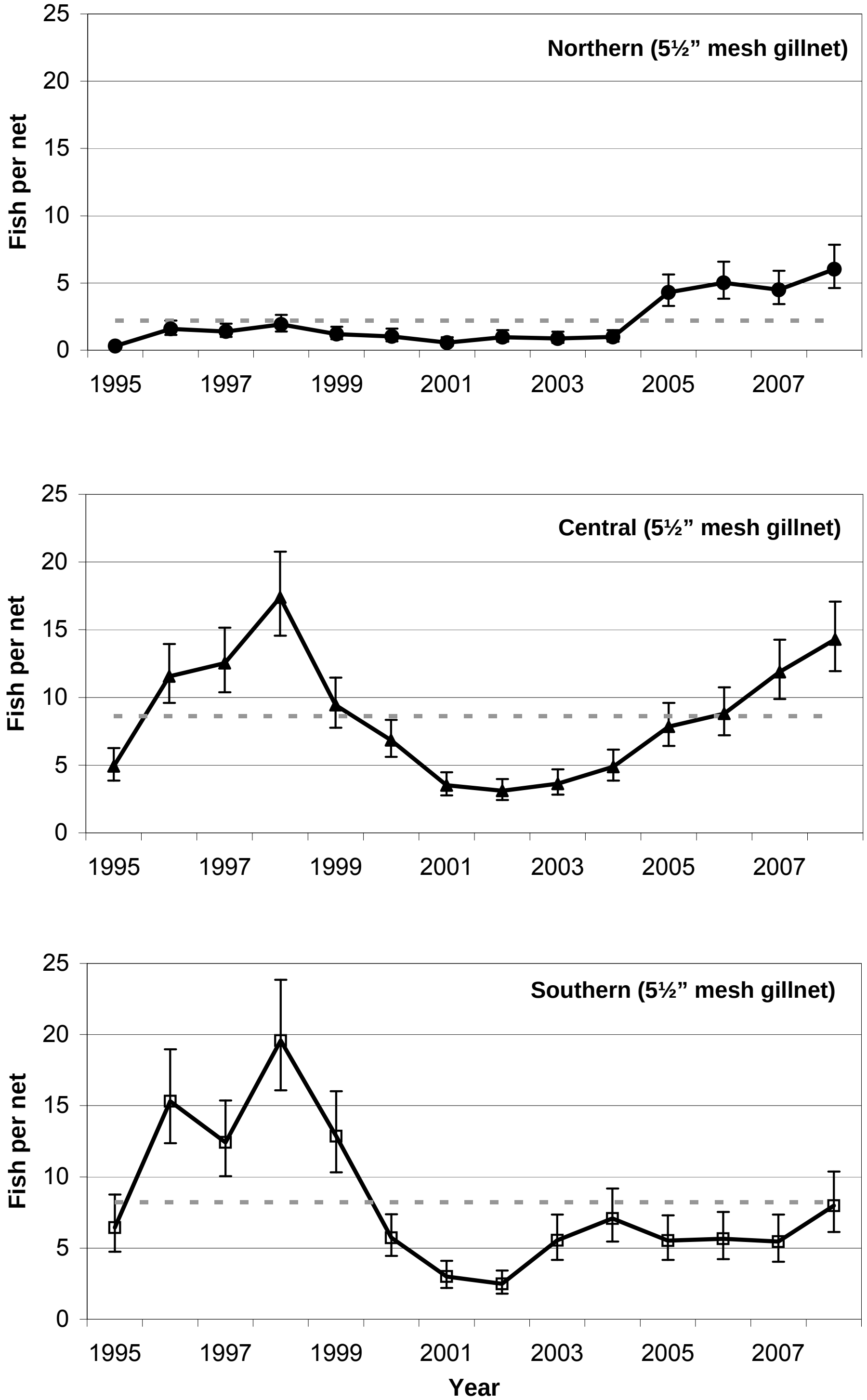


Figure 19. Comparison of trends in standardized catch rates of cod (± 95% CL’s) from sentinel surveys of three inshore regions of 2J3KL using 5½” mesh gillnets. Dashed grey lines indicate series means.

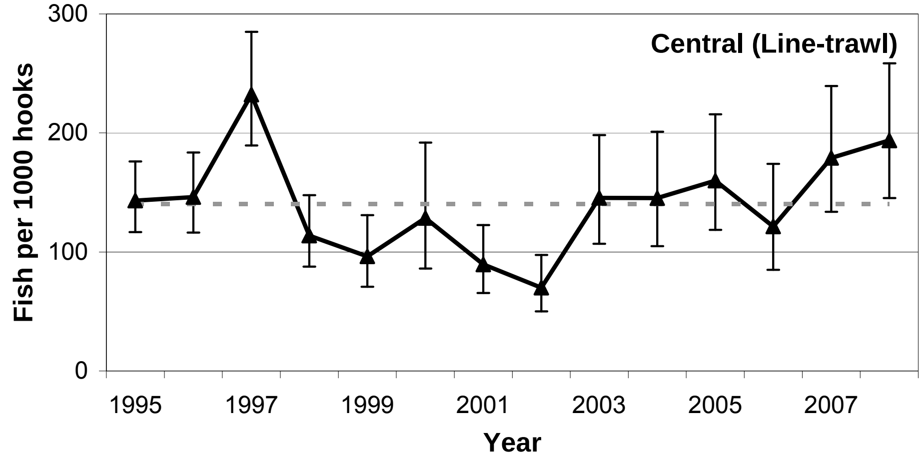


Figure 20. Trends in standardized catch rates of cod (± 95% CL's) from sentinel surveys of the inshore central region of 3KL using linetrawls. Dashed grey lines indicate series means.

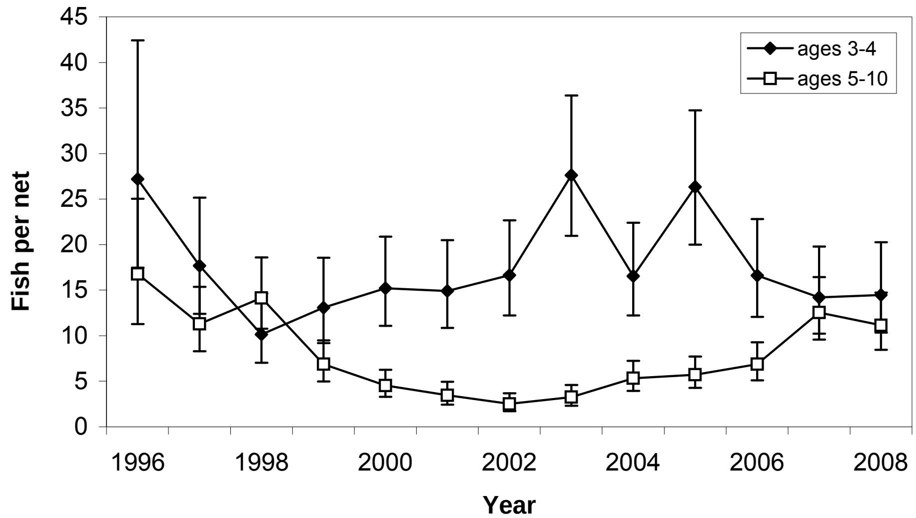


Figure 21. Trends in standardized catch rates (with 95% confidence intervals) for two age groups of cod from sentinel surveys in the inshore central area of 3KL using small mesh (3¼) gillnets.

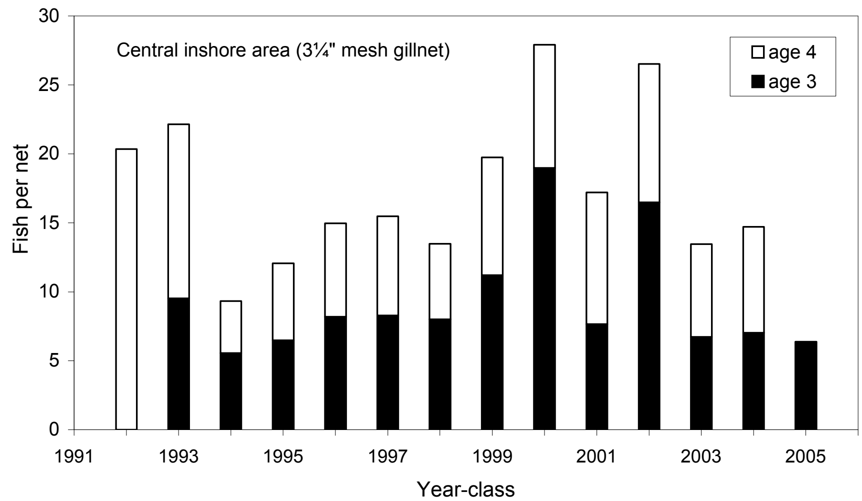


Figure 22. Standardized catch rates for the 1992-2005 year classes of cod at ages 3-4 using small mesh (3¼”) gillnets during sentinel surveys in the inshore central area.

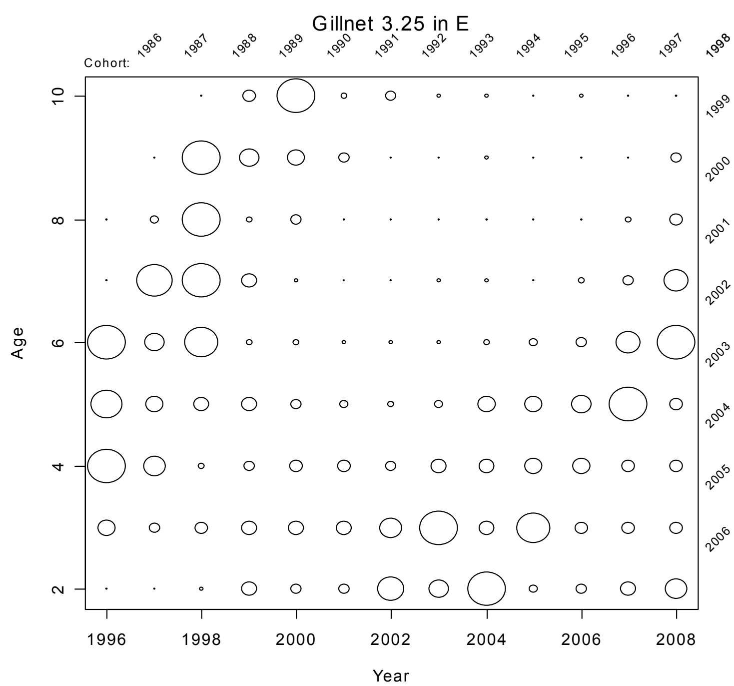


Figure 23. Standardized age-disaggregated catch rate indices for small mesh gillnets (3¼” mesh) estimated using data from sentinel survey sites in 2J3KL. Catch rates are proportional to symbol area; values within each age were divided by the maximum within an age.

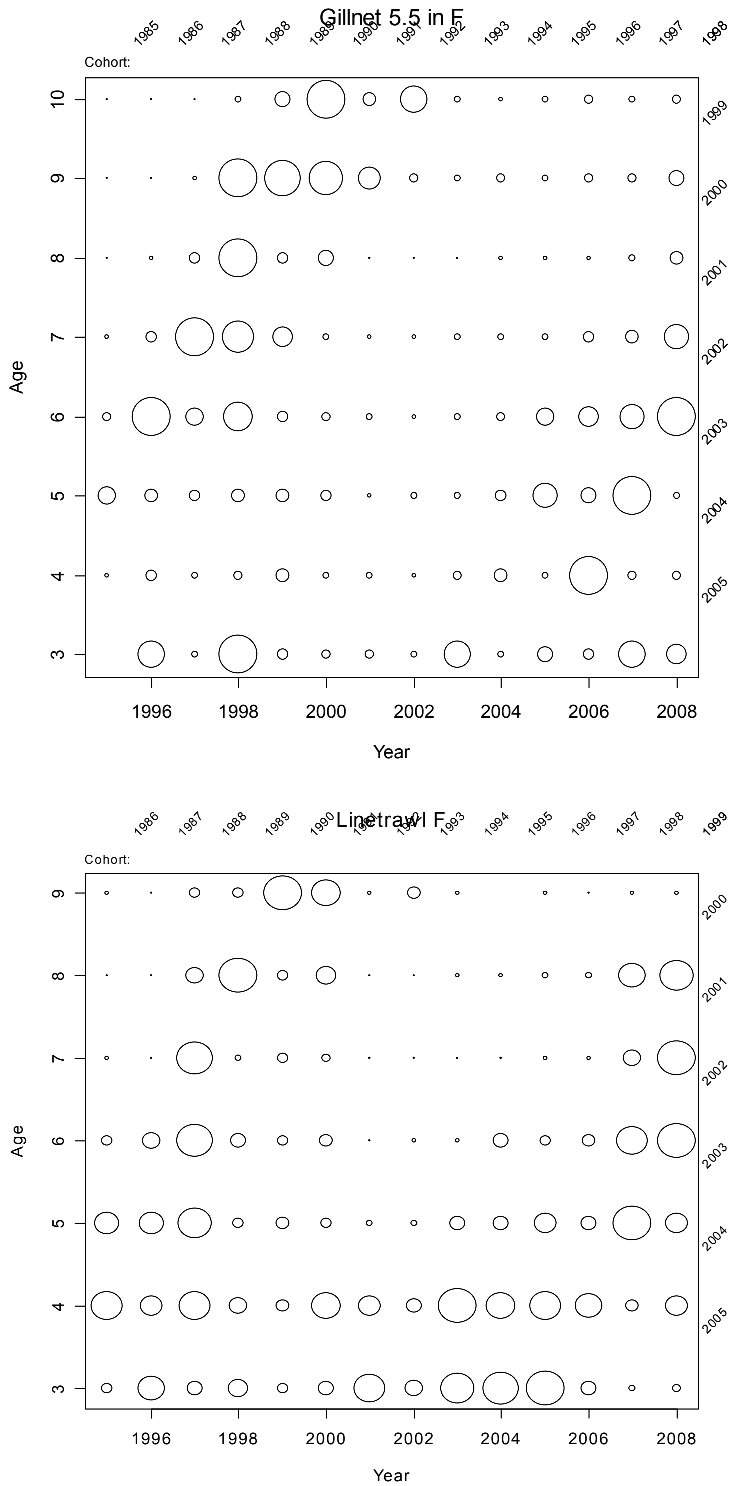


Figure 24. Standardized age-disaggregated catch rate indices for 5½” mesh gillnets, (upper panel) and linetrawls (lower panel) estimated using data from sentinel survey sites in 2J3KL. Catch rates are proportional to symbol area; values within each age were divided by the maximum within an age.

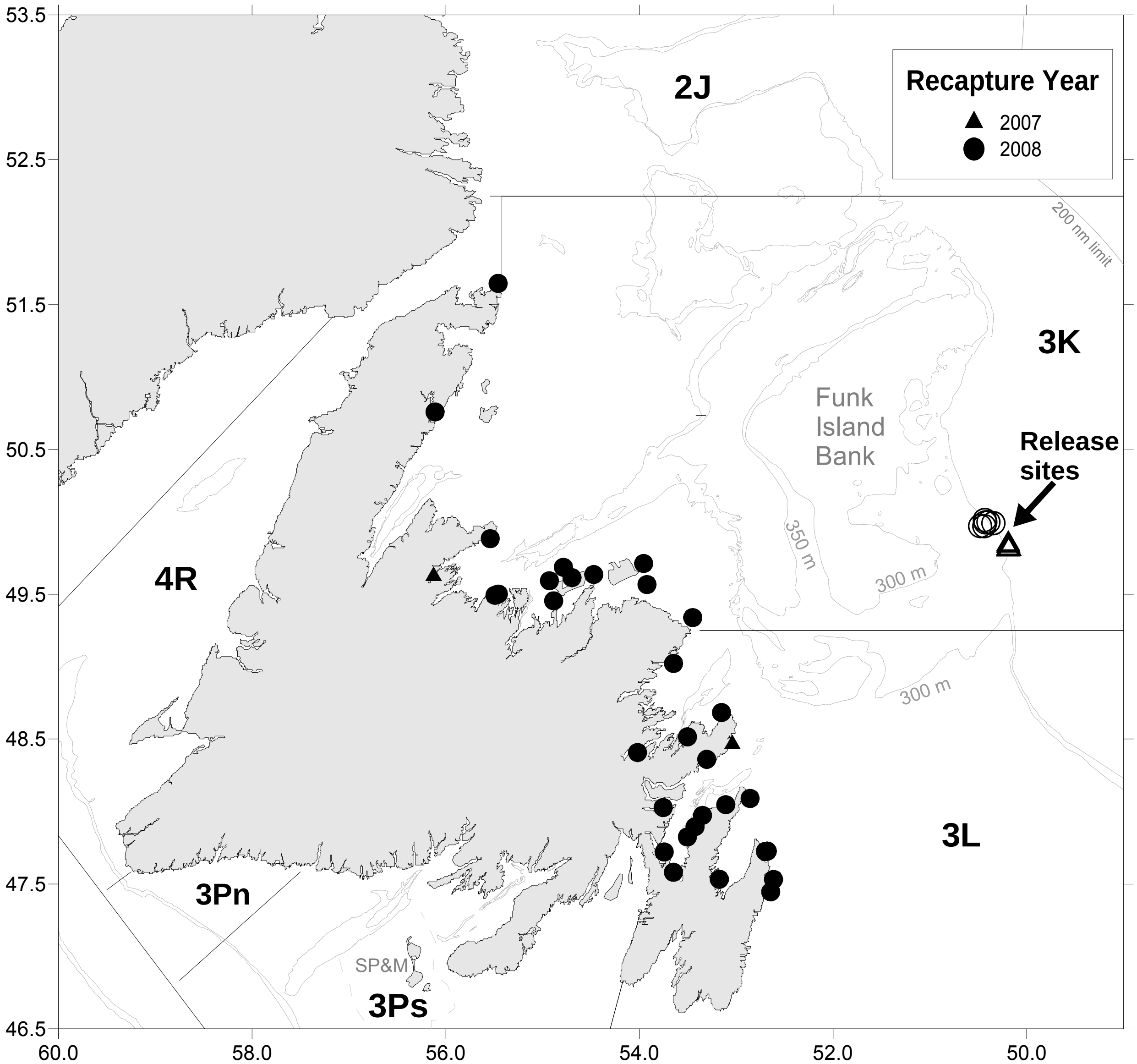


Figure 25. Release sites and recapture locations for cod tagged in the offshore of 3K east of Funk Island Bank during March 2007 (triangles) and 2008 (circles). Grey lines indicate the 300 m and 350 m depth contours.

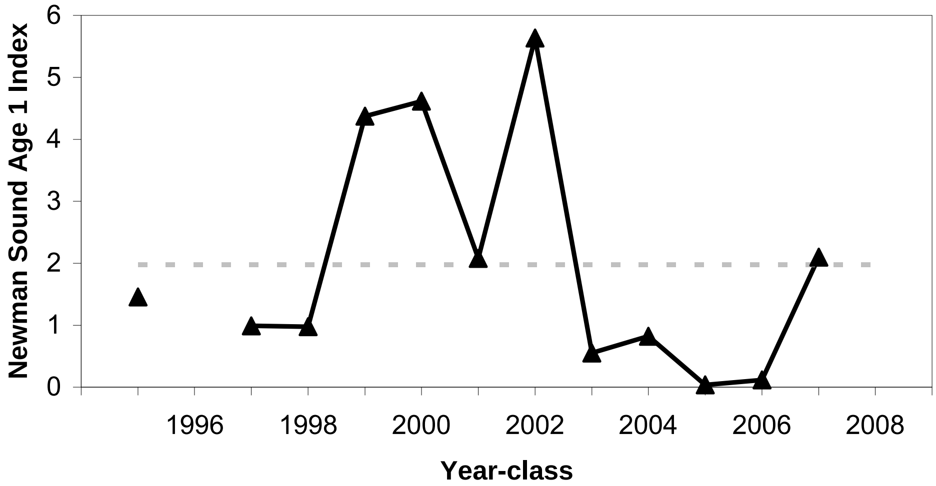


Figure 26. Trends in the numbers of age 1 cod from beach seine surveys in Newman Sound, Bonavista Bay.

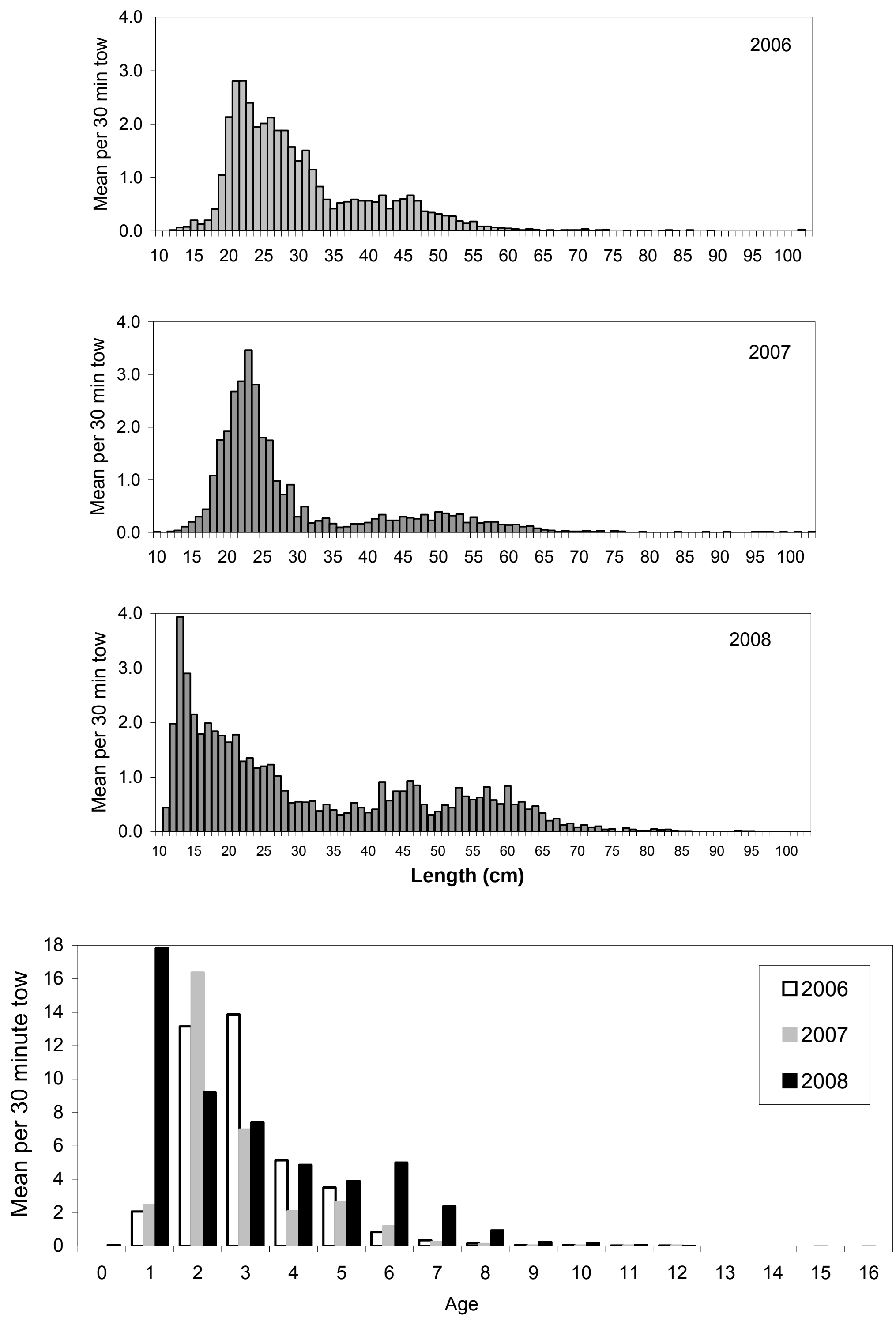


Figure 27. Comparison of the length composition (upper three panels) and age composition (lower panel) of catch of cod from the DFO-Industry mobile gear survey of the near-shore of NAFO Divisions 2J3KL during 2006-08.

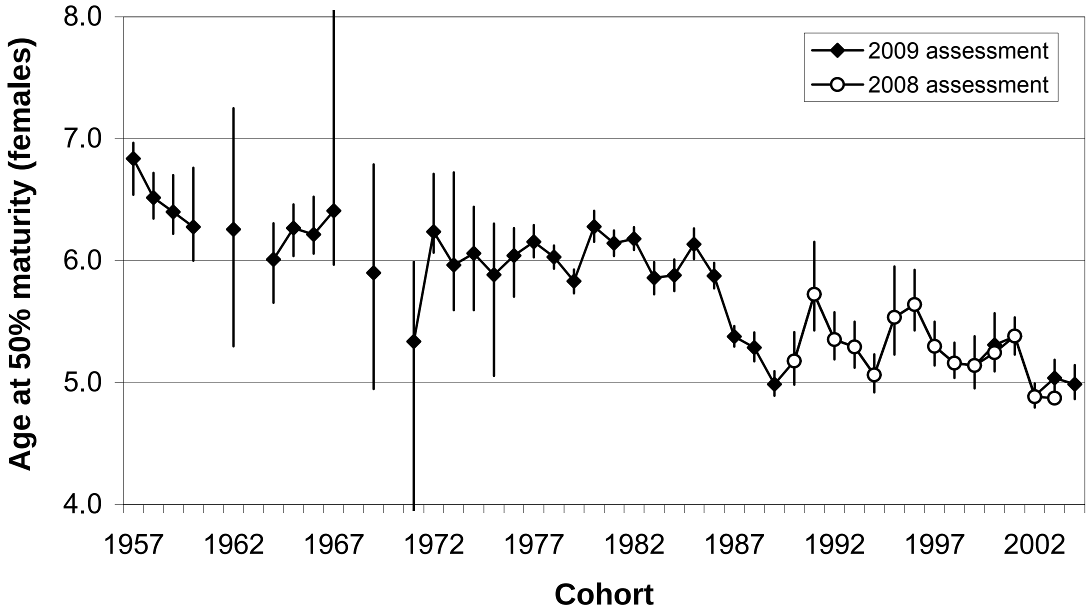


Figure 28. Age at 50% maturity (± 95% CI) by cohort for female cod in Divisions 2J3KL combined based on sampling during autumn research bottom-trawl surveys. The open circles show the results from the previous assessment back to the 1990 cohort. See text for details

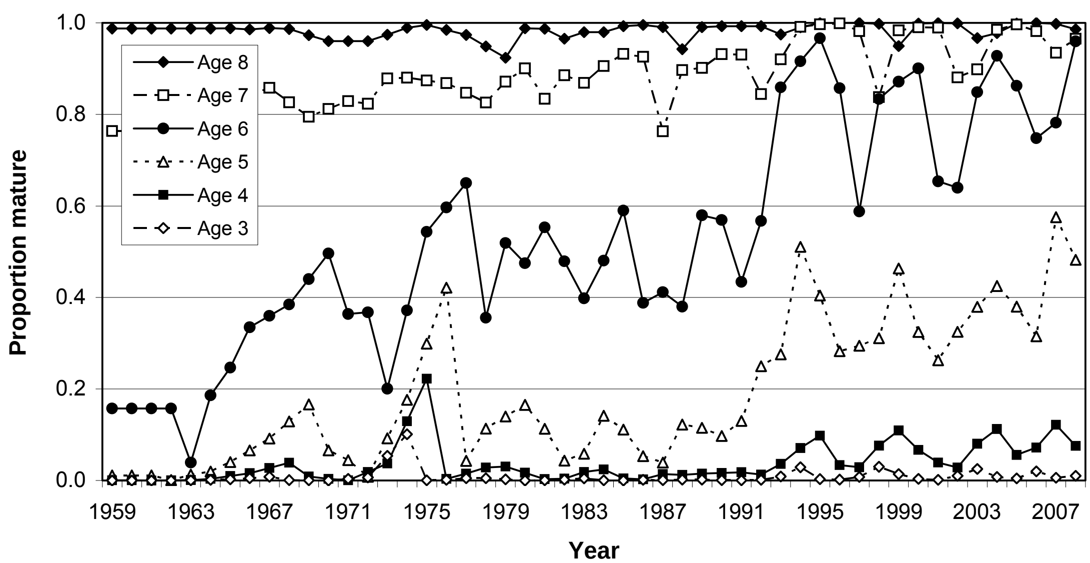


Figure 29. Estimated proportions mature at ages 3-8 for female cod from NAFO Divisions 2J3KL combined. The percentage mature at age estimated from sampling during the autumn research bottom-trawl survey in year *t* is displayed for year *t*+1.

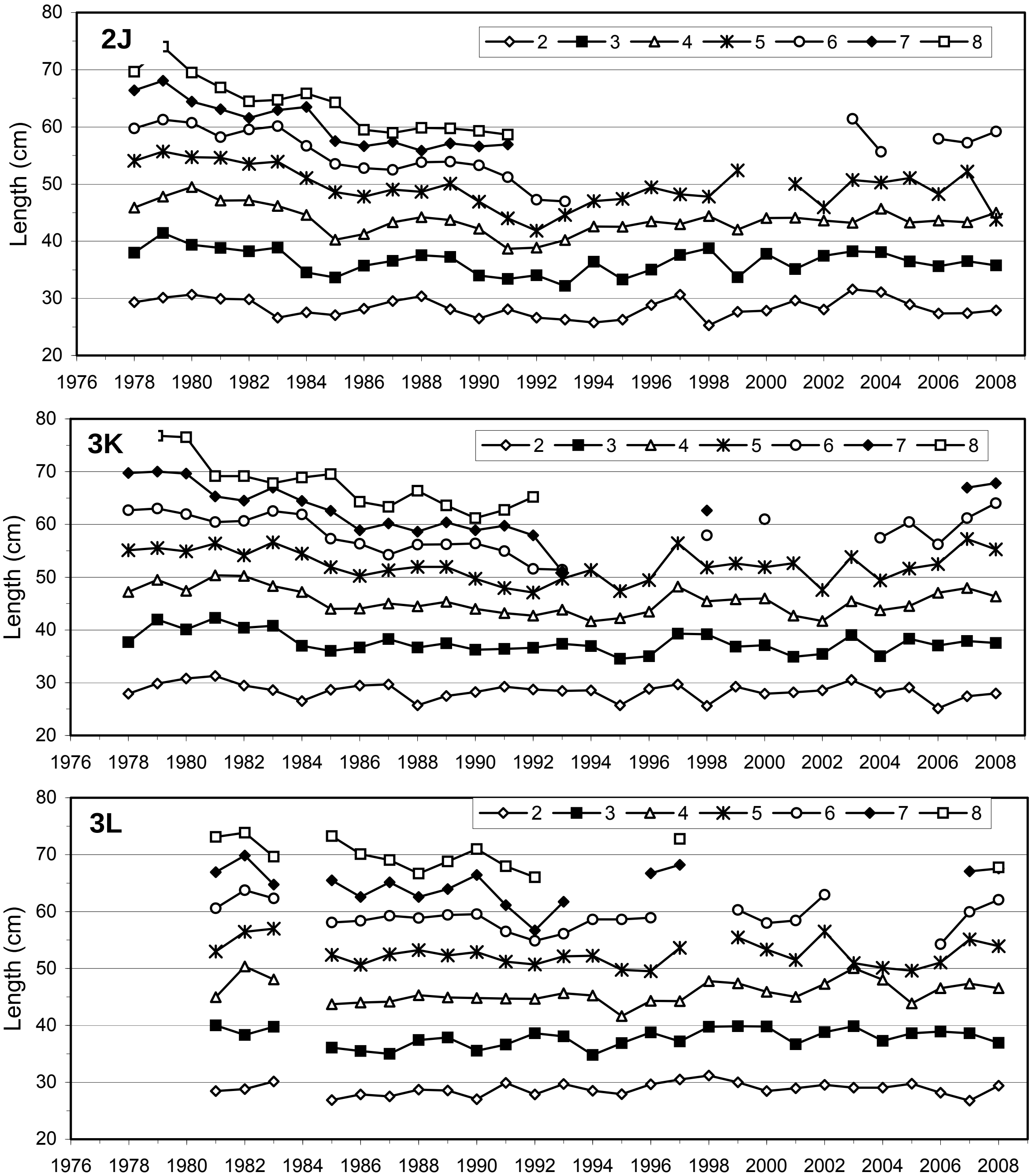


Figure 30a. Mean lengths (cm) at ages 2-8 of cod in Divisions 2J, 3K and 3L in 1978-2008, from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-80 and 1984.

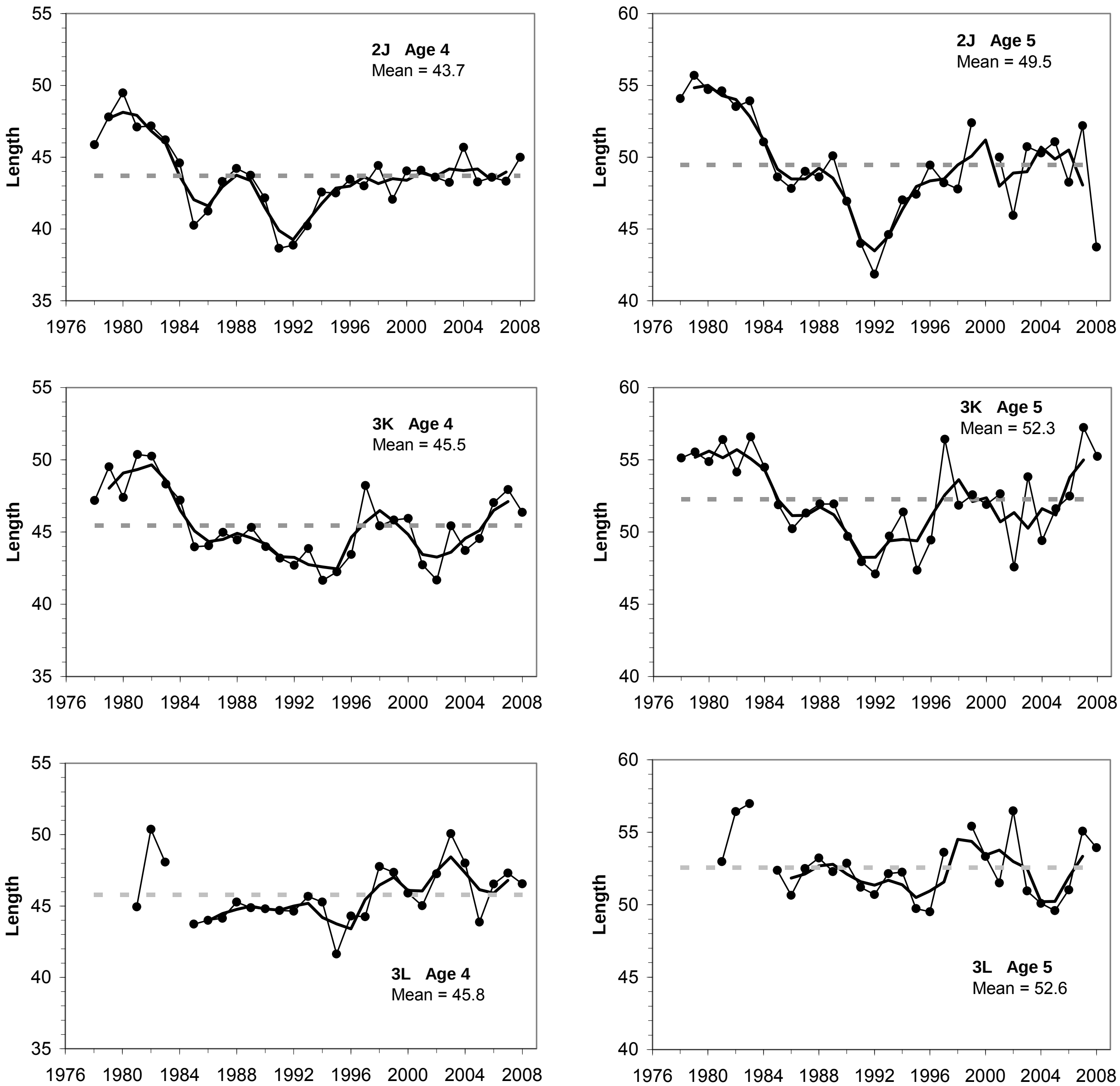


Figure 30b. Mean lengths (cm) at ages 4 and 5 of cod in Divisions 2J, 3K and 3L during 1978-2008 from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. The lines in each panel indicate the annual means (solid line with symbols), a 3-year moving average (heavy solid line) and the mean over all years for which there were observations (dashed line). There were no surveys in Division 3L in 1978-80 and 1984.

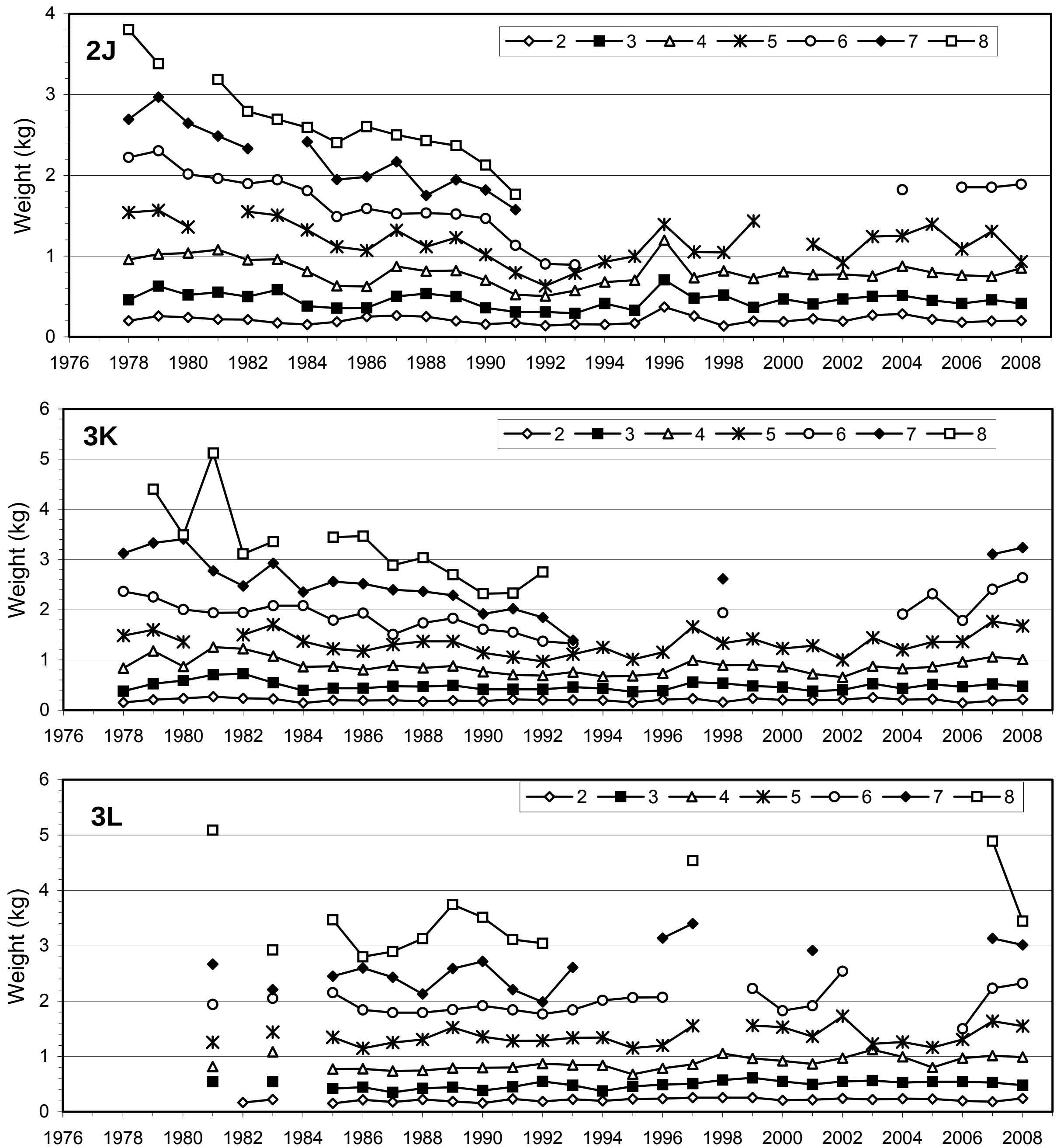


Figure 31a. Mean weights at ages 2-8 of cod in Divisions 2J, 3K and 3L in 1978-2008, from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-80 and 1984.

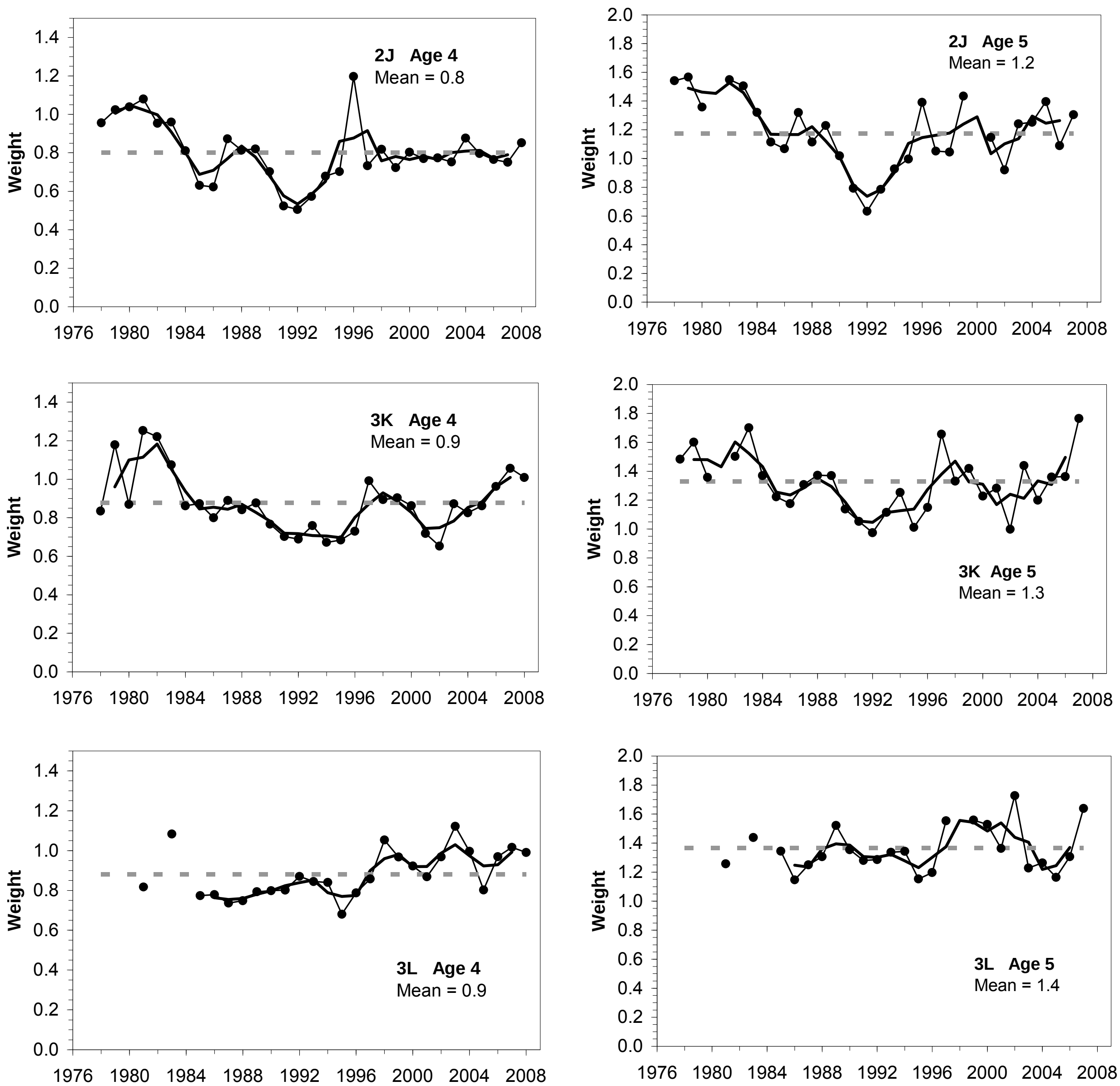


Figure 31b. Mean weights (Kg) at ages 4 and 5 of cod in Divisions 2J, 3K and 3L during 1978-2008, from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. The lines in each panel indicate the annual means (solid line with symbols), a 3-year moving average (heavy solid line) and the mean over all years for which there were observations (dashed line). There were no surveys in Division 3L in 1978-80 and 1984.

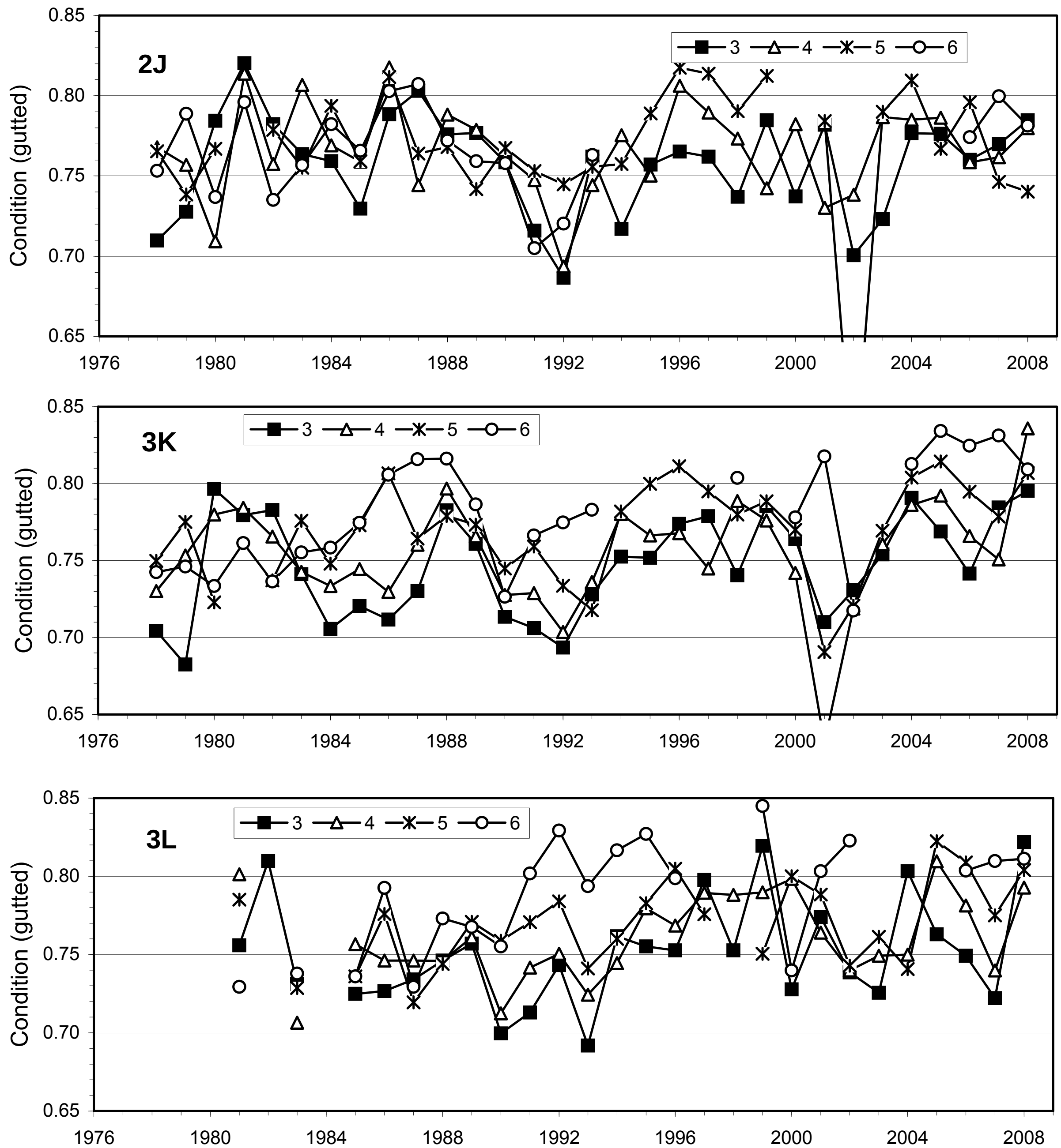


Figure 32. Mean Fulton's condition (gutted weight) at ages 3-6 of cod in Divisions 2J, 3K and 3L in 1978-2008, from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish are not plotted. There were no surveys in Division 3L in 1978-80 and 1984.

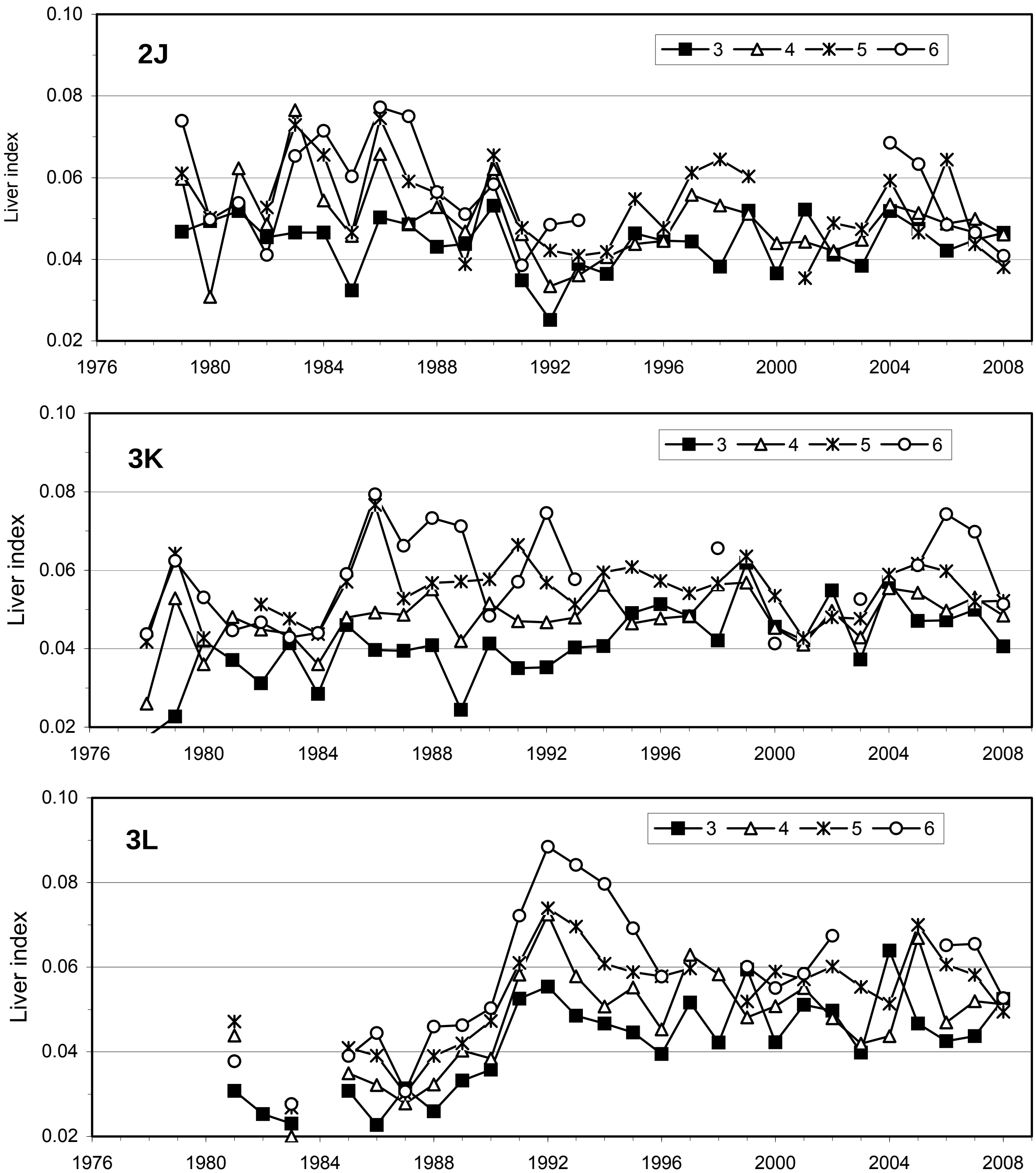


Figure 33. Mean liver index at ages 3-6 of cod in Divisions 2J, 3K and 3L in 1978-2008 from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish in 1995-97 are not plotted. There were no surveys in Division 3L in 1978-80 and 1984.

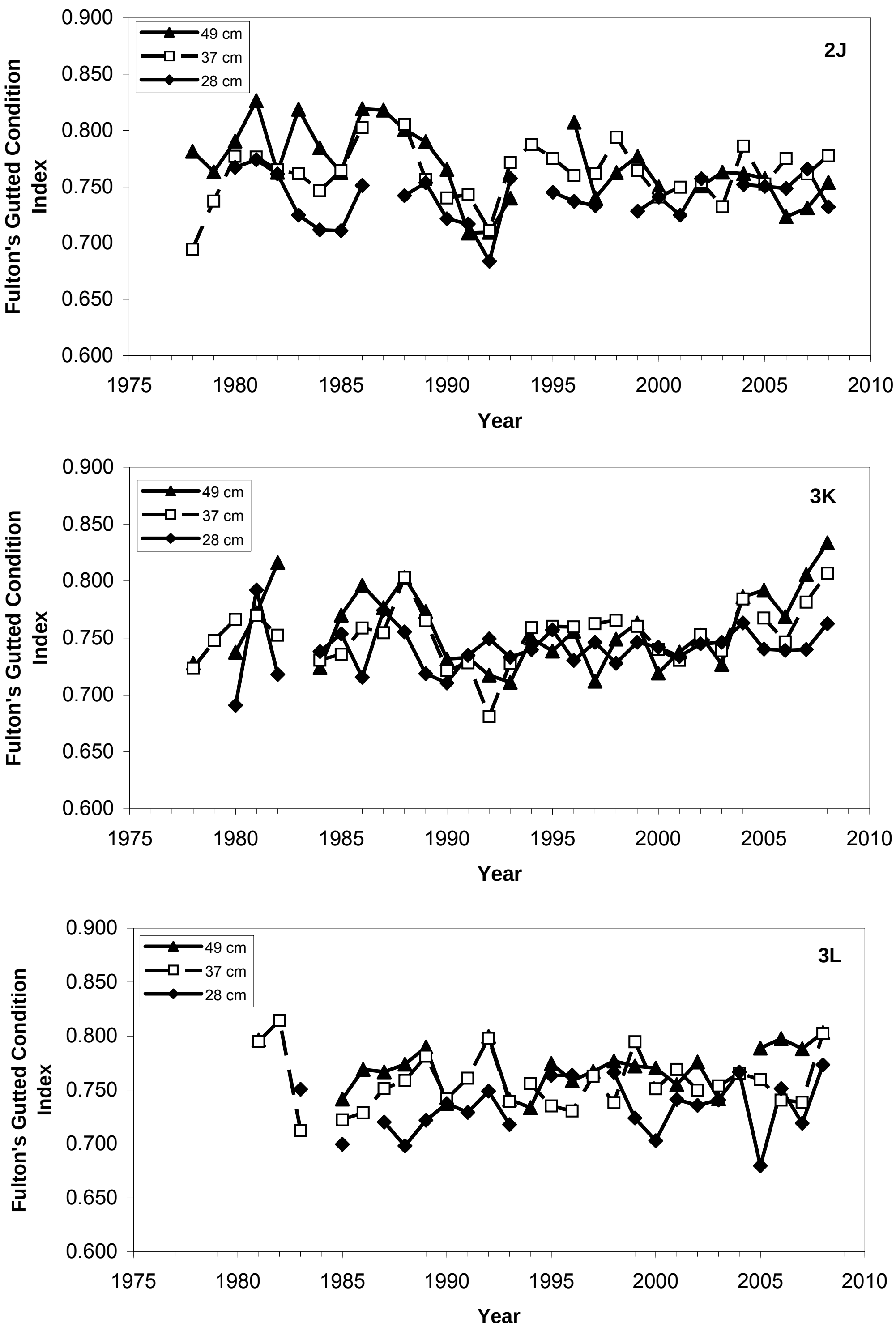


Figure 34. Mean gutted condition index at length classes 28 cm, 37 cm and 49 cm of cod in Divisions 2J, 3K and 3L in 1978-2007, from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish in 1995-97 are not plotted. There were no surveys in Division 3L in 1978-80 and 1984.

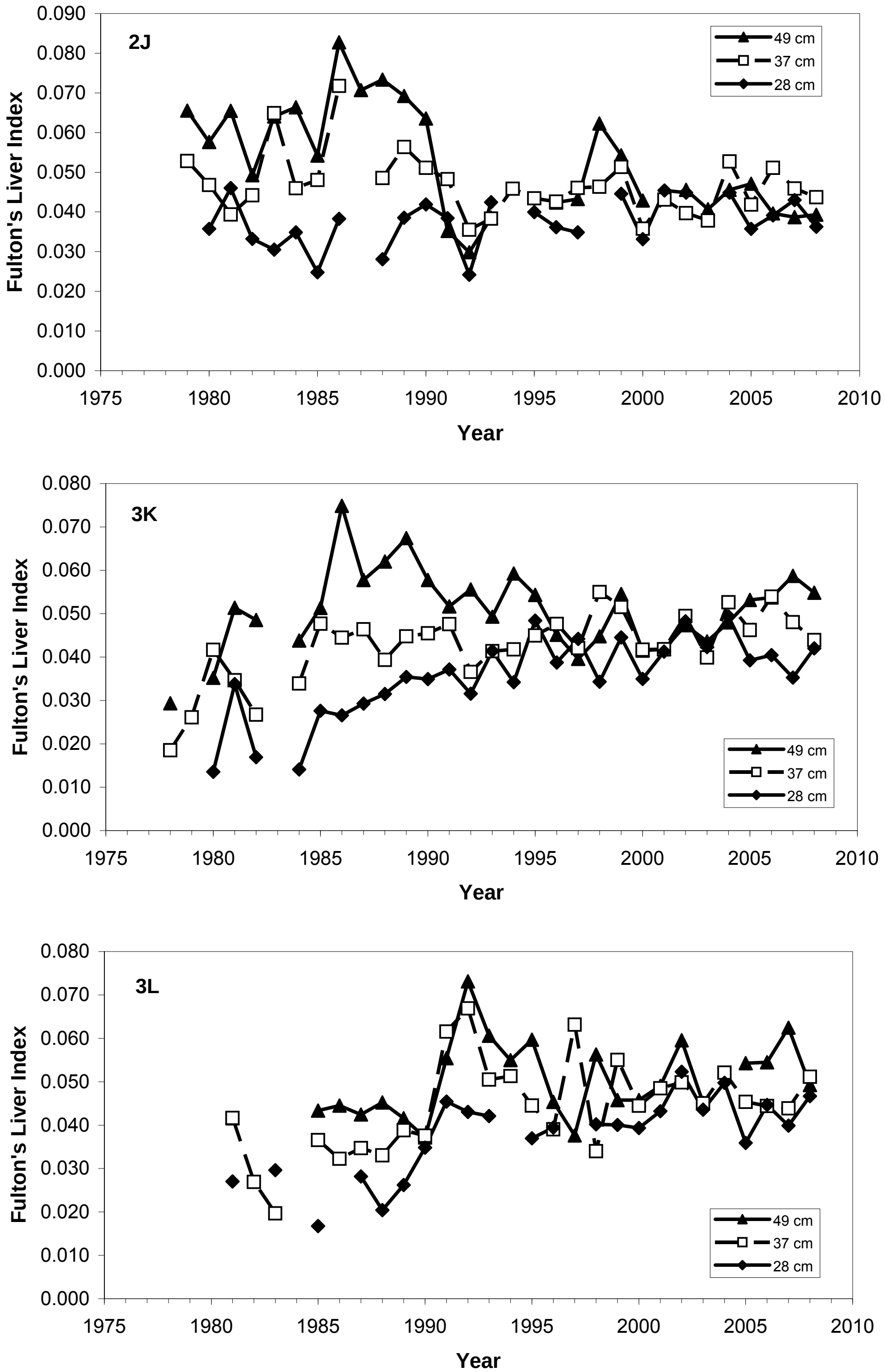


Figure 35. Mean liver index at length classes 28 cm, 37 cm and 49 cm of cod in Divisions 2J, 3K and 3L in 1978-2008 from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish in 1995-97 are not plotted. There were no surveys in Division 3L in 1978-80 and 1984.

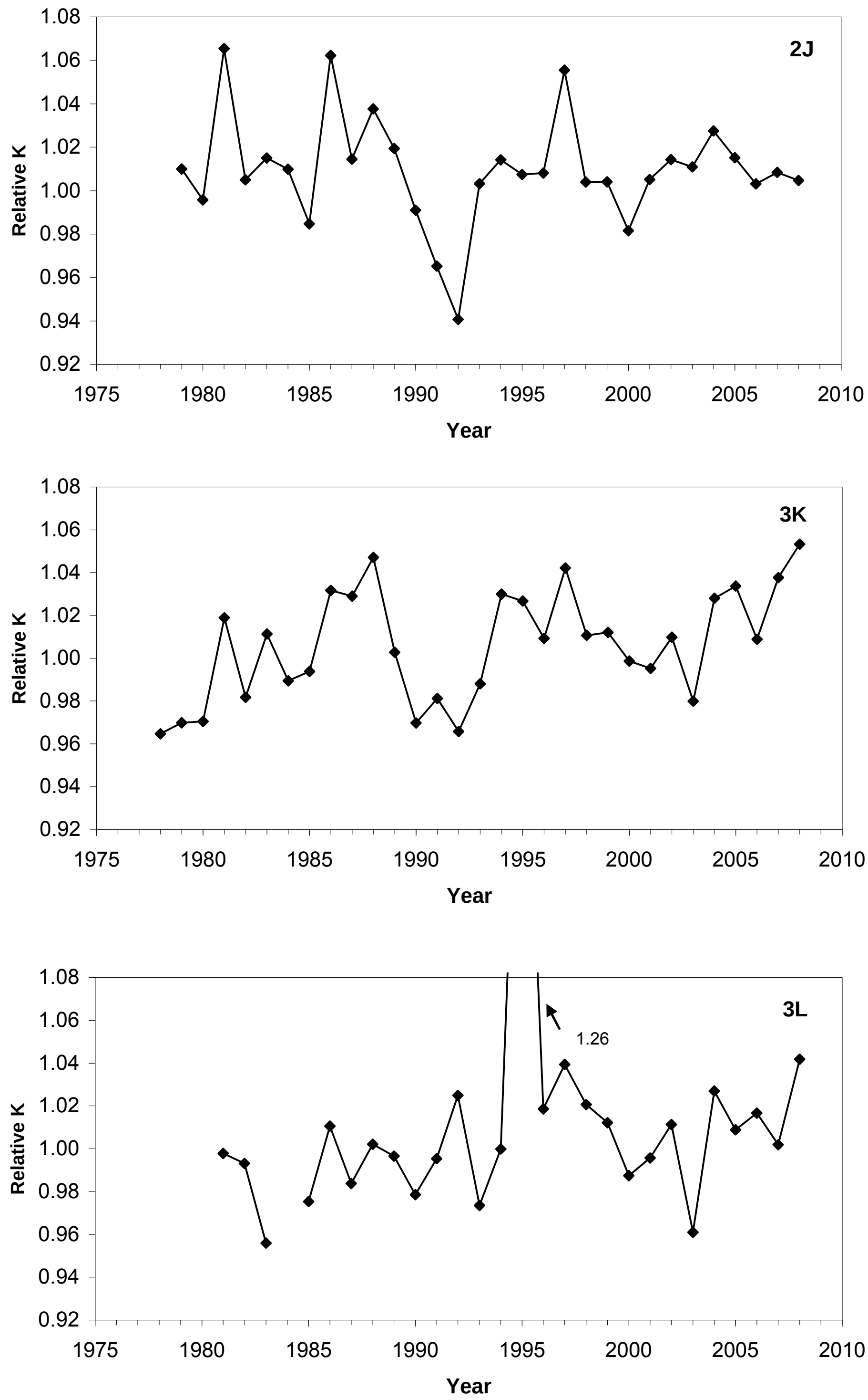
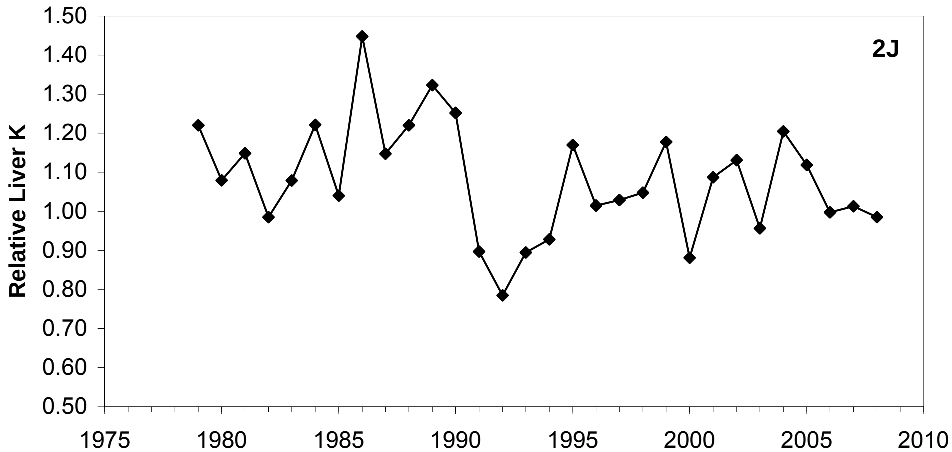
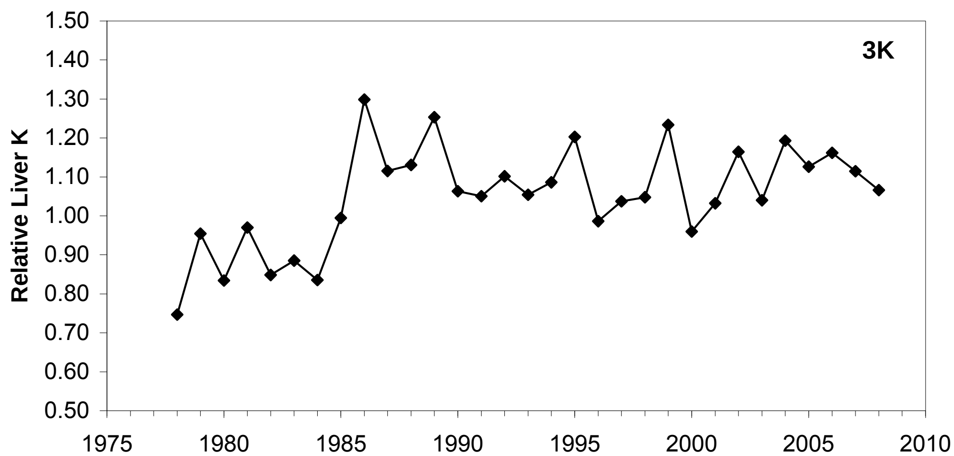


Figure 36. Relative gutted condition of cod in Divisions 2J, 3K and 3L in 1978-2007, from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish in 1995-97 are not plotted. There were no surveys in Division 3L in 1978-80 and 1984.





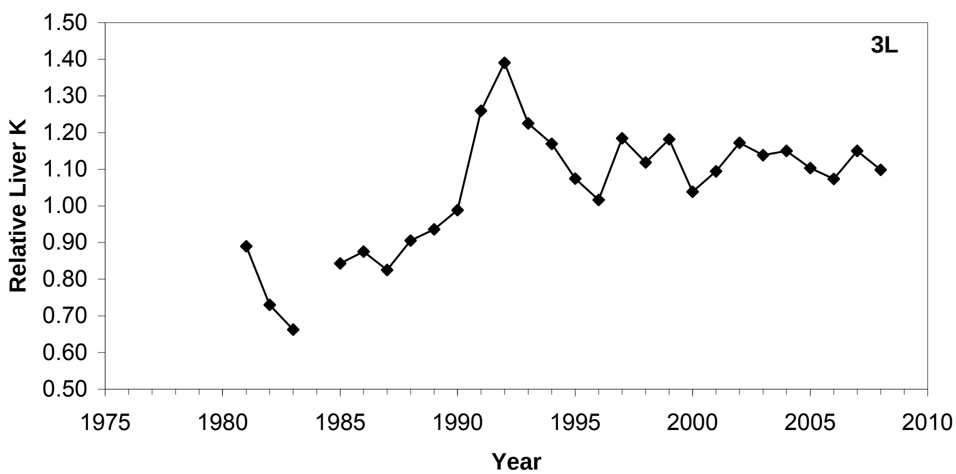


Figure 37. Relative liver condition of cod in Divisions 2J, 3K and 3L in 1978-2008, from sampling during bottom-trawl surveys in autumn. Values calculated from fewer than 5 aged fish in 1995-97 are not plotted. There were no surveys in Division 3L in 1978-80 and 1984.