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Assessment of the cod (*Gadus morhua*) stock in NAFO Subdivision 3Ps (November 2007)

Évaluation du stock de morue (*Gadus morhua*) de la sous-division 3Ps de l'OPANO (novembre 2007)

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ABSTRACT

This document summarizes scientific information used in the 2007 assessment of the cod stock in NAFO Subdiv. 3Ps off the south coast of Newfoundland. Principal sources of information available for this assessment were: reported landings from commercial fisheries (1959-March 2007), oceanographic data, a time series (1973-2007) of abundance and biomass indices from Canadian winter/spring research vessel (RV) bottom-trawl surveys, an industry offshore bottom-trawl survey (1997-2005), inshore sentinel surveys (1995-2006), science logbooks from vessels < 35ft (1997-2006), industry logbooks for larger (> 35 ft) vessels (1998-2006), and tagging studies (1997 onwards). The fishery was still in progress at the time of the assessment and complete information on catch rates and age compositions from the 13,000 t TAC from 1 April 2007 to 31 March 2008 was not available. As in 2006, no model of the dynamics of the entire stock was accepted and the assessment is based primarily on analyses of survey indices and trends in catch. The DFO RV trawl survey indices were revised to include data from inshore strata that have been fished since 1997; the revised indices remain variable with no clear trend in spite of the 12% increase in area surveyed. The industry (GEAC) trawl survey index, which concluded in 2005, was declining. The two inshore (fixed gear) indices from fishing conducted shoreward of the trawl surveys have been stable. New information on recruitment from the DFO RV survey and sentinel linetrawl is consistent with recent assessments (2005, 2006) and indicates that year-classes produced during 2000-2004 are weaker than those produced in 1997 and 1998. The 1997 and 1998 year-classes have been well represented in the catch during 2003-2006; however, these are followed by weaker recruitment (2000-04 year classes) and at current catch levels it is anticipated that fishing mortality will increase over the next few years.

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RÉSUMÉ

Ce document résume l'information scientifique utilisée pour l'évaluation de 2007 du stock de morue de la sous-division 3Ps de l'OPANO, au large de la côte sud de Terre-Neuve. Les principales sources d'information ayant servi à préparer cette évaluation étaient les suivantes : les débarquements déclarés de la pêche commerciale (de 1959 à mars 2007), les données océanographiques, une série chronologique (1973 – 2007) des indices d'abondance et de biomasse tirés des relevés d'hiver-printemps au chalut de fond du navire de recherche (NR) canadien, un relevé hauturier de l'industrie au chalut de fond (1997 – 2005), des relevés côtiers par pêche indicatrice (1995 – 2006), les journaux de bord scientifiques des bateaux de moins de 35 pi (1997 – 2006), les journaux de bord des gros bateaux (> 35 pi) de l'industrie (1998-2006) et des études de marquage (1997 et suivantes). La pêche était encore en cours au moment de l'évaluation et l'on ne disposait pas de renseignements complets sur les taux de capture et la composition selon l'âge du TAC de 13 000 t pour la période d'avril 2007 au 31 mars 2008. Comme en 2006, le modèle de la dynamique du stock n'a pas été accepté et l'évaluation est basée principalement sur les analyses des indices issus des relevés et les tendances des prises. Les indices tirés des relevés au chalut du NR du MPO ont été révisés de manière à y inclure les données de la strate côtière où se déroulent des activités de pêche depuis 1997; les indices révisés demeurent variables, sans tendance particulière, malgré l'augmentation de 12 % de l'étendue du relevé. L'indice d'abondance établi d'après les relevés au chalut de l'industrie (GEAC), terminés en 2005, affiche une baisse. Les deux indices côtiers (engins fixes) obtenus à partir d'activités de pêche pratiquées plus près des côtes que les relevés au chalut sont demeurés stables. De nouvelles données sur le recrutement, fournies par le relevé du NR du MPO et la pêche indicatrice à la palangre, concordent avec les récentes évaluations (2005, 2006) et indiquent que les classes d'âge produites entre 2000 et 2004 sont plus faibles que celles de 1997 et 1998. Les classes d'âges de 1997 et 1998 étaient bien représentées dans les prises de 2003 à 2006; toutefois, elles sont suivies par un faible recrutement (classes d'âge de 2000 à 2004) et, aux taux d'exploitation actuels, on s'attend à une augmentation de la mortalité par pêche au cours des prochaines années.

INTRODUCTION

This document gives an account of the regional assessment of the Atlantic cod (*Gadus morhua*) stock in NAFO Subdiv. 3Ps located off the south coast of Newfoundland (Fig. 1 and 2). The assessment was conducted in St. John's, Newfoundland during 5-9th November 2007. The history of the cod fishery in NAFO Subdiv. 3Ps and results from other recent assessments of this stock are described in previous documents (Pinhorn 1969; Bishop et al. 1991, 1992, 1993, 1994, 1995; Shelton et al. 1996; Stansbury et al. 1998; Brattey et al. 1999a, 1999b, 2000, 2001a, 2002a, 2003, 2004, 2005, 2007).

The directed cod fishery on this stock was reopened in May 1997 with a total allowable catch (TAC) set at 10,000 t (see Table 1), following a moratorium initiated in August 1993. The TAC was subsequently increased to 20,000 t in 1998 and further to 30,000 t in 1999. The TAC was subsequently reduced to 20,000 t in 2000, and for the five management years (ending 31 March 2006) was been set at 15,000 t. The TAC for management years 1 April 2006-31 March 2007 and 1 April 2007-31 March 2008 was set at 13,000 t.

The present assessment incorporates various sources of information on 3Ps cod. The 2007-08 commercial fishery was still in progress at the time of the assessment meeting. Detailed information on catch-at-age up to the end of March 2007 was available and preliminary catch information for the period 1 April -1 October 2007 was also used. Additional sources of information included science logbooks for vessels <35 ft (1997-2006), industry logbooks for vessels >35 ft (1998-2006), an industry trawl survey on St. Pierre Bank from 1997 to 2005 (McClintock [in prep.]), inshore sentinel surveys from 1995 to 2006 (Maddock-Parsons and Stead 2007), and recaptures of tagged cod (received up to the end of 2006) from tagging conducted in 3Ps during 1997-2005 (Brattey and Healey 2006).

ENVIRONMENTAL OVERVIEW

Oceanographic data from NAFO Div. 3P during the spring of 2007 were examined and compared to previous years and the long-term (1971-2000) average and findings are described in detail in Colbourne and Murphy (2008) who stated "Temperature measurements on St. Pierre Bank show anomalous cold periods in the mid-1970s and from the mid-1980s to mid-1990s. Beginning in 1996 however, temperatures moderated, decreased again during the spring of 1997 and returned to normal values during 1998. During 1999 and 2000 temperatures continued to increase, reaching the highest values observed since the late 1970s in some regions. During 2001-2003 however, temperatures cooled significantly to values observed during the mid-1990s with the average temperature during the spring of 2003 the coldest in about 13 years. Temperatures during both 2004 and 2005 warmed considerably over 2003 values to 1°C above normal in some areas. The areal extent of <0°C bottom water during 2003 increased to the highest in about 13 years but decreased during 2004 and 2005 to <10%, the lowest since 1988. On St. Pierre Bank bottom water with temperatures <0°C almost completely disappeared during the warm years of 1999, 2000, 2004 and 2005. During the spring of 2007 however, near-bottom temperatures decreased to below normal values in many areas particularly on St. Pierre Bank, where the area of <0°C water increased to near 30%. The areal extent of bottom water with temperatures >3°C has remained relatively constant at about 50% of the total 3P area, although actual temperature measurements show considerable inter-annual variability."

COMMERCIAL CATCH

Catches (reported landings) from 3Ps for the period 1959 to 1 October 2007 are summarized by country and separately for fixed and mobile gear in Table 1 and Fig. 3a and 3b. Prior to the moratorium, Canadian landings for vessels <35 ft were estimated mainly from purchase slip records collected and interpreted by Statistics Division, Department of Fisheries and Oceans. Shelton et al. (1996) emphasized that these data may be unreliable. Post-moratorium landings for vessels <35 ft have come mainly from a dock-side monitoring program initiated in 1997. Landings for vessels >35 ft come from logbooks. Non-Canadian landings (mainly France) are compiled from national catch statistics reported by individual countries to NAFO and there is generally a lag in the submission of final statistics; consequently, the most recent entries in Table 1 are designated as provisional.

The stock in the 3Ps management unit was heavily exploited in the 1960's and early 1970's by non-Canadian fleets, mainly from Spain and Portugal, with reported landings peaking at about 87,000 t in 1961 (Table 1, Fig. 3a). After extension of jurisdiction (1977), cod catches averaged between 30,000 t and 40,000 t until the mid-1980s when increased fishing effort by France led to increased total reported landings, reaching a high for the post-extension of jurisdiction period of about 59,000 t in 1987. Subsequently, reported catches declined gradually to 36,000 t in 1992. Catches exceeded the TAC throughout the 1980's and into the 1990's. The Canada-France boundary dispute led to fluctuations in the French catch during the late 1980's. A moratorium was imposed on all directed cod fishing in August 1993 after only 15,216 t had been landed, the majority being taken by the Canadian inshore fixed gear fishery (where inshore is typically defined as unit areas 3Psa, b, and c; Fig. 1). In this year, access by French vessels to Canadian waters was restricted. Under the terms of the 1994 Canada-France agreement, France is now allocated 15.6% of the TAC, of which Canadian trawlers must fish 70%, with the remainder fished by small inshore fixed gear vessels based in St. Pierre and Miquelon.

Since 1997, most of the TAC has been landed by Canadian inshore fixed gear fishermen, with remaining catch taken mainly by the mobile gear sector fishing the offshore, i.e. unit areas 3Psd, e, f, g, h (Table 1, Fig. 1, 3a, and 3b). This general pattern has continued since the fishery reopened in 1997, but there has been a slight increase in landings from offshore unit areas due to some smaller fixed gear vessels redirecting their effort to offshore fishing areas. During the 2006 calendar year, total reported landings were 13,157 t with the inshore fixed gear sector accounting for 9,595 t (72.9%) of the total (Table 1). In the 2007 calendar year to 1 October, the inshore fixed gear sector accounted for 6,718 t (78.5%) of the reported landings of 8,553 t; the offshore mobile gear sector typically fishes in the late fall and early winter and this allocation had yet to be taken; inshore landings are also typically high in late fall (see below).

Line-trawl (=longline) catches dominated the fixed gear landings over the period 1977-93, reaching a peak of over 20,000 t in 1981 and typically accounting for 40-50% of the annual total for fixed gear (Table 2, Fig. 4). In the post-moratorium period, line-trawls have accounted for 16 to 23% of the fixed gear landings. Gillnet landings increased steadily from about 2,300 t in 1978 to a peak of over 9,000 t in 1987, but declined thereafter until the moratorium. Gillnets have been responsible for the dominant portion of the inshore catch since the fishery reopened in 1997, with gillnet landings exceeding 10,000 t (i.e. 50% of the TAC) for the first time in 1998, and approaching 18,000 t in 1999. Gillnets have typically accounted for 70-80% of the fixed gear landings since 1998. Gillnets accounted for a lower percentage of the fixed gear landings in 2001 (60%), partly due to a temporary management restriction in their use that was removed part way through the fishery following extensive complaints from industry. Gillnets are also being used extensively in the offshore areas in the post-moratorium period (see below). Trap catches have varied over the time period, but have not exceeded 8,000 t and have declined from 1,167 t to negligible amounts (<120 t) from 1998 onwards. Hand-line catches were a small component of the inshore fixed gear fishery prior to the moratorium (about 10-20%) and accounted for <5% of landings during most of the post-moratorium period. However, hand-line catch for 2001 shows a substantial increase (to 17% of total fixed gear) compared with the 1998-2000 period and this may reflect the temporary restriction in use of gillnets described above.

Monthly landings during 2006 and up to 1 October 2007 are summarized for inshore (3Psa/b/c) and offshore (3Psd-h) and for each of the major gear types, in Table 3a. Inshore catches in 2006 have come mostly from gillnets with substantial gillnet landings in most months (up to 1,370 t) except January-April (<110 t). Line-trawls were fished inshore mostly during late summer and fall with highest monthly landings (~430 t) in October. Hand-line catches were taken mainly during summer and fall with a peak in August. In the offshore, otter trawl fishing by Canadian trawlers and vessels chartered by St. Pierre and Miquelon to fish the French allocation was concentrated mainly during the first and last quarters of the year. There was also a substantial offshore gillnet catch in 2006 with landings totaling over 2,671 t taken mostly during July-November. Line-trawls were fished in the offshore throughout the year but accounted for a small proportion (5%) of offshore landings, totaling <60 t in most months except January-February (178-402 t). Overall, landings in 2006 were dominated by the directed gillnet fishery with the remaining catch taken by otter trawl, followed by line-trawl and hand-line, with negligible amounts taken by trap. Landings by gear type and season show no major changes in recent years, except for a slight increase in offshore gillnet.

The landings for the 2006 calendar year and the first nine months of 2007 are summarized by month and unit area in Table 3b. Inshore landings were low (<5 t) in March and April 2006 and came mostly from by-catch fisheries. Monthly landing trends in 3Psb and 3Psc show similar patterns, with peaks in June-July and November, whereas those in 3Psa were more variable through June-November. Landings from Placentia Bay in June 2007 (1,500 t) were notably higher than those for June 2006 (980 t). Placentia Bay accounts for most of the inshore catch although the percentage of the total taken from this area has been gradually diminishing and is presently around 30%.

In the offshore, monthly landings tended to be more variable among unit areas. Unit area 3Psh accounted for most of the offshore catch from winter otter trawl fisheries, but landings from 3Pse and 3Psf were also high (>900 t) in late summer and fall from vessels fishing gillnets. Preliminary landings for the 2007 calendar year for the offshore show similar spatial and temporal trends to those seen in 2006.

The distribution of post-moratorium catches among unit areas is illustrated in Fig. 5. The inshore (3Psa, 3Psb, and 3Psc) has consistently accounted for most of the reported landings. These have typically been highest in Placentia Bay (3Psc), ranging from 4,000 t to almost 11,650 t with typically 28-51% of the entire TAC coming from this unit area alone; however, this percentage has shown a slight decline recently. Landings from 3Psa and 3Psb have been fairly consistent at about 1,100-3,200 t and generally between 7-12% and 9-18% of the TAC, respectively. Most of the offshore landings have come from 3Psh and 3Pse/f (Halibut Channel and the southeastern portion of St. Pierre Bank). There was a slight increase in landings from 3Psd in 2006 (770 t). Unit area 3Psg continues to have the lowest landings (<4% of the annual total each year since 1997). Overall the distribution of landings in 2006 shows no major changes relative to recent years.

The 1st of April 2006 to 31st of March 2007 conservation harvesting plan placed various seasonal and gear restrictions on how the 3Ps cod fishery could be pursued. Full details of these measures, which differ among gear sectors, are available from DFO Fisheries and Aquaculture Management (FAM) in St. John's.

CATCH-AT-AGE

Samples of length and age composition of catches were obtained from the inshore trap, gillnet, line-trawl and hand-line fisheries and the offshore otter trawl, gillnet, and line-trawl fisheries by port samplers and fishery observers. Sampling of the Canadian and French (St. Pierre and Miquelon, SPM) catches in 2006 was undertaken, with 75,800 and 14,901 fish measured for length from Canadian and French catches, respectively; in addition, 8,969 and 1,167 otoliths were examined for age determination (Table 4). The sampling was well distributed spatially and temporally across the gear sectors. Substantial landings in summer from inshore fixed gears (see Table 3a) were sampled intensively, particularly line-trawl and gillnet. The winter offshore otter trawl fishery was also sampled heavily, particularly in the first quarter. Sampling of lengths and ages of the Canadian and French catches during January-March 2007 was also undertaken, but data were not complete at the time of the assessment meeting.

The age composition and mean length-at-age of commercial catches were calculated as described in Gavaris and Gavaris (1983). The average weights were derived from a standard length-weight (wt) relationship where:

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

Catch-at-age for all gears combined based on sampling of Canadian and French vessels in 2006 is summarized in Table 5 and Fig. 6a and 6b. Catch-at-age data for the French catch was provided by colleagues in SPM.

In the 2006 landings from all gears combined, a wide range of ages are represented (4-17 year olds) but most of the catch is comprised of ages 4-10 (Table 5, Fig. 6a). The age composition of the 2006 catch is consistent with that of the previous four years, with the 1997 and 1998 year classes (ages 8 and 9) strongly represented (Fig. 6b). The most abundant age in 2006 was 8 yr olds with over 1.0 million individuals taken (21% of total by numbers); this is unusual for the 3Ps stock and a historical reconstruction of the catch at age (Table 6) shows that ages 4-6 are typically most abundant in the catch. The proportion of younger cod (ages 3-5) in the catch in 2006 was 6%, much lower than the 2005 value (16%). The percentage of older ages (>10 yr old) in 2006 (8.0%) was also similar to that of 2005 (6.4%).

Detailed information on the catch from the first three months of 2007 was not available at the time of the assessment; this catch is typically taken mainly by mobile gear in the offshore.

Catch at age for the three main gear types, and for all gears combined for 2006, is illustrated in Fig. 7a. All gears catch a range of ages, but the dominance of gillnet selectivity on ages 5-9 is evident, whereas line-trawls caught mostly younger fish (peak at age 5) and otter trawls caught more older fish (peak at age 8). Catches by France and Canada are shown separately only for otter trawl as only this gear has sufficient catch for comparison between the two countries (Fig. 7b). Older cod (ages 8-10) are much more strongly represented in the Canadian versus the French otter trawl landings, whereas the converse is true for ages 6 and 7.

A time series of catch numbers-at-age (ages 3-14 shown) for the 3Ps cod fishery from 1959 to 2006 is given in Table 6. As noted in recent assessments there are discrepancies in the sum of the product check for the 1959-76 catch-at-age and attempts have been made to clarify these discrepancies by checking for missing catch and by adding plus group catch, but neither of these adequately explained the discrepancies. Further investigation is ongoing to check the fixed weights used for the 1959-76 period and to check the sampling protocols to see if either contributed to the discrepancies. Until these discrepancies are resolved, it is recommended that catch at age prior to 1977 not be used in population analyses.

The catch-at-age data indicate that in the pre-moratorium period the landings were dominated by young fish, typically aged 4-6, whereas in the post moratorium period slightly older ages (i.e. ages 5-8) have been more common; this probably reflects the switch in dominant gears from line-trawl to gillnet. For the 2006 fishery, 8 and 9 year-old cod (1997-98 year classes) are still well represented. Note that the TAC, total landings, and gears employed in the fishery have been similar throughout the past several management years, yet the composition of the catch has shown some notable changes. A broad range of ages are represented in the catch, but the modal age has increased progressively over the past 5 years as the 1997 year class gets progressively older and moves through the peak ages selected by gillnets (typically ages 5-7) (see Fig. 6b). The 1998 year class follows the same pattern, but appears less strongly in the catch compared to the 1997 year class.

WEIGHT-AT-AGE

Mean weights-at-age in the 3Ps fishery (including landings from the commercial and food fisheries and the sentinel surveys) are given in Table 7a and Fig. 8a. Beginning of the year weights-at-age are given in Table 7b and Fig. 8b. The mean weights-at-age are derived from the sampling of catches taken by several gears in various locations at various times of the year; the weights at age may therefore vary with season and gear, and possibly by geographic area. The annual means by gear vary considerably; for example, mean weights-at-age in the 2002 3Ps fishery tended to be least in hand-line and greatest in offshore mobile gear (predominantly otter trawl) (Brattey et al. 2003), with the weight of the 1994 year-class at age 8 in the former being less than half the weight in the latter.

For young cod (ages 3-6), weights-at-age computed in recent years tend to be higher than those in the 1970s and early 1980s (Table 7a; Fig. 8a). The converse is true for older fish. Sample sizes for the oldest age groups (>10) have been low in recent years due to the relative scarcity of old fish in the catch. Interpretation of trends in weights-at-age computed from fishery data is difficult because of among-year variability in the proportion at age caught by gear, time of year and location.

SENTINEL SURVEY

The sentinel survey has been conducted in 3Ps since 1995 and there are now twelve complete years of catch and effort data (see Maddock-Parsons and Stead 2007). During 2006, the sentinel survey continued to produce a time series of catch/effort data and biological information collected by trained fish harvesters at various inshore sites along the south coast of Newfoundland. In 2006, there were 13 active sites in 3Ps, using predominantly gillnets (5½" mesh) in unit area 3Psc (Placentia Bay) and line-trawls in 3Psb and 3Psa (Fortune Bay and west). One 3¼" gillnet was also fished at each of 6 sites in Placentia Bay one day per week. Fishing effort was reduced in 2003 to an average of 6 weeks, but increased to 9 weeks during 2004-2006. Fishing times averaged 10 weeks in 2001 and 2002, 8 weeks in 2000 as opposed to 6 weeks in 1999 and 12 weeks from 1995 to 1998. Most fishing takes place in fall/early winter. Maddock-Parsons and Stead (2001, 2003a, 2003b, 2004, 2005, 2006, 2007) have produced a time series of weekly average catch rates and annual relative length frequencies (number of fish at length divided by amount of gear). Catch rates for 5½" gillnets in 2006 remained low and similar to those reported for 2000-05 and line-trawl catch rates in 2006 were higher than the 2001-05 level.

As in previous assessments, an attempt was made to produce an age dis-aggregated index of abundance for the twelve completed years in gillnet (5½" mesh) and line-trawl sectors of the program; there is insufficient data from the 3¼" gillnets to develop an index for this gear. Sentinel fishers typically fish a control and an experimental site; the location of the control site is fixed, whereas the location of the experimental site can change only within the local area.

STANDARDIZED SENTINEL CATCH RATES

The catch from 3Ps was divided into cells defined by gear type (5½" mesh gillnet and line-trawl), area (unit areas 3Psa, 3Psb, and 3Psc), year (1995-2006) and quarter. Age-length keys were generated for each cell using fish sampled from both the fixed and experimental sites; however, only fish caught at the fixed sites were used to derive the catch rate indices. Length frequencies and age-length keys were combined within cells. The numbers of fish at length are assigned an age proportional to the number at age for that particular cell length combination. Fish that were not assigned an age because of lack of information within the initial cell were assigned an age by aggregating cells until the data allowed an age to be assigned. For example, if there are no sample data in a quarter then quarters are combined to half-year, half-years are combined to year; if an age still cannot be assigned, and then areas are combined for the year. Sampling of the sentinel catch for otoliths for ageing has been somewhat reduced since 2002 with only between 305 and 455 otoliths per year from gillnet catches during 2003-06. From line-trawl there were <700 otoliths per year during 2003 and 2004, but the numbers increased to 1,132 otoliths during 2005 and to 1,160 during 2006.

Catch-at-age and catch per unit effort (CPUE) data were standardized using a generalized linear model to remove site and seasonal effects. For gillnets, only sets at fixed sites during July to November with a soak time between 12 and 32 hours were used in the analysis. For line-trawl, sets at fixed sites during August to November with a soak time less than or equal to 12 hours were used in the analysis. Zero catches were generated for ages not observed in a set. Prior to modeling, data are aggregated within a gear-division-site-month-year-age cell. Sets with effort and no catch are valid entries in the model. Note that catch rates from the sentinel fishery are expressed in terms of numbers of fish, rather than catch weight as was used in the analyses of logbook data. This has important implications when comparing trends in these indices.

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

$$\log\left(\mu_i\right) = X_i^T \beta$$

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

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

$$\log\left(\mu_i\right) = \log\left(E_i\right) + month_{i(j)}\beta_j\left(site_{i(k)}\beta_k\right) + age_{i(l)}\beta_l\left(year_{i(m)}\beta_m\right),$$

where log (E_i) is an offset parameter for fishing effort and j,k,l,m indicate the level for each of the four factors.

In the present assessment, the model adequately fitted data from gillnets and line-trawls.

Trends in standardized total (ages 3-10 combined) annual catch rates, expressed in terms of numbers of fish, are shown in Fig. 9a. For gillnets there is no trend over the period 1995-97, but catch rates declined rapidly from 1997 to 1999 then remained stable but low from 1999 to 2006. For line-trawls, catch rates show a decline from 1995, but have been relatively stable with no clear trend from 1997 to 2006.

Two standardized annual catch rate-at-age indices were also produced in the present assessment, one for each gear type. All effects included in the model were significant. The standardized gillnet and line-trawl catch rate-at-age indices for 1995-2006 are given in Table 8 and Fig. 9b and 9c. For gillnets, several year classes were well-represented in catches during 1995-97 but these are replaced by weaker year classes in subsequent years. During 2002-06, the 1997 and 1998 year classes are not strongly represented in the sentinel gillnet catch.

For line-trawls, catch rates were higher for the 1989 and 1990 year-classes during 1995-96. In 2000-02, sentinel line-trawl catch rates improved for younger fish (3 and 4 year olds) compared to 1995-99, but those for older fish continued to decline. The estimates for age 3 in 2003, age 4 in 2004, and age 5 in 2005 (i.e. the 2000 cohort) are the lowest in the series for those ages. The estimates for ages 5-7 in sentinel line-trawl in recent years have improved slightly and reflect the appearance of the 1997 and 1998 year classes. The 1999 year class also appears reasonably strong at ages 4-5 then below average for age 6 in sentinel line-trawl; this year class is weak in sentinel gillnet and in other (mobile gear) indices. In 2006, linetrawl catch rates for all ages (3-10) increased, suggesting a year effect in the data rather than a change in stock size (Fig. 9c).

As described in recent 3Ps cod assessments, interpretation of the sentinel catch rate indices is difficult. Sentinel fisheries were free from competitive influences during 1995-96 as the commercial fishery was closed. However, commercial fisheries may have had some disruptive influence on the execution of the sentinel fishery during since 1997, particularly in Placentia Bay. The concentration of fishing effort in Placentia Bay, primarily with gillnets, may have had a negative influence on the sentinel gill-net catch rates. Competition with commercial fishers for fishing sites, local depletion, inter-annual changes in the availability of fish to inshore, and shifts in the timing of sentinel fishing to accommodate periods of commercial fishing could all influence mean catch rates between years. The extents to which such effects influence catch rates are not fully understood. Gillnets do not clearly track the 1997 and 1998 cohorts which are evident in other indices of the 3Ps cod stock. The decline in sentinel gill net catch rates after the fishery reopened in 1997 are consistent with the inshore catch rate data from science log-books and the high estimates of exploitation from tagging in Placentia Bay. In contrast, the line-trawl catch rates, which mainly incorporate data from areas west of the Burin Peninsula, show less of a decline and rates show some indication of the appearance of the stronger 1997 and 1998 year classes. The cohort signals in the sentinel line-trawl are also reasonably consistent with the DFO RV survey index, the GEAC survey index (see below), and the commercial catch-at-age, all of which show that the 1997 and 1998 year classes were relatively strong.

SCIENCE LOGBOOKS (<35 ft sector)

A new science logbook was introduced to record catch and effort data for vessels <35 ft in the re-opened fishery in 1997. Prior to the moratorium, the only data for vessels <35 ft came from purchase slips, which provided limited information on catch and no information on effort. Since the moratorium, catch information comes from estimated weights and/or measured weights from the dockside monitoring program. Catch rates have the potential to provide a relative index of temporal and spatial patterns of fish density, which may relate to the overall biomass of the stock. There are currently data for about 120,000 records in the database, although only 5,700 for 2005 and 5,900 for 2004, the two lowest values since 1997. A notable finding in this assessment and the 2006 assessment was that the percentage of cod catch in the logbooks for the <35’ sector has decreased over time, from about 70% in 1997 and 1998 to currently less than 30%. These figures exclude catches recorded without location and adding these catches would bring the recent figures up to about 50%. Part of the decline may be due to an increasing portion of small boat owners taking their allocation in offshore unit areas; a total of 21,000 records in the database have fishing area reported as area 88 when there is no such inshore area and this code is used to indicate offshore areas. Nonetheless, a substantial fraction of the catch and effort data from smaller vessels is not available for examination.

These data pertain to the inshore fishery, i.e. unit areas 3Psa, 3Psb, and 3Psc. An initial screening of the data was conducted and observations were not used in the analysis if the amount of gear or location was not reported (or reported as offshore), more than 30 gillnets were used, or <100 or >4,000 hooks were used on a line-trawl. As observed in previous assessments, preliminary examination of the logbook data indicated that soak time for gillnets is most commonly 24 hours with 48 hours the next most common time period. In comparison, line-trawls are typically in the water for a much shorter period of time – typically 2 hours with very few sets more than 12 hours. About 23% of the records were excluded using these criteria and this percentage has been increasing in recent years.

The issues described above have resulted in a substantial fraction of <35 ft catch not being available for analysis. In 2006 only 22% of the <35 ft gillnet catch and 24% of the <35 ft linetrawl catch is included in the CPUE standardization.

As in previous assessments, effort was treated as simply the number of gillnets, or hooks for line-trawls (1000’s), deployed in each set of the gear; soak times were not adjusted as the relationship between soak time, gear saturation and fish density is not known. Catch rates from science logbooks are expressed in terms of weight (whereas those from the sentinel fishery are expressed in terms of numbers); commercial catches are generally landed as head-on gutted and recorded in pounds; these were converted to kg by multiplying by 2.2026.

The frequency distribution of catches per set is skewed to the right for most gears (not shown). For gillnets, catches per set are typically 100-200 kg with a long tail on the distribution extending to about 2 t. The distribution of catches for line-trawls was similarly skewed.

The catch from 3Ps was divided into cells defined by gear type (gillnet and line-trawl), location (defined as fishing areas 29-37 and illustrated in Fig. 10a), and year (1997-2006).

Initially, un-standardized CPUE results were computed and examined; in this preliminary analysis plots of median annual catch rate for gillnets and line-trawl were examined for each year-location. Catch rates for gillnets tend to be higher in areas 29-31 (Placentia Bay) than elsewhere. The 2006 gillnet catch rates were not markedly different from recent values and were lower than those in the earliest part of the time series (Fig. 10b). For line-trawl, most data comes from areas west of the Burin Peninsula and the results areas 29-33 are based on fewer data (generally <50 sets per year) and show more annual variability. Line-trawl catch rates in 2006 were generally good across 3Ps and values for four areas (32-35, 37), mostly around the Burin Peninsula and in Fortune Bay and west, were the highest in the time series.

Prior to modeling, the data were aggregated within each gear-year-month-location cell, and the aggregated data were weighted by its associated cell count. Catch per unit effort (CPUE) data were standardized to remove site (fishing area) and seasonal (month, year) effects. Note that sets with effort and no catch are valid entries in the model.

In the present assessment, the model adequately fitted data from gillnets and line-trawls and two standardized annual catch rate indices were produced, one for each gear type. All effects included in the model were significant.

From model results for gillnets, catch rates have shown a downward trend during 1998-2000 and have subsequently been low but stable (Fig. 10c). The gill-net catch rates have declined from about 37 kg per net in 1997 to 17 kg per net in 2001, but subsequently remained fairly constant at 19-21 kg/net during 2002-06. For line-trawls, catch rates declined from 303 kg/1000 hooks in 1997 to a minimum of 203 kg/1000 hooks during 2002. Values for 2003 to 2006 have been progressively higher and the 2006 value is the highest observed at 353 kg/1000 hooks.

The observed trends in commercial catch rate indices for the inshore fishery are influenced by many factors. There have been substantial annual changes in the management plans in the post-moratorium period (Brattey et al. 2003). In addition, catch rates from mobile commercial fleets can be related more to changes in the degree of local aggregation of cod and can be a poor reflection of overall trends in stock abundance, particularly for stocks in decline. While this is likely to be a bigger problem with respect to otter-trawl derived catch rates, gillnets and line-trawls can also be deployed to target local aggregations. For inshore fisheries, catch rates can also be strongly influenced by annual variability in the extent and timing of inshore as well as long-shore cod migration patterns. Similarly, the changes in management regulations, particularly the switch from a competitive fishery to IQs and for some vessels the need to fish cod as by-catch to maximize financial return, can have a strong influence on catch rates that is unrelated to stock size (DFO 2006). Consequently, inshore commercial catch rate data must be interpreted with caution. Where these data can be dis-aggregated into ages independently of the commercial catch at age data (as is the case with the sentinel survey) the information may be more easily interpreted in terms of stock size. Despite these issues, the initial declines in gillnet and line-trawl catch rates following the re-opening of the fishery in 1997 were cause for concern. The increase in modeled catch rates for line-trawl observed in 2003-06 appear to be reflecting the appearance of the 1997 and 1998 year classes in the inshore catch; the increase observed in 2005-06 appears to be reflecting the increased growth, larger size, and heavier weight of these same year classes. Close inspection of the commercial catch-at-age data has shown that cod aged 8 and 9 comprised 23% of the total linetrawl catch in 2006 compared to an average of about 10% prior to 2004. Modeled gillnet catch rates have shown no significant changes in recent years.

INDUSTRY LOGBOOKS (>35 ft sector)

Median annual catch rates by gear sector and unit area from log books of larger vessels (>35' sector) were also examined. The data for gillnets was too sparse for firm conclusions to be drawn. The large vessel (>100 ft) otter trawl catch rates showed strong seasonality with generally lower catch rates during late fall (October-December) and highest catch rates in February (Fig. 11) ; superimposed on this seasonality there was an overall declining trend in catch rates from 1999 to 2004, but the 2005 and 2006 values were higher. The trends remain difficult to interpret in terms of stock size given that the large vessels typically fish a localized area in the vicinity of southern Halibut Channel (see Fig. 2) during the winter months when cod in this area are highly aggregated.

TAGGING EXPERIMENTS

A project involving tagging of adult (>45 cm) cod initiated in 1997 has continued but only offshore cod have been tagged since the fall of 2003. The purpose of the tagging study is to provide information on movement patterns of 3Ps cod as well as obtain ongoing estimates of exploitation rates on different components of the stock. Further details are provided below and in Brattey and Healey (2006).

ESTIMATES OF EXPLOITATION (HARVEST) RATE

The methods used to estimate average annual exploitation rates (harvest rates, in percent) for cod tagged in different regions of 3Ps are described in detail previously (Brattey and Cadigan 2004; Brattey and Healey 2003, 2004; Cadigan and Brattey 2003, 2006). During 2001-05, the mean exploitation rate was relatively high for cod tagged in Placentia Bay (3Psc, 22-31%) compared to those tagged in Fortune Bay (3Psb, 10-12%), Burgeo Bank/Hermitage Channel (3Psd, 1-8%) or offshore in Halibut Channel (3Psg/h, 2-6%), respectively.

During 2006, mean annual exploitation estimates remained high for cod tagged in Placentia Bay (25%), and showed no major changes for cod tagged in Fortune Bay (13%), Burgeo Bank/ Hermitage Channel (2%), or Halibut Channel (5.2%). The 2006 estimates for inshore tagging are for cod aged 7+ and as such are not strictly comparable to estimates for previous years which have more younger fish. Cod are normally at least 4 years old when tagged and no inshore tagging was conducted during 2004-06. Offshore tagging (Halibut Channel area) was conducted in 2004 and 2005.

As in the previous assessment, mean exploitation was low among cod tagged offshore (3Psg/h) in spite of substantial offshore landings. These low offshore exploitation rates are consistent with a large offshore biomass in relation to the magnitude of recent offshore catches. However, the offshore estimates of exploitation are considered uncertain because of the limited timing and localization of offshore tagging coverage and restricted distribution of fishing activity in the offshore. There is also greater uncertainty in the reporting rates of tags from the offshore, and in the survival of fish caught and released after tagging offshore in deep (>200 m) water.

The timing of offshore tagging coverage was switched from April to December in 2003-05 to address some of these concerns about offshore tagging and to investigate whether winter catches in the offshore portion of 3Ps includes northern Gulf (3Pn4RS) cod. Both the percentage of tagged cod returned and distribution of recaptures (all within 3Ps) are similar to those of cod tagged in the offshore of 3Ps during April.

Brattey and Healey (2006) emphasized that the 2005 results pertain mostly to the 6+ portion of the 3Ps cod stock because no inshore tagging has been conducted since the fall of 2003 and at that time tagged would typically be at least 4 years old. The 2006 results therefore pertain mostly to 7+ cod. Also, the exploitation rate on cod that are newly recruited to the fishery during 2006 cannot be determined from the tagging returns as none of these cohorts were tagged, at least in the inshore. The fishery in the past three years (2003-05) has mostly exploited the relatively strong 1997 and 1998 year classes which in 2006 were 8 and 9 years old, respectively (Brattey et al. 2005, 2006). Subsequent year classes (2000-04) appear to be weaker (results herein); consequently, Brattey and Healey (2006) cautioned that as the 1997 and 1998 year classes age and grow beyond the main selection size of gillnets, the fishery will switch to these weaker incoming year classes which could result in an increase in fishing mortality if current catch levels are maintained. To address this issue inshore tagging was resumed in 2007, with approximately 3,800 cod tagged and released widely across unit areas 3Psa/b/c. Recaptures from these experiments in the coming years will provide information on harvest rates of more recent year classes.

The tagging results for 2006 agree with previous findings (Brattey et al. 2001b, 2002b; Brattey and Healey 2004, 2005, 2006), and indicate restricted mixing of cod from different portions of the 3Ps stock area as well as higher exploitation of adult cod tagged inshore, particularly in Placentia Bay. The complex migration patterns and stock structure may have some influence on the various abundance indices that are available for the stock (see Brattey et al. 2005) and add uncertainty to any sequential population analyses of the stock as a whole. The limited mixing of inshore cod in particular make it difficult to determine whether inshore indices are reflecting trends in the stock as a whole or mainly of inshore components of the stock. Trends in the indices differ between inshore and offshore and are difficult to reconcile with the tagging results. Tagging suggests lower exploitation in the offshore yet the DFO RV and GEAC offshore abundance indices have shown variability with no clear trend or declining trends. In contrast, inshore indices (sentinel) have been stable for several years (albeit at a lower level than when the fishery opened in 1997), but tagging suggests that in some inshore area such as Placentia Bay exploitation has consistently been relatively high (~25%). The discrepancy between trends in inshore/offshore abundance indices and tagging estimates of exploitation was also noted in the 2006 assessment and remains enigmatic and difficult to explain.

RESEARCH VESSEL SURVEY

Stratified-random surveys have been conducted in the offshore areas of Subdiv. 3Ps during the winter-spring period by Canada since 1972 and by France for the period 1978-92. The two surveys were similar with regard to the stratification scheme used, sampling methods and analysis, but differed in the type of fishing gear and the daily timing of trawls (daylight hours only for French surveys). Canadian surveys were conducted using the research vessels A. T. Cameron (1972-82), Alfred Needler (1983-84), and Wilfred Templeman (1985-2007). From the limited amount of comparable fishing data available, it has been concluded that the three vessels had similar fishing power and no adjustments were necessary to achieve comparable catchability factors, even though the A.T. Cameron was a side trawler. The French surveys were conducted using the research vessels Cyros (1978-91) and Thalassa (1992) and the results are summarized in Bishop et al. (1994).

The stratification scheme used in the DFO RV bottom-trawl survey in 3Ps is shown in Fig 12. Canadian surveys have covered strata in depth ranges to 300 ftm since 1980. Five new inshore strata were added to the survey from 1994 (779-783) and a further eight inshore strata were added from 1997 (293-300) resulting in a 12% increase in the surveyed area. For surveys from 1983 to 1995, the Engel 145 high-rise bottom trawl was used. The trawl catches for these years were converted to Campelen 1800 shrimp trawl-equivalent catches using a length-based conversion formulation derived from comparative fishing experiments (Warren 1997; Warren et al. 1997; Stansbury 1996, 1997). For the increased area fished since 1997 only the Campelen 1800 trawl has been used. In the 2007 assessment, new indices based on unconverted Campelen data for this augmented survey area were presented for the first time; this larger area has now been fished for nine of the last ten years (1997-2007, excluding 2006 when the survey was not completed due to operational difficulties with the vessel). Two survey time series can now be constricted from the catch data from Canadian surveys. To avoid confusion, throughout this document as well as the Science Advisory Report (DFO, 2007) the larger surveyed area that includes new inshore strata is referred to as the “combined inshore/offshore survey” and the time series extends from 1997-2007, whereas the original smaller surveyed area is referred to as the “offshore” survey and the time series that incorporates a random stratified design extends from 1983-present.

The results (in Campelen or Campelen-equivalent units, see below) for the Canadian “offshore” survey are summarized by stratum in terms of numbers (abundance) (Table 9) and biomass (Table 10). Data for the 1983-2006 period are in Brattey et al. (2005). The timing of the surveys, number of sets fished, and vessel(s) used are also described. Strata for which no samples are available were filled in using a multiplicative model. Timing of the survey has varied considerably over the period. In 1983 and 1984 the mean date of sampling was in April, in 1985 to 1987 it was in March, and from 1988 to 1992 it was in February. Both a February and an April survey were carried out in 1993; subsequently, the survey has been carried out in April. The change to April was aimed at reducing the possibility of stock mixing with cod from the adjacent northern Gulf (3Pn4RS) stock in the western portion of 3Ps. The stock mixing issue is described in more detail in previous assessments (Brattey et al. 2006).

ABUNDANCE, BIOMASS, AND DISTRIBUTION

A time series of trawlable abundance and biomass indices from DFO random stratified RV offshore survey is given in Fig.13. The abundance and biomass index estimates for the 2005 survey were 42.7 million fish and 46,059 t. There was no estimate for 2006. The corresponding values for the 2007 survey were 38.7 million fish and 34,740 t. In the 2007 survey there were no major changes in the distribution of survey catches compared with other recent surveys. The strata with the largest catches in terms of biomass were strata 298, 315, and 319 and these 3 strata accounted for 84% of the biomass index and 62% of the abundance index for the surveyed portion of the stock area.

Trends in the abundance index and biomass index from the RV survey are shown for the offshore (i.e. index strata only, depths less than or equal to 300 ftm, excluding the new inshore strata) and the combined inshore/offshore area (Fig. 13). The time series for abundance and for biomass from 1983 to 1999 show considerable variability, with strong year effects in the data. Both abundance and biomass are low after 1991 with the exception of 1995, 1998, and 2001. The 1995 estimate is influenced by a single enormous catch contributing 87% of the biomass index and therefore has a very large standard deviation. The 1997 Canadian index was the lowest observed in the time series, which goes back to 1983, being less than half of the 1996 index. The size composition of fish in the 1997 RV survey suggested that this survey did not encounter aggregations of older fish, yet these fish were present in the 1996 survey and in subsequent commercial, sentinel, and survey catches. The minimum trawlable abundance index has declined from 88.2 million in 2001 to 38.7 million in 2007. The minimum trawlable biomass estimate has been variable with no clear trend in the post-moratorium period, although the most recent value is the lowest at 34,740 t. In general, trends in the abundance and biomass indices are difficult to discern due to high intra-annual variability. Excluding the 1995 and 1997 survey results would suggest the time series can be broadly divided into three periods – highest during 1983-90, lowest during 1991-97, and intermediate values during the most recent period 1998-2007. The trends and degree of variability in the combined inshore/offshore survey are almost identical to those of the offshore survey in spite of the 12% increase in surveyed area; the only exception is in 2004 when the combined inshore/offshore survey shows higher biomass and abundance due mainly to a large estimate from inshore stratum 294 (see Tables 9 and 10).

The survey data are also expressed in terms of catch rates (i.e. mean numbers per tow) for the offshore survey (Fig. 14a) for the period 1983-2007 and for the eastern and western portions of the area separately (Fig. 14b). The trend for the eastern portion of the stock area is similar to that for the abundance and biomass indices for the stock area as a whole. Catch rates for the eastern portion show considerable variability, with strong year effects, but are generally higher in the 1980's, and low after 1991, and intermediate in the late 1990's and early 2000's. The 1995 estimate is influenced by a single large catch taken at the southern end of Halibut Channel. The catch rates for the western (Burgeo) portion, which has been surveyed in April since 1993, are variable, but are generally higher than those for the eastern region. The value for 1998 is high due to several large catches on Burgeo Bank and vicinity that may have included fish from the neighbouring northern Gulf (3Pn4RS) cod stock. Catch rates for the western region have, in general, tended to be more variable than from the larger eastern region. The age-aggregated surveys in recent years do not give any strong indications of a significant influx of cod from the neighbouring 3Pn4RS stock.

To investigate whether there have been annual shifts in the distribution of the stock at the time of the survey, trends in the proportion of the total abundance observed in three different regions of the stock area were compared (Fig. 15); the areas were: the inshore (strata 293-298, and 779-783), the Burgeo area (Hermitage strata 306-309, and 714-716), and the eastern area (remaining strata). Data from the combined inshore/offshore survey were used and the Campelen trawl was fished in all these surveys. The proportions were variable, with typically 30-70% observed in the larger eastern area, 20-60% in the western area, and around 10% in the inshore area; an exception was 2005 when almost 40% of the total abundance index was observed in the inshore, again due to a large estimate for inshore stratum 294.

The spatial distribution of catches of cod during the 2007 survey was examined, for all ages combined (Fig. 16a) and separately for ages 1-4, and ages 5-8 (Fig. 16b and 16c). Brattey et al. (2007) showed that during 1999-2005 cod were caught over a considerable portion of NAFO Div. 3P with the largest catches typically in the southern Halibut Channel area, on Burgeo Bank and vicinity, in the outer portion of Fortune Bay, and in 3Pn. During these years cod were consistently scarce in the deep water below the mouth of Placentia Bay and in the inner reaches of Hermitage Channel. Since 2000, catches of cod on the central portion of St. Pierre Bank have become progressively scarcer. In the 2003 and 2004 surveys, the distribution of cod was similar to that of the 2002 survey, with no large catches on St. Pierre Bank. In the 2005 and 2007 surveys, there were fewer older fish (>6 yr) but the distribution of survey catches shows no major changes. Larger catches were taken mainly on Burgeo Bank, the outer portions of Fortune Bay, northern St. Pierre Bank and Halibut Channel.

The plots of age-disaggregated distribution of survey catches show that although there were no very large catches of 1 or 2 yr old cod, 1 yr olds were widely distributed (Fig. 16b). The overall mean per tow for 1 yr olds was the highest in the time series at 3.2 (see Table 11A). Larger catches of 3 and 4 yr olds were taken mainly on Burgeo Bank, Fortune Bay, and Halibut Channel. Catches of 5 yr old were taken only in Halibut Channel and at one site in outer Fortune Bay and there were no large catches of older fish (>age 6) (Fig. 16c).

Colbourne and Murphy (2008) updated their previous analysis (Colbourne and Murphy 2005) of changes in the distribution of survey catches in relation to temperature and concluded the following: "The most evident trend in the numbers of cod caught per set during the multi-species surveys was the high number of zero catches in the <0°C water on St. Pierre Bank and regions to the east of the Bank, mainly from 1985 to 1998 but also from 2001 to 2003. During 1999 and 2000 larger catches became more wide spread over St. Pierre Bank as cold (<0°C) water disappeared from the area. In general, cod tend to prefer the warmer (2°-6°C) portion of the available habitat with a slightly warmer preference based on weight than on total numbers. Finally, variations in the estimated abundance and biomass of cod from the RV surveys in strata with water depths <92 m are significantly correlated with bottom temperatures for that depth range, indicating a potential climate effect on cod distribution in this area".

AGE COMPOSITION

Survey numbers at age are obtained by applying an age-length key to the numbers of fish at length in the samples. The current sampling instructions for Subdiv. 3Ps require that an attempt be made to obtain 2 otoliths per one cm length class from each of the following locations: Northwest St. Pierre Bank (strata 310-314, 705, 713), Burgeo Bank (strata 306-309, 714-716), Green Bank-Halibut Channel (strata 318-319, 325-326, 707-710), Placentia Bay (strata 779-783) and remaining area (strata 315-317, 320-324, 706, 711-712). This is done to spread the sampling over the survey area. The otoliths are then combined into a single age-length key and applied to the survey data. The resulting estimates of age-disaggregated mean numbers per tow are given in Table 11a. These data can be transformed into trawlable population at age by multiplying the mean numbers per tow at age by the number of trawlable units in the survey area. This is obtained by dividing the area of the survey by the number of trawlable units. For the “offshore” survey in 3Ps, the survey area is 16,732 square nautical miles including only strata out to 300 ftms (and excluding the relatively recent inshore strata added in 1997). The swept area for a standard 15 min tow of the Campelen net is 0.00727 square nautical miles. Thus, the number of trawlable units in the 3Ps survey is $16{,}732 \div 0.00727 = 2.3 \times 10^6$.

The mean numbers per tow at age in the DFO RV survey for the “offshore” index is given in Table 11a and results for ages 1-15 are shown the form of “bubble” plots in Fig. 17a. Cod up to 20 years old were not uncommon in survey catches during the 1980’s, but the age composition became more contracted through the late 1980s and early 1990s. Survey catches over the post-moratorium period have consistently shown few survivors from year-classes prior to 1989. Recent surveys (2000-04) indicate that the 1997 and 1998 year classes are stronger than those seen through the mid-1990s, given that their catch rates are much higher and they track through the time series quite consistently. These 1997 and 1998 year classes also appear strong in GEAC surveys conducted in 2001-04, and to a lesser extent in recent sentinel line-trawl (Table 8). However, in the 2005 and 2007 survey index the 1997 and 1998 year classes are much weaker relative to recent catches of the corresponding ages (ages 7 and 8 in 2005 and ages 9 and 10 in 2007). The 1999 and 2000 year classes also appear weak in the 2005 and 2007 surveys relative to those of 1997 and 1998. The 2001 and 2002 year classes appeared stronger in 2005, but are poorly represented in 2007; also, close inspection of the distribution of survey catches shows that these ages were much more strongly represented in the western portion of the stock area (see below). Overall, the indications are that none of the 2000-2004 year classes are strong (a more quantitative analysis of recruitment is given below). This indication of poorer incoming recruitment from the survey index is a significant issue as these year classes will supply any commercial catch over the next several years. Overall, the age composition of survey catches has expanded in recent years with ages up to 17 yrs represented; however, the age structure remains somewhat contracted relative to the mid-1980s with presently few fish older than age 15.

Survey catches from the inshore strata surveyed since 1997 show a highly variable age composition with strong year effects and little evidence of cohort tracking (Table 11b, Fig. 17b). In the last three surveys cod aged 4-12 have tended to be more abundant relative to the 1997-2004 period. Note that some data are available for 2006 as the survey in that year was not completed but covered inshore strata reasonable well.

The age composition of the survey catches from the eastern and western portions of the stock area can also be compared from 1993 onwards (Table 11c, Fig. 17c and 17d). The purpose was to look for evidence of an influx of northern Gulf cod into 3Ps at the time of the survey. Catches-at-age per tow have tended to be higher in the western portion of the stock area, with a prominent year effect in 1998, when several age classes (3-9) appeared strongly in the survey catches in the western portion; however, none of these year classes have subsequently appeared strongly in either stock area. A notable finding in the 2000-04 survey catches from western (and eastern) 3Ps is the consistently strong representation of the 1997 and 1998 year classes; however, these year classes appear weak in the two most recent surveys (2005 and 2007) from both regions of the stock area. The 1999 year class appeared to be quite strong in the western portion of the surveyed area in 2002-04, but has subsequently been poorly represented. In the 2005 survey, 3 and 4 yr old cod (2001 and 2002 yr classes) were strongly represented in the western portion but are poorly represented in the 2007 survey. In general, the age composition of recent survey catches from eastern and western 3Ps suggest that incoming recruitment (2000-04 year classes) is weaker than was observed when the 1997 and 1998 were recruiting to the commercial stock. Early indications are that the 2006 year class may be stronger, given that 1 yr olds were widely distributed throughout the eastern portion but not the western portion of 3Ps; however, more data are required before firm conclusions can de drawn about the relative strength of this year class. The age-disaggregated data do not give any indications of an influx of northern Gulf cod at the time of the 2007 survey and show that the age composition of survey catches from western 3Ps tends to be highly variable.

SIZE-AT-AGE (MEAN LENGTH AND MEAN WEIGHT)

The sampling protocol for obtaining lengths-at-age (1972-2007) and weights-at-age (1978-2007) has varied over time (Lilly 1998), but has consistently involved stratified sampling by length. For this reason, calculation of mean lengths and weights included weighting observations by population abundance at length (Morgan and Hoenig 1997), where the abundance at length (3-cm size groups) was calculated by areal expansion of the stratified arithmetic mean catch at length per tow (Smith and Somerton 1981).

Mean lengths-at-age were updated using the 2007 survey data and values have been revised from those reported in previous assessments (Table 12; Fig. 18a). Mean lengths have varied over time, and a peak occurred in the mid-1970s for young ages (3-4) and progressively later to 1980 for older ages. This peak does not track individual year-classes particularly well; in general, year-classes born in the 1970s experienced faster growth than those born in the 1980s (Lilly 1996; Chen and Mello 1999a). There was a decline in length-at-age from the early 1980s to the late 1980s or the early to mid-1990s, with the duration of the decline increasing with age (Fig. 18a and b). There has been an increase in length-at-age since the mid-1990s, but not to the levels seen in the early 1980s.

Year-to-year variability at older ages has been considerable (as much as 20 cm at age 10) during the past decade or so. There has not yet been a thorough analysis to determine if these differences were caused mainly by environmental factors (e.g. temperature or prey availability), cohort factors (e.g. cohort abundance or distribution) or any of the numerous additional possibilities, such as changes in maturation schedules (Chen and Mello 1999b) or size-selective fishing mortality. Variability associated with sampling or processing could also be important.

Much of the high variability in length-at-age at older ages (say 7-10) appears to be caused by cohort effects. For example, the 1989, 1990 and 1992 year-classes were relatively long at age, whereas the 1988, 1991 and particularly the 1987 year-classes were relatively short (Brattey et al. 2003). There has not yet been an investigation of the reasons for such cohort effects.

Another important contributor to variability in the estimates of size-at-age at older ages is the increase in range of sizes within a cohort as it ages, combined with a decrease in sample size at length, the latter being a simple consequence of declining abundance.

Selectivity characteristics of the research trawl are of concern for accurate estimation of size-at-age at younger ages, particularly ages 1 and 2. It may be assumed that estimation at younger ages has improved since the change to the Campelen trawl in 1996.

An exploration of the effects of environmental factors such as temperature has not been conducted because there appears to be negative growth at ages less than 10 for at least 2 cohorts during each of the intervals 1977-78, 1980-81, 1989-90 and 1993-94 (Lilly 1998). Such extreme year effects could result from the existence within 3Ps of groups of fish with different growth rates, coupled with annual variability in the proportion of the age sample taken from each of those groups. This possibility is discussed further by Lilly (1996).

Values for mean weight at age were updated with data from the 2007 survey and values have been revised from those reported in previous assessments. As expected, the patterns in mean weight-at-age (Table 13; Fig. 19a and b) appear to be very similar to those in length-at-age. The high year-to-year variability at older ages in recent years, noted above for length-at-age, is much more pronounced in weight-at-age, with weights-at-age in some years being more than twice that in others. The weight-at-age estimates may include more sampling variability than the length-at-age estimates in years prior to 1990 because they are based on much smaller sample sizes (Lilly 1998). The weight-at-age data also include variability associated with among-year and within-year variability in weight at length (condition).

CONDITION

Condition of cod (mean somatic condition and liver index) were not updated for the 2007 assessment, but will be updated in subsequent assessments. The somatic condition and liver index of each fish were expressed using Fulton's condition factor $((W/L^3)*10^5)$, where W is gutted weight (kg) or liver weight (kg) and L is length (cm). Condition and liver index at age were calculated as described above for size-at-age.

Mean somatic (gutted) condition at age (Table 14; Fig. 20A) was variable from 1978 to 1986 and relatively constant from 1986 to 1992. It dropped suddenly in 1993, rose to an intermediate level in 1996-1998 and subsequently declined, although the most recent values have returned to an intermediate level. Condition at age could be influenced by changes in length-at-age (see above) combined with the tendency for condition calculated with Fulton's formula to increase with body length. For this reason, condition at length (Fig. 20B) might be more appropriate than condition at age as an indicator of changes in condition over time. In addition, much of the apparent annual variability in the survey data is related to the timing of the surveys (Lilly 1996). When mean condition in each of three length groups was plotted against the median date of sampling during the survey (Fig. 20C), there was a gradual decline in condition from the earliest median date (Feb. 7) to approximately late April, after which there was an increase. The time course of changes from late April onward is poorly defined because of the paucity of observations. Sampling of cod caught during sentinel surveys in the inshore in 1995 revealed a similar decline in condition during the winter and early spring, with a minimum in late April to early June (Lilly 1996).

Mean liver index at age (Table 15; Fig. 21A) had a pattern similar to that seen in somatic condition, except that the values in 1983 were more clearly at higher levels than during other years in the early 1980s and there was a more pronounced peak in the late 1980s and early 1990s. When the values for specific size groups (Fig. 21B) were plotted against the median date of sampling (Fig. 21C), there was a very pronounced decline in liver index during winter and early spring. A similar decline was evident in samples from the 1995 sentinel survey (Lilly 1996).

From the above, it is clear that the low levels of somatic condition and liver index in recent years (1993-2005) are mainly a consequence of sampling near the low point of the annual cycle and are not indicative of a large and persistent decline in well-being. Nevertheless, it is apparent that there was some annual variability within this recent time period. To explore this a little further, percentiles of gutted condition and liver index were calculated for all cod of a relatively wide size range (40-59 cm) sampled during the 1993-2005 period. There was considerable variability in gutted condition (for the period 1993-2003: median = 0.693; 90th percentile range = 0.597 – 0.792; n = 1814). The distributions did not vary much among years, but the medians in 1996, 1998, 2003 and 2005 were somewhat higher than in other years (Fig. 22). Percentiles for liver index were also highly variable (for the period 1993-2003: median = 0.0174; 90th percentile range = 0.0064 – 0.0376; n = 1825). Median liver index was highest in 1998, 2003 and 2005 and lowest in 1999 and 2001.

MATURITY AND SPAWNING

The gonads of samples of cod collected during annual DFO winter/spring bottom-trawl surveys were visually inspected and assigned to the category “immature” or “mature” according to the criteria of Templeman et al. (1978). Mature fish were further classified as maturing, spawning, or spent (see Morgan and Brattey 1996). Visual inspection is not always totally accurate and there can be difficulties in classifying some stages. For example, mature fish that are skipping a spawning year (Rideout et al. 2005) may be erroneously classified as immature or vice-versa. Mature fish with a developing gonad may resorb the eggs and not spawn that year. Also, mature fish that have recently shed a batch of hydrated eggs may be classified as maturing when they are in fact spawning. The extent to which these errors influence the estimation of proportion mature and proportion at each stage of maturation has not been fully evaluated. Bolon and Schneider (1999) showed using histological methods that the visual method of classification was reasonably accurate, but tended to slightly underestimate the proportion of spawning fish and overestimate the proportion of maturing fish among cod sampled in Placentia Bay when spawning was taking place; however, this would not influence the estimation of the proportion mature/immature which is conducted mainly to estimate the spawning stock biomass. Morgan and Rideout (2005) estimated the frequency of skipped spawning in 3Ps cod and found that on average 84% of female cod in 3Ps were estimated to spawn each year with little variability in this estimate from year to year; this finding suggests that in most years failure to detect skipped spawning in mature fish would not have a major influence on estimation of spawning stock biomass of 3Ps cod.

In the assessments conducted since 2000, maturation of 3Ps cod has been estimated by cohort; prior to 2000 maturation was estimated by year. In addition, data extending back to 1954 have been included in the analyses of maturation. Annual estimates of age at 50% maturity (A50) for females from the 3Ps cod stock, collected during annual winter/spring DFO RV surveys, were calculated as described by Morgan and Hoenig (1997). Trends in age at 50% maturity (A50) are shown in Fig. 23A and only cohorts with a significant slope and intercept term are shown; parameter estimates (and SE’s) for cohorts from 1954 to 2001 are given in Table 16 and the model did not adequately fit the data from subsequent cohorts (2002 onwards). The estimated A50 was generally between 6.0 and 7.0 for cohorts from the mid-1950s to the early 1980s, but declined dramatically thereafter to 5.1 in the 1988 cohort (Table 16, Fig. 23A). Declining age at maturity has been observed in other cod stocks and may reflect genetic changes in the population that may be cause for concern (Trippel 1995; Heino et al. 2002; Olsen et al. 2004, 2005). Age at maturity by cohort remained low but fairly constant for the 1988-1994 cohorts; estimates for the 1995 and 1996 cohorts appeared to be increasing, but are followed by a further decline for the 1997 and 1998 cohorts with the latter having the lowest A50 in the time series at 4.6 yr. More recent cohort have similar A50 to those of 1998-2004, but estimates for the most recent cohorts (2000-01) are more uncertain because only younger ages from these cohorts are available to estimate A50. Males show a similar trend in A50 over time (data not shown), but tend to mature about one year earlier than females.

Annual estimates of the proportion mature at age are shown in Table 17; these were obtained from the cohort model parameter estimates in Table 16. The 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 1970s and 1980s, particularly for ages 5, 6, and 7 (Fig. 23B). Also, the model estimates for the proportion mature at age 6 in the 1997 and 1998 cohorts are much higher than those of recent cohorts at the same age and this has a substantial effect on the recent estimates of spawner biomass for this stock. In addition, the age composition of the spawning biomass may have important consequences in terms of producing recruits. 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). Several characteristics of the spawning stock biomass (SSB) of 3Ps cod (and other NF fish stocks) were explored for variability and for relationships with the residuals from Beverton-Holt stock-recruit models (Morgan et al. 2000). Weighted mean age of the SSB, proportion of first time spawners, and proportion female all showed substantial variability over time, but the results were not consistent among the stocks examined and were difficult to interpret. Morgan et al. (2007) also found that there was no consistent relationship between age-composition of the spawning stock and recruitment in 3Ps cod

The time series of maturities for 3Ps cod shows a long-term trend as well as considerable annual variability. To project the maturities for 3Ps cod forward to 2010, for each age group the average of the last three estimates for the same age group was used (Table 17). To fill in missing age groups in the early part of the time series the average of the first three estimates for the same age was used. There has been considerable debate at recent assessments about the best way to project maturities forward for 3Ps cod and other stocks. The present method can result in large changes in the estimates of proportion mature for incomplete cohorts, and hence considerable variability in the most recent estimates and projections of spawning stock biomass. For the most recent cohorts there are no data for older ages and model fits use data from younger ages. Alternative methods that also use information from older ages in adjacent cohorts are presently being explored as a possible way of providing more reliable estimates of maturity for unfinished cohorts and for projections.

Maturities of adult female cod sampled in four sub-areas of NAFO subdivision 3Ps during winter/spring RV bottom-trawl surveys from 1983-2007 are shown in Fig. 24. Note that immature fish are excluded from this analysis. Values are included for some areas for 2006, but survey coverage was limited and the values are more uncertain. The areas are defined as Burgeo Bank / Hermitage Channel (Strata 306-310 and 714-716), Southern 3Ps/Halibut Channel (all areas south of 45°34.5’ N), mid-3Ps which includes the remainder of the subdivision (excluding inshore strata 293-300 and 779-783), and inshore strata (293-300 and 779-783). The timing of the survey varied through the time series, with surveys predominantly in April during 1983-84, March during 1985-87, February from 1988-92, and April from 1993 to 2005. There were two surveys

(February and April) in 1993; only the April one is shown here. The four sub-areas show a consistent pattern of maturity stages across most of the time series, with maturing fish dominating in most years. The switch in timing from February to April clearly results in an increase in the proportions of spawning fish and a reduction or disappearance of fish that are spent from the previous year. When surveys were conducted in April, spawning and spent fish were found in each area; within any one year the proportion of spawning and spent fish tended to vary among sub-areas, but generally about 15-40% of the mature fish sampled were spawning or recently spent. The results from the 2007 survey show no dramatic changes from recent years. The results from the April 2003 sample from the Halibut Channel appear somewhat anomalous, with a high proportion of spent fish compared to other areas. The results also show that a substantial proportion (typically 20-40%) of the mature female cod sampled in the Burgeo area in the April surveys are spawning or spent and therefore, by definition, likely belong to the 3Ps stock. Most of the remaining adult females in Burgeo are maturing to spawn later in the same year and their stock affinities remain unclear.

Overall, cod in 3Ps appear to spawn over a significant portion of the year and at many locations within the stock area, and there appears to be no consistent peak in the spawning time. Spawning is spatially widespread and is known to occur on Burgeo Bank, St. Pierre Bank, and the Halibut Channel area, as well as inshore in Hermitage Bay (3Psa), Fortune Bay (3Psb) and Placentia Bay (3Psc). Spawning in Placentia Bay in recent years has been studied more intensively than elsewhere in 3Ps (Bolon and Schneider 1999; Lawson and Rose 1999; Bradbury et al. 2000).

MORTALITY RATES FROM SURVEY AND CATCH DATA

An analysis of the catch rate data from various indices of the 3Ps stock was conducted using FLEDA, which is part of the FLR suite of analysis tools available for stock assessment. These procedures were applied to 3Ps cod catch-at-age, and catch-at-age by gear type. The procedures were also applied to the DFO RV survey (offshore index strata, and inshore strata fished since 1997), the GEAC survey, and the Sentinel gillnet and linetrawl catch rates.

The strength of the 1989 and 1997-98 year classes were apparent in age-composition analyses of all data. The results showed that overall, linetrawl caught smaller fish than gillnet and otter trawl, and that the otter trawl caught larger fish. However, in many years the age composition of gillnet and otter trawl catches were similar, which was not an anticipated result.

A comparison of DFO RV survey catches revealed that mean number per tow for ages 1 and 2 were higher in inshore strata compared to the offshore index strata. In most years catch rates at older ages were higher in the offshore strata than in the inshore strata, but 2004 was an exception. Internal consistency diagnostics for the RV survey index based on offshore strata only were better than diagnostics for the survey index based on the combined inshore and offshore strata.

Estimates of the instantaneous rate of total mortality (Z) for 1997-2007 from the combined inshore/offshore DFO RV survey varied annually but with no trend. The average Z was 0.35 for ages 5-11. Note that the lack of a survey in 2006 created some difficulties in computing Z's. The solution used was to compute a 2-year Z for 2005 to 2007, and prorate this mortality to an annual basis for 2005 and 2006. Z's for 1997-2004 from the GEAC survey averaged 0.64. In the inshore, Z's for 1997-2004 and ages 5-8 from the Sentinel linetrawl index averaged 0.59 but showed a decreasing trend since 2001. Mortalities computed from the Sentinel gillnet index at ages 5-8 do not reflect true mortality because of the selectivity of this gear type, but the trend has generally decreased since 1997.

The annual mortality rate for cod aged 5-11 from the combined inshore/offshore DFO RV survey has varied without trend, with an average annual rate of 30% (instantaneous rate=0.35) during 1997-2007 (Fig. 25). Assuming that natural mortality (*m*) has been at the typical value of 18% per year (*m*=instantaneous rate of 0.2 per yr), the results of this analysis suggest that average fishing mortality during this period has not been excessive.

GEAC STRATIFIED RANDOM TRAWL SURVEY

In 2005, the Groundfish Enterprise Allocation Council (GEAC) carried out a ninth consecutive fall bottom-trawl survey directed at cod to complement current DFO RV surveys conducted in spring.

The ninth survey conducted in December 2005 was the last in the time series of this survey and the following text is reproduced from Brattey et al. (2006): DFO provided advice on the stratified random design and catch sampling. Results of the previous surveys are reported in McClintock (1999a, 1999b, 2000, 2001, 2002) and for the survey conducted during 1-14 December 2005 full details are given in McClintock (in prep.). These surveys are carried out in late fall and cover a large portion of offshore 3Ps, but not the Burgeo Bank area. The commercial trawler *M.V. Pennysmart* was used in all surveys. Tows are of 30 min. duration using an Engels 96 high lift trawl with a 135 mm diamond mesh cod end (not lined). The trawl was fitted with rock-hopper foot-gear and Bergen #7 trawl doors. Performance of the trawl was checked onboard using Scanmar net sensors: bridge display of door-spread, opening, and clearance were recorded as well as depth and temperature. A total of 71 successful stratified random tow sets were completed in the 2005 survey.

The mean cod catch in 2005 was 5.2 fish per tow with a mean catch weight of 4.5 kg; these values are substantially lower than previous surveys (see McClintock, in prep.).

The trawlable biomass index for 2005 was 11,000 t, the lowest value in the time series and substantially less than the 2004 value of 23,000 t (Fig. 26a). The biomass index has shown considerable annual variability, increasing by a factor of four between 1999 and 2000 and decreasing by a factor of 2.3 between 2000 and 2001; however, the biomass index has declined consistently since 2002. Survey coverage during 1997 was somewhat less than in subsequent years; hence the values for 1997 are for a slightly smaller area.

The abundance index for 2005 was 4.5 million fish, somewhat less than the 2004 value (6.6 million fish). The abundance index is also variable, but has declined consistently since 2001 with the lowest value in 2005 (Fig. 26a).

In terms of age composition, the 2005 catch (expressed as mean nos. at age per tow) was comprised of a range of ages from 2 to12 (Table 18, Fig. 26b).Three and four year old cod (2001 and 2002 year classes) were most abundant, but their numbers were not high relative to catches of those ages in preceding years, notably 1997, 2000, and 2001. Older ages were weakly represented and there were no fish older than age 12. The 1997 and 1998 year classes, though present, were not strongly represented and have declined rapidly in GEAC survey catches over past 3-4 years. Overall, the GEAC survey is showing considerable annual variability, but with a declining trend in the latter portion. The age composition of the catches from the industry and DFO surveys are in reasonably close agreement, particularly in the most recent years, and both surveys show poorer incoming recruitment and a decline in the numbers of older fish.

RECRUITMENT INDEX

A multiplicative model was used to estimate the relative year class strength produced by the 3Ps spawning stock as indicated from trawl survey indices (mean numbers per tow at age). Following discussion on the appropriate indices to include in attempting to develop a recruitment index, it was decided that it would be inappropriate to include all of the available indices because of the different trends and uncertainty as to whether the available indices were indicative of trends in the stock as a whole or only portions of it. The input data set was restricted to:

i) GEAC mean numbers per tow data,1998-2005, 2007 at ages 3 and 4, and

ii) DFO RV combined inshore/offshore survey mean numbers per tow during 1997-2005 and 2007 including ages 1-4 in true Campelen units.

Only year classes with two or more observations were included in the input.

On a log-scale the model can be written as follows:

$\log(I_{s,a,y}) = \mu + Y_y + (SA)_{s,a} + \varepsilon_{s,a,y}$,

where:

μ = overall mean
s = survey subscript
a = age subscript
y = year class subscript
I = Index (mean nos. per tow)
Y = year class effect
SA = Survey * Age effect, and
ε = error term.

Estimation of model parameters was conducted using PROC MIXED in SAS/OR software. The input data were equally weighted. Each of the model terms (year-class and survey-age) were significant. The estimated least-squares means are plotted in Fig. 27. The results indicate that recruitment has been highly variable and particularly poor during the early to mid-1990's when several consecutive year classes were below the long-term average. A previous analysis that incorporated a longer time-series of data from the DFO RV survey of the offshore showed that recruitment , though variable, was generally higher in the 1980's (Brattey et al 2007). The 1997 and 1998 year classes have been the strongest in the recent time period, but the present analysis also indicates that all subsequent year classes (2000-04) are average or poor.

Some information on the relative strength of recent year-classes is also available from the sentinel line-trawl index. This index covers an inshore portion of the stock area shoreward of the trawl surveys. The age-disaggregated sentinel line trawl index (Table 8, Fig. 9b and c) provides evidence that most year classes produced during 2000-02 are weaker than the 1997 and 1998 year classes.

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Table 1. Reported landings of cod (t) from NAFO Subdivision 3Ps, 1959 - October 2007 by country and for fixed and mobile gear sectors.

	Can. (Newfoundland)		Can. (Mainland)	France			Spain	Portugal	Others	Total	TAC
	Offshore	Inshore		St. Pierre & Michelon		Metro					
Year	(Mobile)	(Fixed)	(All gears)	Inshore	Offshore	(All gears)	(All gears)	(All gears)	(All gears)		
1959	2,726	32,718	4,784	3,078		4,952	7,794	3,647	471	60,170	
1960	1,780	40,059	5,095	3,424	210	2,460	17,223	2,658	4,376	77,285	
1961	2,167	32,506	3,883	3,793	347	11,490	21,015	6,070	5,553	86,824	
1962	1,176	29,888	1,474	2,171	70	4,138	10,289	3,542	2,491	55,239	
1963	1,099	30,447	331	1,112	645	324	10,826	209	6,828	51,821	
1964	2,161	23,897	370	1,002	1,095	2,777	15,216	169	9,880	56,567	
1965	2,459	25,902	1,203	1,863	707	1,781	13,404		4,534	51,853	
1966	5,473	23,785	583	-	3,207	4,607	23,678	519	4,355	66,207	
1967	3,861	26,331	1,259	2,244		3,204	20,851	980	4,044	62,774	
1968	6,538	22,938	585	-	880	1,126	26,868	8	18,613	77,556	
1969	4,269	20,009	849	-	2,477	15	28,141	57	7,982	63,799	
1970	4,650	23,410	2,166	1,307	663	35	35,750	143	8,734	76,858	
1971	8,657	26,651	731	1,196	455	2,730	19,169	81	2,778	62,448	
1972	3,323	19,276	252	990	446	-	18,550	109	1,267	44,213	
1973	3,107	21,349	181	976	189	-	19,952	1,180	5,707	52,641	70,500
1974	3,770	15,999	657	600	348	5,366	14,937	1,246	3,789	46,712	70,000
1975	741	14,332	122	586	189	3,549	12,234	1,350	2,270	35,373	62,400
1976	2,013	20,978	317	722	182	1,501	9,236	177	2,007	37,133	47,500
1977	3,333	23,755	2,171	845	407	1,734	-	-		32,245	32,500
1978	2,082	19,560	700	360	1,614	2,860	-	-	45	27,221	25,000
1979	2,381	23,413	863	495	3,794	2,060	-	-	-	33,006	25,000
1980	2,809	29,427	715	214	1,722	2,681	-	-	-	37,568	28,000
1981	2,696	26,068	2,321	333	3,768	3,706	-	-	-	38,892	30,000
1982	2,639	21,351	2,948	1,009	3,771	2,184	-	-	-	33,902	33,000
1983	2,100	23,915	2,580	843	4,775	4,238	-	-	-	38,451	33,000
1984	895	22,865	1,969	777	6,773	3,671	-	-	-	36,950	33,000
1985	4,529	24,854	3,476	642	9,422	8,444	-	-	-	51,367	41,000
1986	5,218	24,821	1,963	389	13,653	11,939	-	-	7	57,990	41,000
1987	4,133	26,735	2,517	551	15,303	9,965	-	-	-	59,204	41,000
1988	3,662	19,742	2,308	282	10,011	7,373	-	-	4	43,382	41,000
1989	3,098	23,208	2,361	339	9,642	892	-	-	-	39,540	35,400
1990	3,266	20,128	3,082	158	14,771	-	-	-	-	41,405	35,400
1991	3,916	21,778	2,106	204	15,585	-	-	-	-	43,589	35,400
1992	4,468	19,025	2,238	2	10,162	-	-	-	-	35,895	35,400
1993	1,987	11,878	1,351	-	-	-	-	-	-	15,216	20,000
1994	82	493	86	-	-	-	-	-	-	661	0
1995	26	555	60	-	-	-	-	-	-	641	0
1996	60	707 [2]	118			-	-	-	-	885	0
1997 [1]	122	7,205 [2]	79	448	1,191	-	-	-	-	9,045	10,000
1998 [1]	4,320	11,370 [2]	885	609	2,511	-	-	-	-	19,694	20,000
1999 [1]	3,097	21,231 [2]	614	621	2,548	-	-	-	-	28,111	30,000
2000 [1]	3,436	16,247 [2]	740	870	3,807	-	-	-	-	25,100 [4]	20,000
2001 [1]	2,152	11,187 [2]	856	675	1,675	-	-	-	-	16,546 [4]	15,000
2002 [1]	1,326	11,292 [2]	499	579	1,623	-	-	-	-	14,892 [4]	15,000
2003 [1]	1,869	10,600 [2]	412	734	1,645	-	-	-	-	15,260 [4]	15,000
2004 [1]	1,595	9,450 [2]	790	465	2,113	-	-	-	-	14,414 [4]	15,000
2005 [1]	1,863	9,537 [2]	818	617	1,941	-	-	-	-	14,778 [4]	15,000
2006 [1]	1,007	9,595 [2]	675	555	1,326	-	-	-	-	13,157 [4]	13,000
2007 [3]	1,060	6,718	.		775	-	-	-	-	8,553 [4]	13,000

[1] Provisional catches

[2] Includes recreational fishery and sentinel fishery.

[3] Catch for Canada and France to 1 October 2007.

[4] TAC's are now set for the period 1 April to 31 March rather than by calender year and the TAC was 20,000 t for 2000-2001, 15,000 t for 2001-2002 until 2005-2006 and 13,000 t. for subsequent years

Table 2. Reported fixed gear catches of cod (t) from NAFO Subdivision 3Ps by gear type (includes non-Canadian and recreational catch).

Year	Gillnet	Longline	Handline	Trap	Total
1975	4,995	4,083	1,364	3,902	14,344
1976	5,983	5,439	2,346	7,224	20,992
1977	3,612	9,940	3,008	7,205	23,765
1978	2,374	11,893	3,130	2,245	19,642
1979	3,955	14,462	3,123	2.030	23,570
1980	5,493	19,331	2,545	2,077	29,446
1981	4,998	20,540	1,142	948	27,628
1982	6,283	13,574	1,597	1,929	23,383
1983	6,144	12,722	2,540	3,643	25,049
1984	7,275	9,580	2,943	3,271	23,069
1985	7,086	10,596	1,832	5,674	25,188
1986	8,668	11,014	1,634	4,073	25,389
1987	9,304	11,807	1,628	4,931	27,670
1988	6,433	10,175	1,469	2,449	20,526
1989	5,997	10,758	1,657	5,996	24,408
1990	6,948	8,792	2,217	3,788	21,745
1991	6,791	10,304	1,832	4,068	22,995
1992	5,314	10,315	1,330	3,397	20,356
1993	3,975	3,783	1,204	3,557	12,519
1994	90	0	381	0	471
1995	383	182	0	5	570
1996	467	158	137	10	772
1997[1]	3,760	1,158	1,172	1,167	7,258
1998[1]	10,116	2,914	308	92	13,430
1999[1]	17,976	3,714	503	45	22,237
2000[1]	14,218	3,100	186	56	17,561
2001[1]	7,377	2,833	2,089	57	12,357
2002[1]	7,827	2,309	775	119	11,030
2003[1]	8,313	2,044	546	35	10,937
2004[1]	7,910	2,167	415	15	10.508
2005[1]	8,112	2,016	626	6	10,760
2006[1]	7,590	2,698	314	2	10,603
2007[2]	5,359	344	328	0	6,030

[1]provisional catch
[2]catch to 1 October 2007, excluding recreational

Table 3a. Reported monthly landings (t) of cod from the inshore and offshore of NAFO Subdivision 3Ps by gear type during 2006 and 2007 (to 1 October).

2006	Offshore			Inshore					
MONTH	**Otter trawl**	**Gillnet**	**Line trawl**	**Gillnet**	**Line trawl**	**Handline**	**Trap**	**Otter trawl**	***Total**
Jan	747.9		177.9	109.3	121.0	11.3	.	13.9	973.4
Feb	575.9	28.7	402.0	37.0	64.2	24.9	.	5.5	1,274.6
Mar	51.0 .		5.1	4.3	0.3	.	.	.	129.4
Apr	10.2 .		11.2	.	4.3	.	.	.	26.6
May	4.7	22.9	8.0	368.1	81.2	2.2			484.7
Jun	0.2	103.2	6.9	1,255.7	115.4	26.7	1.7		1,497.9
Jul	4.3	451.2	7.2	1,370.9	104.7	70.2	.	0.1	1,961.9
Aug	65.9	530.7	15.3	311.5	270.3	78.9	.	.	1,097.6
Sep	23.0	599.6		223.1	276.9	21.5	.	.	672.0
Oct	148.1	393.7	0.4	269.6	432.0	39.8	.	.	.
Nov	401.1	516.8	55.0	804.0	404.4	32.6	.	.	.
Dec	495.4	24.5	0.6	164.7	133.7	5.4	.	2.9	.
TOTAL	2,527.7	2,671.4	689.4	4,918.2	2,008.3	313.7	1.7	22.3	13,152.8

*total excludes 4.5 t of landings from other gear types

2007	Offshore			Inshore					
MONTH	**Otter trawl**	**Gillnet**	**Line trawl**	**Gillnet**	**Line trawl**	**Handline**	**Trap**	**Otter trawl**	**Total**
Jan	449.8	.	35.9	166.7	127.6	2.5	.	0.2	782.7
Feb	976.9	9.8	288.4	36.2	34.0	0.8	.	.	1,346.1
Mar	279.3	.	0.9	.	0.1	.	.	0.0	280.3
Apr	.	.	.	0.2	0.2	0.3	.	.	0.6
May	11.1	4.1	1.6	156.7	48.6	2.4	.	.	224.4
Jun	.	39.5	12.9	1,814.6	61.8	50.4	2.5	1.3	1,983.1
Jul	0.0	105.2	7.0	1,615.4	92.8	138.6	5.9	1.8	1,966.7
Aug	18.0	29.0	17.3	608.3	210.8	119.0	0.8	36.4	1,039.5
Sep	33.5	0.3	28.9	780.2	41.3	13.3	0.0	26.6	924.2
Oct									
Nov									
Dec									
TOTAL	1,768.5	187.9	393.0	5,178.4	617.2	327.3	9.2	66.4	8,547.7

*total excludes 1.8 t of landings from other gear types

Table 3b. Reported monthly landings (t) of cod from unit areas in NAFO Subdiv. 3Ps during 2006 and 2007 (to 1 October).

2006	Inshore			Offshore					
Month	3Psa	3Psb	3Psc	3Psd	3Pse	3Psf	3Psg	3Psh	*Totals
Jan	49.3	110.2	96.0	10.0	0.4	15.0	0.0	900.5	1,181.3
Feb	29.9	45.9	55.9	58.1	0.1	2.9	0.0	945.7	1,138.3
Mar	0.3	0.0	4.3	0.1	0.0	1.4	1.6	52.9	60.5
Apr	3.7	0.6	0.0	2.3	0.0	0.0	4.4	14.7	25.7
May	99.9	173.8	177.7	16.9	3.5	4.9	5.3	5.0	487.1
Jun	143.7	276.3	979.6	28.9	0.0	33.4	3.2	29.7	1,494.8
Jul	168.5	312.0	1,065.8	205.7	107.0	91.3	25.8	14.2	1,990.4
Aug	291.2	105.4	264.4	46.1	278.8	179.1	39.1	7.2	1,211.3
Sep	197.9	171.3	154.8	64.1	338.1	173.8	47.5	42.1	1,189.7
Oct	211.7	251.4	279.3	126.7	118.7	226.2	6.3	121.0	1,341.3
Nov	90.2	405.2	746.1	200.9	67.3	432.8	22.3	234.8	2,199.5
Dec	11.2	133.3	162.2	8.0	0.0	17.7	0.1	487.9	820.4
Totals	1,297.5	1,985.4	3,986.1	767.7	913.8	1,178.3	155.7	2,855.6	13,140.2

* Excludes 17 t of catch from unspecified unit area

2007	Inshore			Offshore					
Month	3Psa	3Psb	3Psc	3Psd	3Pse	3Psf	3Psg	3Psh	Totals
Jan	1.2	200.0	95.8	0.0	0.0	0.0	0.0	485.7	782.7
Feb	0.3	34.3	36.5	23.5	0.0	9.5	0.1	1,241.9	1,346.1
Mar	0.1	0.0	0.0	11.7	0.0	0.2	0.6	267.7	280.3
Apr	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.6
May	47.0	112.7	47.9	7.1	0.0	3.8	0.1	7.1	225.7
Jun	127.4	304.5	1,499.6	0.0	0.0	24.1	5.4	23.0	1,983.9
Jul	169.9	540.5	1,144.4	0.0	4.6	39.5	3.9	65.7	1,968.6
Aug	212.9	241.6	521.5	0.0	35.7	24.4	1.5	2.9	1,040.5
Sep	52.0	377.7	431.9	24.4	28.9	9.4	0.0	0.0	924.2
Oct	.	.	.	.	.	.	.	.	.
Nov	.	.	.	.	.	.	.	.	.
Dec	.	.	.	.	.	.	.	.	.
Totals	610.7	1,811.9	3,777.5	66.6	69.3	111.0	11.6	2,094.0	8,552.7

Table 3c. Reported monthly landings (t) of cod from unit areas in NAFO Subdivision 3Ps during the management year 1 April 2006 to 31 March 2007.

	Inshore			Offshore					
2006	**3Psa**	**3Psb**	**3Psc**	**3Psd**	**3Pse**	**3Psf**	**3Psg**	**3Psh**	**Totals**
Apr	3.7	0.6	0.0	2.3	0.0	0.0	4.4	14.7	25.7
May	99.9	173.8	177.7	16.9	3.5	4.9	5.3	5.0	487.1
Jun	143.7	276.3	979.6	28.9	0.0	33.4	3.2	29.7	1,494.8
Jul	168.5	312.0	1,065.8	205.7	107.0	91.3	25.8	14.2	1,990.4
Aug	291.2	105.4	264.4	46.1	278.8	179.1	39.1	7.2	1,211.3
Sep	197.9	171.3	154.8	64.1	338.1	173.8	47.5	42.1	1,189.7
Oct	211.7	251.4	279.3	126.7	118.7	226.2	6.3	121.0	1,341.3
Nov	90.2	405.2	746.1	200.9	67.3	432.8	22.3	234.8	2,199.5
Dec	11.2	133.3	162.2	8.0	0.0	17.7	0.1	487.9	820.4
2007									
Jan	1.2	200.0	95.8	0.0	0.0	0.0	0.0	485.7	782.7
Feb	0.3	34.3	36.5	23.5	0.0	9.5	0.1	1,241.9	1,346.1
Mar	0.1	0.0	0.0	11.7	0.0	0.2	0.6	267.7	280.3
Totals	1219.6	2063.6	3962.3	734.7	913.4	1168.8	154.9	2952.0	13169.3

Table 4. Number of cod sampled for length and age and available to estimate the commercial catch at age for 2006.

	Number Measured								
	Offshore			Inshore					
Month	Ottertrawl	Gillnet	Linetrawl	Gillnet	Linetrawl	Handline	Trap	Other	Totals
Jan	1,106	0	0	672	2177	0	0	31	3,955
Feb	260	0	475	20	14	0	0	4	769
Mar	117	0	0	0	129	0	0		246
Apr	128	0	0	0	0	0	0		128
May	0	56	0	5528	1040	51	0	189	6,675
Jun	0	434	0	4584	1708	133	0	206	6,859
Jul	0	2,335	0	5306	2150	698	0	270	10,489
Aug	0	540	0	983	6996	0	0	149	8,519
Sep	0	580	0	708	10637	0	0	46	11,925
Oct	390	0	0	673	5351	20	0		6,434
Nov	413	717	0	6400	11133	87	0	30	18,750
Dec	0	0	0	0	0	0	0	138	0
	2,414	4,662	475	24,874	41,335	989	0	1,063	75,812

	Number Aged								
	Offshore			Inshore					
Qtr	Ottertrawl	Gillnet	Linetrawl	Gillnets	Linetrawl	Handline	Trap		Totals
1	294	0	216	84	220	0	0		814
2	50	160	0	984	221	0	0		1,415
3	0	770	0	1,320	809	296	0		3,195
4	87	204	0	764	2466	24	0		3,545
	431	1,134	216	3,152	3,716	320	0		8,969

	Sampling by France			
Qtr	Ottertrawl	Gillnet	Ottertrawl	Gillnet
	Measured		Aged	
1	4,908		525	
3		3,214		321
4	6,769		321	
Total	11,677	3,214	846	321

Table 5. Estimates of average weight (kg), length (cm), and numbers-at-age (000's) for Canadian landings together with the French catch and the resulting total catch numbers-at-age for cod in 3Ps during 2006.

2006 Total catch							
	AVERAGE		CATCH			France	Total
	WEIGHT	LENGTH	NUMBER				NUMBER
AGE	(kg.)	(cm.)	(000'S)	STD ERR.	CV		(000'S)
1	0.25	31.00	0.01	0.01			0.01
2	0.34	33.66	0.26	0.09			0.26
3	0.57	39.94	43.21	3.19	0.07		43.21
4	1.01	48.08	241.79	8.50	0.04	11.24	253.03
5	1.55	55.21	801.00	17.94	0.02	65.20	866.20
6	1.94	59.47	836.23	20.41	0.02	91.91	928.13
7	2.17	61.80	744.62	19.35	0.03	101.01	845.63
8	2.75	66.06	918.42	20.05	0.02	136.43	1054.84
9	3.44	70.79	575.84	15.87	0.03	56.23	632.07
10	3.47	70.94	228.22	9.53	0.04	9.00	237.22
11	3.13	68.42	74.26	6.30	0.08	6.23	80.48
12	4.92	77.82	32.51	3.32	0.10	3.26	35.77
13	6.59	85.30	17.11	2.10	0.12	1.75	18.86
14	7.50	91.12	6.11	0.84	0.14	1.10	7.21
15	10.00	99.33	3.13	0.86	0.27	0.57	3.71
16	11.27	105.17	7.16	1.41	0.20	0.00	7.16
17	15.86	118.85	8.71	1.30			8.71
18	13.28	112.49	0.06	0.01	0.23		0.06
19	19.11	125.62	0.28	0.24	0.86		0.28
20	17.93	124.00	0.30	0.30	1.00		0.30
21	0.00	0.00	0.00	0.00			0.00
22	14.21	115.00	0.04	0.00	0.01		0.04
23	0.00	0.00	0.00	0.00			0.00
24	0.00	0.00	0.00	0.00			0.00
25	0.00	0.00	0.00	0.00			0.00

Table 6. Catch numbers-at-age (000s) for the commercial cod fishery in NAFO Subdiv. 3Ps from 1959 to 2006 (only ages 1-14 shown).

Year/Age	3	4	5	6	7	8	9	10	11	12	13	14
1959	1,001	13,940	7,525	7,265	4,875	942	1,252	1,260	631	545	44	1
1960	567	5,496	23,704	6,714	3,476	3,484	1,020	827	406	407	283	27
1961	450	5,586	10,357	15,960	3,616	4,680	1,849	1,376	446	265	560	58
1962	1,245	6,749	9,003	4,533	5,715	1,367	791	571	187	140	135	241
1963	961	4,499	7,091	5,275	2,527	3,030	898	292	143	99	107	92
1964	1,906	5,785	5,635	5,179	2,945	1,881	1,891	652	339	329	54	27
1965	2,314	9,636	5,799	3,609	3,254	2,055	1,218	1,033	327	68	122	36
1966	949	13,662	13,065	4,621	5,119	1,586	1,833	1,039	517	389	32	22
1967	2,871	10,913	12,900	6,392	2,349	1,364	604	316	380	95	149	3
1968	1,143	12,602	13,135	5,853	3,572	1,308	549	425	222	111	5	107
1969	774	7,098	11,585	7,178	4,554	1,757	792	717	61	120	67	110
1970	756	8,114	12,916	9,763	6,374	2,456	730	214	178	77	121	14
1971	2,884	6,444	8,574	7,266	8,218	3,131	1,275	541	85	125	62	57
1972	731	4,944	4,591	3,552	4,603	2,636	833	463	205	117	48	45
1973	945	4,707	11,386	4,010	4,022	2,201	2,019	515	172	110	14	29
1974	1,887	6,042	9,987	6,365	2,540	1,857	1,149	538	249	80	32	17
1975	1,840	7,329	5,397	4,541	5,867	723	1,196	105	174	52	6	2
1976	4,110	12,139	7,923	2,875	1,305	495	140	53	17	21	4	3
1977	935	9,156	8,326	3,209	920	395	265	117	57	43	31	11
1978	502	5,146	6,096	4,006	1,753	653	235	178	72	27	17	10
1979	135	3,072	10,321	5,066	2,353	721	233	84	53	24	13	10
1980	368	1,625	5,054	8,156	3,379	1,254	327	114	56	45	21	25
1981	1,022	2,888	3,136	4,652	5,855	1,622	539	175	67	35	18	2
1982	130	5,092	4,430	2,348	2,861	2,939	640	243	83	30	11	7
1983	760	2,682	9,174	4,080	1,752	1,150	1,041	244	91	37	18	8
1984	203	4,521	4,538	7,018	2,221	584	542	338	134	35	8	8
1985	152	2,639	8,031	5,144	5,242	1,480	626	545	353	109	21	6
1986	306	5,103	10,253	11,228	4,283	2,167	650	224	171	143	79	23
1987	585	2,956	11,023	9,763	5,453	1,416	1,107	341	149	78	135	50
1988	935	4,951	4,971	6,471	5,046	1,793	630	284	123	75	53	31
1989	1,071	8,995	7,842	2,863	2,549	1,112	600	223	141	57	29	26
1990	2,006	8,622	8,195	3,329	1,483	1,237	692	350	142	104	47	22
1991	812	7,981	10,028	5,907	2,164	807	620	428	108	76	50	22
1992	1,422	4,159	8,424	6,538	2,266	658	269	192	187	83	34	41
1993	278	3,712	2,035	3,156	1,334	401	89	38	52	13	14	5
1994	9	78	173	74	62	28	12	3	2	0	0	0
1995	3	7	56	119	57	37	7	2	0	0	0	0
1996	9	43	43	101	125	35	24	8	2	1	0	0
1997	66	427	1,130	497	937	826	187	93	31	4	1	0
1998	91	373	793	1,550	948	1,314	1,217	225	120	56	15	1
1999	49	628	1,202	2,156	2,321	1,020	960	873	189	110	21	8
2000	76	335	736	1,352	1,692	1,484	610	530	624	92	37	16
2001	80	475	718	1,099	1,143	796	674	257	202	192	28	13
2002	155	607	1,451	1,280	900	722	419	355	96	70	71	14
2003	15	301	879	1,810	1,139	596	337	277	167	67	55	84
2004	62	113	654	1,592	1,713	649	266	180	104	47	17	24
2005	49	330	515	1,007	1,628	1,087	499	143	95	41	26	12
2006	0	43	253	866	928	846	1,055	632	237	80	36	19

Table 7a. Mean annual weights-at-age (kg) calculated from lengths-at-age based on samples from commercial fisheries (including food fisheries and sentinel surveys) in Subdivision 3Ps in 1959-2006. The weights-at-age from 1976 are extrapolated back to 1959.

	3	4	5	6	7	8	9	10	11	12	13	14
1959	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1960	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1961	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1962	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1963	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1964	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1965	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1966	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1967	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1968	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1969	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1970	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1971	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1972	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1973	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1974	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1975	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1976	0.28	0.69	1.08	1.68	2.40	3.21	4.10	5.08	6.03	7.00	8.05	9.16
1977	0.55	0.68	1.30	1.86	2.67	3.42	4.19	4.94	5.92	6.76	8.78	10.90
1978	0.45	0.70	1.08	1.75	2.45	2.99	4.10	5.16	5.17	7.20	7.75	8.72
1979	0.41	0.65	1.01	1.65	2.55	3.68	4.30	6.49	7.00	8.20	9.53	10.84
1980	0.52	0.72	1.13	1.66	2.48	3.60	5.40	6.95	7.29	8.64	9.33	9.58
1981	0.48	0.79	1.32	1.80	2.30	3.27	4.36	5.68	7.41	9.04	8.39	9.56
1982	0.45	0.77	1.17	1.78	2.36	2.88	3.91	5.28	6.18	8.62	8.64	11.41
1983	0.58	0.84	1.33	1.99	2.58	3.26	3.77	5.04	6.56	8.45	10.06	11.82
1984	0.66	1.04	1.40	1.97	2.64	3.77	4.75	5.56	6.01	9.04	11.20	10.40
1985	0.63	0.85	1.23	1.79	2.81	3.44	5.02	6.01	6.11	7.18	9.81	10.48
1986	0.54	0.75	1.18	1.84	2.43	3.15	4.30	5.50	6.19	8.72	8.05	11.91
1987	0.56	0.77	1.21	1.63	2.31	3.02	4.33	5.11	6.20	6.98	7.08	8.34
1988	0.63	0.82	1.09	1.67	2.17	2.92	3.58	4.98	5.61	6.60	7.46	8.92
1989	0.63	0.81	1.16	1.63	2.25	3.37	4.11	5.18	6.29	7.30	7.75	8.73
1990	0.58	0.86	1.27	1.85	2.45	3.00	4.22	5.09	6.35	7.60	8.31	10.37
1991	0.60	0.75	1.17	1.74	2.37	2.91	3.69	4.23	6.34	7.68	8.64	9.72
1992	0.46	0.69	1.04	1.56	2.23	2.89	4.14	5.54	6.42	7.82	10.40	11.88
1993	0.36	0.68	1.08	1.48	2.13	2.82	4.34	4.30	4.68	7.49	6.85	8.24
1994	0.62	0.82	1.30	1.86	2.05	2.75	3.59	4.38	6.29	7.77	6.78	8.07
1995	0.52	0.85	1.57	2.03	2.47	2.78	3.46	4.30	4.27	4.16	5.59	9.24
1996	0.67	0.98	1.48	2.05	2.53	2.94	3.23	4.03	4.82	4.68	7.26	9.92
1997	0.62	0.90	1.30	1.87	2.51	3.24	3.47	3.52	4.59	6.37	8.58	10.73
1998	0.62	1.02	1.57	2.05	2.42	3.10	4.04	4.13	4.62	5.21	6.39	9.69
1999	0.70	0.92	1.57	2.31	2.53	2.82	3.92	5.32	4.99	5.27	6.14	7.27
2000	0.62	0.90	1.36	2.07	2.74	2.81	3.15	4.60	6.54	6.12	6.42	7.73
2001	0.69	1.02	1.44	1.94	2.57	3.41	3.21	3.46	5.59	8.61	7.61	8.11
2002	0.57	1.02	1.54	2.04	2.32	3.10	4.33	3.90	3.87	6.05	8.89	7.94
2003	0.68	0.97	1.57	2.11	2.34	2.63	3.87	4.75	4.30	5.33	7.82	10.35
2004	0.59	0.96	1.37	2.04	2.49	2.74	2.85	5.02	6.71	5.25	7.13	8.79
2005	0.64	0.94	1.39	1.84	2.46	2.90	3.16	3.25	4.36	6.15	5.53	7.85
2006	0.57	1.01	1.55	1.94	2.17	2.75	3.44	3.47	3.13	4.92	6.59	7.50

Table 7b. Beginning of the year weights-at-age calculated from commercial annual mean weights-at-age, as described in Lilly (MS 1998). The values for 1976 are extrapolated back to 1959. The values for 2006 are geometric means of the 2003-05 values.

Year/age	3	4	5	6	7	8	9	10	11	12	13	14
1959	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1960	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1961	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1962	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1963	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1964	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1965	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1966	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1967	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1968	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1969	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1970	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1971	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1972	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1973	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1974	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1975	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1976	0.18	0.44	0.86	1.35	2.01	2.78	3.63	4.56	5.53	6.50	7.51	8.59
1977	0.49	0.44	0.95	1.42	2.12	2.86	3.67	4.50	5.48	6.38	7.84	9.37
1978	0.37	0.62	0.86	1.51	2.13	2.83	3.74	4.65	5.05	6.53	7.24	8.75
1979	0.31	0.54	0.84	1.33	2.11	3.00	3.59	5.16	6.01	6.51	8.28	9.17
1980	0.42	0.54	0.86	1.29	2.02	3.03	4.46	5.47	6.88	7.78	8.75	9.55
1981	0.38	0.64	0.97	1.43	1.95	2.85	3.96	5.54	7.18	8.12	8.51	9.44
1982	0.33	0.61	0.96	1.53	2.06	2.57	3.58	4.80	5.92	7.99	8.84	9.78
1983	0.43	0.61	1.01	1.53	2.14	2.77	3.30	4.44	5.89	7.23	9.31	10.11
1984	0.58	0.78	1.08	1.62	2.29	3.12	3.94	4.58	5.50	7.70	9.73	10.23
1985	0.58	0.75	1.13	1.58	2.35	3.01	4.35	5.34	5.83	6.57	9.42	10.83
1986	0.45	0.69	1.00	1.50	2.09	2.98	3.85	5.25	6.10	7.30	7.60	10.81
1987	0.46	0.64	0.95	1.39	2.06	2.71	3.69	4.69	5.84	6.57	7.86	8.19
1988	0.56	0.68	0.92	1.42	1.88	2.60	3.29	4.64	5.35	6.40	7.22	7.95
1989	0.54	0.71	0.98	1.33	1.94	2.70	3.46	4.31	5.60	6.40	7.15	8.07
1990	0.51	0.74	1.01	1.46	2.00	2.60	3.77	4.57	5.74	6.91	7.79	8.96
1991	0.56	0.66	1.00	1.49	2.09	2.67	3.33	4.22	5.68	6.98	8.10	8.99
1992	0.38	0.65	0.88	1.35	1.97	2.62	3.47	4.52	5.21	7.04	8.94	10.13
1993	0.23	0.56	0.86	1.24	1.82	2.51	3.54	4.22	5.09	6.94	7.32	9.25
1994	0.53	0.54	0.94	1.42	1.74	2.42	3.19	4.36	5.20	6.03	7.13	7.43
1995	0.38	0.72	1.13	1.63	2.14	2.39	3.08	3.93	4.32	5.12	6.59	7.92
1996	0.58	0.72	1.12	1.79	2.26	2.70	3.00	3.73	4.55	4.47	5.49	7.45
1997	0.48	0.78	1.13	1.67	2.27	2.86	3.20	3.37	4.30	5.54	6.34	8.83
1998	0.51	0.79	1.19	1.63	2.13	2.79	3.62	3.79	4.03	4.89	6.38	9.12
1999	0.62	0.76	1.27	1.90	2.28	2.61	3.49	4.64	4.54	4.93	5.66	6.82
2000	0.48	0.79	1.12	1.80	2.52	2.67	2.98	4.25	5.90	5.53	5.82	6.89
2001	0.57	0.79	1.14	1.62	2.31	3.06	3.00	3.30	5.07	7.50	6.83	7.22
2002	0.44	0.84	1.25	1.71	2.12	2.83	3.84	3.53	3.66	5.82	8.75	7.77
2003	0.57	0.75	1.27	1.81	2.19	2.47	3.46	4.53	4.09	4.54	6.88	9.59
2004	0.46	0.81	1.15	1.79	2.29	2.53	2.74	4.41	5.64	4.75	6.16	8.29
2005	0.49	0.74	1.16	1.59	2.24	2.69	2.94	3.04	4.68	6.42	5.38	7.48
2006	0.49	0.77	1.19	1.72	2.24	2.56	3.03	3.93	4.76	5.18	6.11	8.41

Table 8. Standardized gillnet (5.5 in mesh) and line-trawl annual catch rate-at-age indices estimated using data from sentinel fishery fixed sites. Catch rates are fish per net for gill nets and fish per 1000 hooks for line-trawl. The 1997 and 1998 cohorts are shaded.

Gill net **Year/Age**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Totals**
1995	0.03	0.11	4.91	10.35	6.03	2.90	0.39	0.14	23.85
1996	0.02	0.26	2.57	11.90	9.84	2.84	0.84	0.07	28.22
1997	0.01	0.25	5.66	5.26	8.84	7.91	0.97	0.70	28.66
1998	0.00	0.05	0.91	6.26	3.03	2.22	1.40	0.32	13.68
1999	0.06	0.08	0.56	0.92	1.46	0.65	0.31	0.30	5.41
2000	0.01	0.03	0.29	0.68	0.66	0.88	0.29	0.10	2.91
2001	0.03	0.17	0.40	0.82	0.63	0.34	0.31	0.13	2.81
2002	0.01	0.04	0.56	0.93	0.89	0.38	0.18	0.20	3.15
2003	0.02	0.06	0.22	0.92	0.43	0.15	0.07	0.03	1.90
2004	0.00	0.06	0.20	0.79	0.81	0.34	0.10	0.02	2.32
2005	0.00	0.03	0.14	0.58	0.67	0.36	0.25	0.02	2.03
2006	0.00	0.05	0.32	0.61	0.55	0.63	0.24	0.16	2.58
Linetrawl **Year/Age**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Totals**
1995	10.91	20.44	65.63	91.24	23.81	18.07	3.87	1.89	229.95
1996	9.72	35.00	33.10	52.67	54.13	15.10	8.38	1.96	210.07
1997	6.70	28.15	28.02	18.75	17.61	24.89	2.44	1.85	128.41
1998	9.23	20.53	23.82	18.66	6.93	10.41	12.28	2.21	104.07
1999	6.05	16.68	21.47	15.43	7.30	5.63	4.17	1.67	78.38
2000	16.91	36.42	34.08	22.43	9.83	8.53	2.81	1.20	132.22
2001	20.57	31.38	22.24	12.51	7.31	4.49	2.52	0.80	101.81
2002	14.77	30.81	27.91	9.76	6.02	2.07	1.15	0.91	93.40
2003	2.83	34.69	36.52	18.55	8.04	3.35	1.19	0.67	105.85
2004	10.32	10.76	37.89	20.63	10.50	3.45	1.65	0.47	95.66
2005	8.16	21.08	14.07	13.63	12.78	5.01	2.30	0.85	77.87
2006	11.62	20.33	31.01	22.65	15.23	13.80	4.27	1.87	120.79

Table 9. Cod abundance estimates (000's of fish) from DFO bottom-trawl research vessel surveys in NAFO Division 3Ps (1997-2007 shown). Shaded cells are model estimates. See Fig. 11 for location of strata. For 1983-1996 results see Brattey et al. (2007).

Depth range (fathoms)	Strata		Vessel / Trips / Sets / Mean Date / sq. mi.	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
			Trips	202-203	219-220	236-237	313-315	364-365	418-419	476-477	523+546	617-618	688	757-759
			Sets	158	176	175	171	173	177	176	177	178		178
			Mean Date	12-Apr-97	21-Apr	24-Apr	21-Apr	18-Apr	15-Apr	22-Apr	24-Apr	27-Apr		18-Apr
			sq. mi.	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
<30	314		974	77	57	1729	1531	153	67	19	117	256	nf	1570
	320		1320	303	1292	3546	5183	1543	478	1601	396	523	nf	333
31-50	293	5	159	107	292	601	394	219	131	120	375	2850	200	317
	308		112	262	4175	2704	1829	1094	285	77	2265	16719	nf	1410
	312		272	19	100	461	1235	636	112	150	56	1141	nf	370
	315		827	38	5721	2428	1895	1040	228	49	395	1161	nf	1268
	321		1189	18	49	894	1161	55	98	82	16	229	nf	65
	325		944	108	16	752	2824	1526	65	16	1120	383	nf	893
	326		166	0	11	52	109	57	0	0	0	0	nf	285
	783	1	229	47	16	110	86	142	13	95	16	252	nf	126
51-100	294	5	135	176	901	362	170	195	613	455	288	20685	1092	1281
	297	5	152	408	209	1892	7000	450	450	42	244	1317	20732	1047
	307		395	1123	23490	5879	6991	5665	833	22912	9328	3172	nf	2735
	311		317	371	1652	2169	2864	610	780	349	2733	788	nf	1715
	317		193	451	173	305	1487	637	1049	372	199	1367	nf	2522
	319		984	1889	15600	11839	9327	58696	34398	2149	26117	6064	nf	15245
	322		1567	234	260	713	1529	413	633	263	649	2463	nf	2507
	323		696	24	32	158	1001	941	64	19	0	101	nf	32
	324		494	272	160	361	442	85	306	391	85	432	nf	481
	781	1	446	195	276	1058	716	1564	261	215	1052	568	491	445
	782	1	183	63	38	38	315	76	227	50	63	221	nf	101
101-150	295	5	209	168	465	976	615	978	144	187	72	976	1781	1469
	298	5	171	110	1861	46	3450	670	371	5399	976	282	21	7475
	300	5	217	584	1579	641	896	791	746	1370	168	657	327	478
	306		363	816	771	708	4191	949	246	277	666	1015	nf	2175
	309		296	260	11980	215	142	2056	13172	484	109	582	nf	1122
	310		170	1380	105	131	187	505	485	1391	12	249	nf	94
	313		165	0	454	91	113	3564	125	567	10	66	nf	124
	316		189	65	104	23	13	26	117	273	69	117	nf	117
	318		129	1881	53	0	231	44	71	11943	275	683	nf	336
	779	1	422	0	39	0	73	26	29	15	19	142	77	671
	780	1	403	35	18	0	40	0	0	0	0	18	nf	400
151-200	296	5	71	632	4	375	107	1924	735	303	2627	35	54	881
	299	5	212	643	49	0	13	131	160	214	44	29	44	44
	705		195	241	376	24	54	83	241	232	267	64	nf	0
	706		476	172	327	87	49	49	82	246	120	310	nf	31
	707		74	353	102	9	0	293	3079	143	121	1263	nf	122
	715		128	516	5874	484	751	3013	1615	960	102	305	nf	132
	716		539	91	3089	2428	196	99	1333	952	74	142	nf	1368
201-300	708		126	388	1464	947	0	35	151	329	85	1419	nf	641
	711		593	44	16	0	783	80	49	96	29	1530	nf	505
	712		731	60	201	50	98	117	67	345	60	15	nf	106
	713		851	901	61	78	176	364	320	372	127	80	nf	45
	714		1074	2765	485	173	151	3781	1346	1678	230	77	nf	373
301-400	709	2	147	nf	0	0	10	30	0	611	0	0	nf	0
401-500	710	1	156	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf
501-600	776	1	159	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
601-700	777	1	183	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
701-800	778	1	166	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
	Total	3		15,122	78,250	39,438	46,543	88,209	61,895	48,737	45,832	42,716		38,722
	Total	4		18,290	83,997	45,537	60,428	95,405	65,775	57,813	51,776	70,748		53,457
	upper			21,365	166,891	55,196	60,749	147,318	119,231	109,897	95,755	171,310		48,978
	t-value			2.31	3.18	2.23	2.20	2.36	2.78	3.18	2.31	4.30		4.30
	std	6		2,703	27,857	7,066	6,457	25,046	20,624	19,233	21,649	29,906		2,383

[1] These strata were added to the stratification scheme in 1994.

[2] Stratum 709 was redrawn in 1994 and includes stratum 710 from previous surveys. All sets in 710 prior to 1994 were recoded to 709.

[3] For index strata 0-300 fathoms in the offshore and includes estimates (shaded cells) for non-sampled strata .

[4] totals are for all strata fished .

[5] These strata were added to the stratification scheme in 1997.

[6] std's are for index strata and do not include estimates from non-sampled strata.

Table 10. Cod biomass estimates (t) from DFO research vessel bottom-trawl surveys in NAFO Subdivision 3Ps during 1997-2007. Shaded cells are model estimates. See Fig. 11 for location of strata. Data for the1983-1996 period are in Brattey et al. (2005).

							Tel 351			Tel 522	AN 656		
		Vessel	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
		Trips	202-203	219-220	236-237	313-315	364-365	418-419	476-477	523+546	617-618	688	757-759
Depth		Sets	158	176	175	171	173	177	176	177	178	24	178
range		Mean Dat	12-Apr	21-Apr	24-Apr	21-Apr	18-Apr	15-Apr	22-Apr	24-Apr	27-Apr	15-Apr	18-Apr
(fathoms)	Strata	sq. mi.	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
<30	314	974	32	8	595	829	46	5	0	10	185	nf	53
	320	1320	114	7766	6287	6761	601	932	2707	395	1890	nf	1274
31-50	293 [5]	159	17	19	27	45	26	9	29	18	1810	34	16
	308	112	93	1461	1572	1088	184	48	12	1949	8011	nf	253
	312	272	13	8	226	640	93	10	9	18	345	nf	60
	315	827	14	20072	3771	3092	491	822	17	335	13514	nf	6456
	321	1189	2	0	1855	4582	2	5	2	2	40	nf	186
	325	944	10	0	418	1307	340	10	3	568	84	nf	172
	326	166	0	0	8	478	25	0	0	0	0	nf	55
	783 [1]	229	0	0	14	16	6	0	2	1	303	nf	12
51-100	294 [5]	135	24	40	19	7	26	47	22	14	21147	716	85
	297 [5]	152	39	22	1697	2339	108	38	5	42	1482	20678	382
	307	395	332	16164	3784	5162	1578	197	26828	6055	2423	nf	1471
	311	317	51	169	3342	1661	26	145	13	182	570	nf	83
	317	193	62	196	36	259	331	88	59	78	218	nf	1118
	319	984	287	28144	18019	8121	51570	38958	755	67844	5845	nf	14166
	322	1567	118	13	117	1893	193	32	26	38	1532	nf	79
	323	696	15	112	227	643	305	7	1	0	28	nf	1
	324	494	11	8	252	25	7	14	13	8	148	nf	51
	781 [1]	446	22	16	64	49	36	13	17	61	203	62	23
	782 [1]	183	2	7	1	7	0	27	1	3	34	nf	5
101-150	295 [5]	209	24	139	45	61	124	8	26	4	727	253	128
	298 [5]	171	42	2608	148	2632	202	75	2735	488	250	30	8445
	300 [5]	217	147	802	650	307	153	124	175	103	391	192	149
	306	363	312	618	553	5123	543	67	51	960	812	nf	2142
	309	296	87	9788	320	303	1118	15666	193	56	464	nf	1328
	310	170	206	72	145	330	488	209	263	4	410	nf	11
	313	165	0	481	162	97	18231	122	807	4	101	nf	352
	316	189	40	138	43	21	63	78	146	103	95	nf	120
	318	129	404	88	0	592	28	43	12705	506	1672	nf	445
	779 [1]	422	0	10	0	4	1	1	2	1	47	5	41
	780 [1]	403	3	1	0	6	0	0	0	0	2	nf	86
151-200	296 [5]	71	175	1	102	20	341	118	36	900	54	20	146
	299 [5]	212	282	231	0	1	411	655	315	35	15	30	327
	705	195	476	345	25	20	71	244	434	288	96	nf	0
	706	476	379	266	68	63	26	40	431	147	301	nf	56
	707	74	72	121	21	0	360	3726	187	329	3347	nf	109
	715	128	233	6849	1127	1240	5599	2525	1188	114	451	nf	167
	716	539	44	1772	4106	229	92	554	735	75	123	nf	1933
201-300	708	126	629	4389	1455	0	54	139	354	76	1272	nf	940
	711	593	43	11	0	1242	75	35	41	22	1864	nf	1024
	712	731	151	267	25	64	65	25	264	39	6	nf	94
	713	851	1101	48	143	123	273	235	261	172	63	nf	27
	714	1074	3471	725	155	123	4113	1212	2306	183	149	nf	514
301-400	709 [2]	147	nf	0	0	5	59	0	383	0	0	nf	0
401-500	710 [1]	156	nf	nf	0	nf	nf	nf	nf	nf	nf	nf	nf
501-600	776 [1]	159	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
601-700	777 [1]	183	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
701-800	778 [1]	166	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf
	Total [3]		8,802	100,100	48,857	46,111	86,991	66,193	50,811	80,560	46,059		34,740
	Total [4]		9,579	103,996	51,624	51,610	88,484	67,308	54,559	82,230	72,524		44,585
	upper		14,193	160,874	71,356	60,876	148,519	134,681	127,771	218,043	146,619		53,944
	t-value		2.36	2.20	2.13	2.15	2.57	2.78	3.18	2.37	3.18		2.12
	std [6]		2,284	27,612	10,563	6,867	23,941	24,636	24,201	58,132	31,623		9,058

[1] These strata were added to the stratification scheme in 1994.
[2] Strata 709 was redrawn in 1994 and includes the area covered by strata 710 previously. All sets done in 710 prior to 1994 recoded to 709.
[3] For index strata 0-300 fathoms in the offshore and includes esitmates (shaded cells) for non-sampled strata .
[4] totals are for all strata fished .
[5] These strata were added to the stratification scheme in 1997.
[6] std's are for index strata and do not include estimates from non-sampled strata.

Table 11a. Mean numbers per tow at age (1-20 only) in Campelen units for the Canadian research vessel bottom trawl survey of NAFO Subdivision 3Ps. Data are adjusted for missing strata. The survey in 2006 was not completed and there were two surveys in 1993 (February and April). The 1997 and 1998 cohorts are shaded.

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993 (Feb)	1993 (Apr)	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	6.42	0.30	0.38	0.20	1.09	0.42	0.49	0.00	1.30	0.00	0.00	0.00	0.00	0.00	0.90	0.22	0.52	1.24	1.25	0.57	0.58	0.52	0.20	0.77		3.18
2	10.01	5.40	7.74	6.62	8.48	9.13	6.50	1.48	27.69	1.80	0.00	0.00	1.63	0.31	1.08	1.53	0.97	2.54	3.33	2.26	1.10	1.46	1.90	1.43		1.73
3	6.52	2.33	14.88	5.65	5.67	5.93	4.66	9.82	5.03	6.95	1.83	1.99	1.46	1.16	3.67	2.33	6.79	2.55	5.36	12.41	3.90	1.78	2.07	6.73		4.84
4	1.14	1.55	12.57	6.48	4.97	2.96	3.17	14.49	10.00	2.11	4.03	4.04	4.31	1.67	3.62	1.04	8.42	2.38	3.10	12.29	8.28	4.08	1.71	4.96		3.11
5	3.72	0.63	9.96	7.95	13.82	2.84	1.51	10.89	11.24	4.15	0.71	1.49	6.10	13.08	1.32	0.50	5.60	2.58	2.17	4.36	5.85	6.55	2.08	1.60		1.48
6	1.62	2.11	3.28	6.33	8.31	6.50	1.16	5.67	5.75	2.03	2.96	1.35	1.73	19.65	2.69	0.28	3.99	2.34	1.82	2.04	3.04	3.94	4.05	0.89		0.76
7	0.48	0.77	2.66	2.13	3.35	5.84	2.15	3.84	2.84	1.03	0.68	0.47	1.62	4.40	2.91	0.30	1.96	1.72	1.20	1.26	2.04	1.50	4.24	0.79		0.44
8	0.89	0.37	0.79	1.47	1.29	3.65	1.21	3.14	1.58	0.53	0.33	0.10	0.50	5.75	0.54	0.24	2.50	0.44	0.89	0.77	0.99	0.72	1.26	0.71		0.22
9	1.61	0.46	0.48	0.84	0.69	1.49	0.67	1.15	1.19	0.26	0.13	0.04	0.08	2.19	0.46	0.14	2.79	0.79	0.35	0.71	0.53	0.33	0.81	0.28		0.47
10	0.75	0.71	0.42	0.29	0.28	0.84	0.37	0.71	0.74	0.24	0.09	0.03	0.04	0.25	0.09	0.05	0.43	0.60	0.31	0.38	0.37	0.18	0.67	0.05		0.42
11	0.36	0.18	0.42	0.24	0.23	0.74	0.41	0.32	0.56	0.08	0.11	0.04	0.03	0.20	0.09	0.02	0.30	0.09	0.53	0.50	0.08	0.19	0.79	0.17		0.12
12	0.14	0.15	0.49	0.29	0.16	0.35	0.13	0.16	0.22	0.04	0.03	0.01	0.02	0.01	0.02	0.00	0.06	0.02	0.12	0.94	0.12	0.05	0.15	0.08		0.09
13	0.06	0.06	0.21	0.17	0.17	0.16	0.11	0.12	0.11	0.01	0.04	0.00	0.01	0.07	0.00	0.00	0.03	0.02	0.00	0.12	0.19	0.11	0.10	0.03		0.08
14	0.05	0.03	0.12	0.10	0.16	0.15	0.05	0.09	0.07	0.01	0.01	0.01	0.01	0.03	0.00	0.00	0.00	0.00	0.01	0.06	0.01	0.01	0.02	0.03		0.05
15	0.04	0.00	0.03	0.06	0.06	0.09	0.09	0.01	0.04	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.07	0.09		0.01
16	0.04	0.04	0.03	0.04	0.04	0.10	0.06	0.05	0.03	0.01	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	0.15		0.01
17	0.01	0.00	0.05	0.02	0.05	0.01	0.04	0.01	0.02	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		0.01
18	0.02	0.03	0.02	0.00	0.04	0.01	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
19	0.01	0.00	0.00	0.00	0.01	0.01	0.01	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
20	0.01	0.00	0.00	0.01	0.01	0.01	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

Table 11b. Mean numbers of cod per tow at age (ages 1-14) for the DFO research vessel bottom trawl survey of inshore strata. The 1997 and 1998 cohorts are shaded.

Year/Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	0.87	1.86	1.05	1.98	3.35	1.86	1.15	1.02	1.02	0.85	3.43
2	1.91	3.26	6.36	6.13	5.83	3.78	7.99	3.88	2.36	9.56	6.05
3	3.32	1.39	1.93	12.82	6.04	2.95	5.49	4.41	4.04	4.45	7.66
4	1.05	0.71	1.80	6.80	1.53	0.50	1.46	3.12	19.71	12.31	3.49
5	0.34	1.74	1.35	3.21	0.20	0.05	1.07	1.35	14.13	16.04	2.98
6	0.08	0.68	1.07	1.39	0.09	0.00	1.63	0.40	12.97	19.37	3.92
7	0.00	0.19	0.79	0.56	0.09	0.04	1.10	0.15	5.83	14.09	3.39
8	0.00	0.34	0.16	0.40	0.03	0.00	0.42	0.04	5.60	2.80	1.94
9	0.03	0.16	0.12	0.07	0.03	0.04	0.00	0.00	1.68	2.28	2.42
10	0.03	0.11	0.05	0.03	0.03	0.00	0.05	0.00	0.07	0.16	0.12
11	0.00	0.06	0.03	0.13	0.07	0.07	0.06	0.00	0.19	0.00	0.15
12	0.00	0.03	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.32	0.04
13	0.00	0.03	0.00	0.00	0.03	0.11	0.03	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 11c. Mean numbers per tow at age in Campelen units for the Canadian research vessel bottom trawl survey of the western (Burgeo area) and eastern portions of NAFO Subdivision 3Ps. Data are adjusted for missing strata. There were two surveys in 1993 (February and April) and the 2006 was not completed. Only ages 1-14 and data for 1993 onwards are shown. The 1997 and 1998 cohorts are shaded.

Western 3Ps (Burgeo area)

Age	1993A	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.41	0.04	0.16	0.08	0.00	0.00		0.00
2	0.00	0.00	0.49	1.37	0.60	0.42	1.14	0.71	6.05	0.83	1.94	1.68	2.74		0.27
3	3.37	4.84	2.60	10.48	2.94	26.74	4.50	4.31	12.35	6.61	4.25	6.22	21.17		0.50
4	8.04	9.73	2.75	12.50	4.73	25.99	6.24	6.56	6.32	9.91	16.66	6.14	20.84		7.85
5	6.44	15.76	2.26	4.87	1.83	28.22	10.27	6.52	4.07	7.77	15.90	8.89	5.41		3.77
6	6.94	8.60	3.03	5.84	1.66	18.46	3.61	7.81	4.35	8.86	14.88	3.75	2.42		3.90
7	1.73	6.26	1.32	6.11	1.02	13.65	3.90	6.20	4.20	6.97	5.65	2.59	1.02		2.17
8	0.53	2.89	2.07	1.17	0.92	6.28	0.50	1.95	1.73	3.09	3.06	0.73	1.06		2.41
9	0.21	0.51	0.58	1.50	0.72	2.43	0.78	0.95	1.22	1.37	1.95	0.66	0.30		0.90
10	0.09	0.16	0.08	0.03	0.11	0.40	0.20	0.08	0.96	0.92	1.23	0.46	0.08		0.38
11	0.15	0.08	0.06	0.17	0.05	2.10	0.23	0.00	0.21	0.32	1.89	0.48	0.00		0.19
12	0.00	0.06	0.05	0.00	0.00	0.00	0.38	0.15	0.10	0.15	0.26	0.15	0.00		0.48
13	0.01	0.02	0.04	0.00	0.00	0.00	0.00	0.00	0.03	0.11	0.58	0.03	0.00		0.00
14	0.01	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.15	0.00		0.00

Eastern 3Ps

Age	1993F	1993A	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	0.00	0.00	0.00	0.00	0.98	0.35	0.60	1.67	1.50	0.68	0.69	0.55	0.26	0.93		4.02
2	0.00	0.00	1.81	0.24	0.98	2.32	0.82	2.68	4.25	1.78	1.25	1.12	2.04	1.18		1.74
3	2.19	1.73	0.73	0.92	1.96	1.70	1.84	1.94	5.26	14.31	3.04	0.72	1.03	3.09		4.55
4	4.75	2.60	2.92	1.19	1.89	0.48	2.04	1.00	2.07	12.75	7.93	1.86	0.66	2.28		2.94
5	0.48	0.60	3.72	15.65	0.62	0.17	1.68	1.81	0.82	3.71	5.30	4.47	0.80	0.83		0.96
6	1.16	0.49	0.65	22.81	1.79	0.09	1.08	2.00	0.88	1.23	2.00	1.66	4.56	0.47		0.28
7	0.12	0.28	0.73	2.93	2.38	0.14	0.64	1.34	0.52	0.63	1.13	0.20	5.87	0.80		0.09
8	0.08	0.05	0.17	3.60	0.35	0.11	2.50	0.35	0.62	0.52	0.61	0.05	1.67	0.57		0.11
9	0.05	0.01	0.01	2.27	0.16	0.04	2.91	0.83	0.26	0.59	0.35	0.09	0.17	0.22		0.33
10	0.01	0.00	0.03	0.29	0.10	0.02	0.27	0.69	0.39	0.13	0.26	0.01	0.39	0.03		0.45
11	0.01	0.01	0.01	0.23	0.07	0.01	0.07	0.04	0.64	0.54	0.01	0.00	0.23	0.19		0.10
12	0.03	0.00	0.01	0.00	0.02	0.00	0.04	0.02	0.10	1.21	0.10	0.01	0.03	0.09		0.06
13	0.01	0.00	0.01	0.07	0.00	0.00	0.00	0.03	0.00	0.09	0.16	0.02	0.00	0.04		0.10
14	0.02	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.06	0.02	0.01	0.03	0.04		0.06

Table 12. Mean length-at-age (cm) of cod sampled during research bottom-trawl surveys in Subdivision 3Ps in winter-spring 1972-2007. Shaded entries are based on fewer than 5 aged fish.

Age	1972	1973	1974	1975	1976	1977
1	14.0	11.6	12.2	12.7	13.0	11.0
2	23.2	22.5	21.7	23.1	22.9	20.4
3	31.5	31.8	33.3	35.4	35.6	31.9
4	41.1	39.6	43.5	44.7	48.4	43.4
5	52.0	50.2	51.0	55.6	57.9	55.5
6	58.6	56.6	55.7	61.3	64.8	63.6
7	62.8	62.3	63.6	66.5	68.2	74.2
8	74.2	66.1	71.1	74.4	71.8	75.4
9	82.3	68.5	69.4	74.2	78.4	88.0
10	90.6	81.1	79.4	75.2	81.7	83.8
11	95.0	88.5	94.0	76.2	94.7	77.3
12	88.3	87.6	95.6	107.2	110.5	87.9

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1		10.8	14.5	14.6	13.2	10.3	12.0		11.0	10.7	9.2	12.0		9.5				
2	19.6	22.2	21.0	22.4	22.1	20.2	19.2	17.9	18.8	19.9	19.7	19.2	19.9	19.2	20.7		19.1	21.2
3	28.0	33.0	28.0	32.3	33.2	31.2	30.7	29.1	27.1	29.5	29.0	30.2	29.9	29.8	30.4	30.9	32.2	29.9
4	36.1	42.8	43.3	44.3	45.2	43.1	42.1	40.3	40.3	39.5	40.7	41.7	40.1	39.0	40.9	41.3	39.4	42.0
5	48.2	47.7	50.7	50.5	53.5	52.9	52.2	51.2	49.0	48.4	47.8	48.2	48.3	47.0	47.4	48.0	48.2	50.4
6	58.9	55.7	58.5	58.7	59.5	57.8	60.7	60.2	55.7	54.1	56.2	56.3	53.7	53.5	55.3	52.7	50.2	56.5
7	66.0	70.5	71.4	63.4	66.6	65.6	66.2	66.4	62.1	61.2	62.2	64.0	56.6	57.4	61.2	62.3	53.7	58.2
8	70.4	76.5	84.9	70.1	70.2	71.5	70.6	74.2	72.2	67.3	66.7	71.8	62.3	62.8	62.4	70.6	59.1	57.9
9	84.3	85.9	94.9	72.7	75.6	73.4	75.5	73.9	76.4	77.8	74.6	75.9	70.1	68.2	66.7	77.1	68.0	63.0
10	86.3	95.3	97.8	83.4	90.6	79.4	79.1	79.4	82.8	85.4	79.7	84.6	76.2	73.7	73.3	80.2	87.7	79.6
11	88.5	94.7	97.0	97.8	98.6	89.6	84.2	88.9	93.3	83.2	79.7	88.5	79.1	73.8	83.9	96.0	79.7	81.3
12	79.3	116.0	106.6	90.2	105.2	93.7	98.1	93.0	93.9	89.9	87.5	96.6	88.7	77.1	81.8	106.0	90.5	83.6

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	12.6	12.7	10.6	12.0	13.3	10.6	12.0	10.7	14.0	12.1		11.1
2	20.8	24.1	22.3	22.4	22.0	21.9	22.0	23.7	20.2	25.5		21.2
3	30.0	31.8	32.8	31.4	31.7	33.2	31.8	31.9	33.7	34.2		30.7
4	38.7	40.9	42.7	43.2	40.8	40.6	42.0	43.0	38.9	41.9		38.1
5	44.2	48.2	49.1	51.4	48.8	47.6	50.8	51.8	47.6	48.6		48.9
6	52.9	51.6	53.3	58.9	54.7	51.4	55.1	55.4	60.8	54.5		54.9
7	60.9	60.7	57.6	61.7	60.5	57.4	55.2	58.6	66.3	63.5		55.8
8	61.2	65.4	67.1	66.2	65.3	68.8	67.2	58.7	69.2	67.6		64.9
9	63.3	67.3	77.4	77.6	67.9	77.5	74.6	70.5	67.3	72.3		81.7
10	76.8	67.3	77.2	86.8	81.2	75.0	79.8	72.0	69.6	72.6		91.6
11	74.7	82.5	64.3	76.9	92.7	85.5	73.4	65.5	73.2	99.2		86.9
12	86.1		78.0	109.0	89.1	96.8	86.0	86.6	73.5	103.4		86.6

Table 13. Mean round weight-at-age (kg) of cod sampled during DFO bottom-trawl surveys in Subdivision 3Ps in winter-spring 1978-2007. Shaded entries are based on fewer than 5 aged fish.

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1		0.04	0.05		0.04	0.05								0.03				
2	0.09	0.09	0.13	0.09	0.16	0.10	0.08		0.12		0.08	0.10	0.07	0.12	0.10		0.14	0.06
3	0.24	0.27	0.16	0.31	0.46	0.28	0.27	0.26	0.18	0.27	0.26	0.29	0.34	0.32	0.57	0.32	0.32	0.27
4	0.48	0.65	0.62	0.70	0.89	0.72	0.63	0.59	0.50	0.56	0.60	0.68	0.68	0.63	0.80	0.70	0.62	0.56
5	1.11	0.97	1.01	1.08	1.30	1.30	1.21	1.04	0.90	0.95	0.95	1.04	1.11	1.04	1.17	1.05	1.16	1.22
6	1.73	1.70	1.70	1.67	1.54	1.65	1.85	1.57	1.37	1.36	1.55	1.33	1.50	1.51	1.67	1.26	1.16	1.72
7	2.37	3.33	3.46	2.08	2.56	1.86	2.79	2.52	2.58	2.03	2.21	2.36	1.73	1.77	2.17	2.03	1.45	1.76
8	3.74	5.09	5.77	3.50	2.61	3.55	3.83	3.21	3.34	2.30	2.52	3.78	2.33	2.39	2.37	3.24	1.95	1.74
9	4.68	5.80	8.37	4.89	4.01	4.04	4.23	3.14	5.02	4.48	3.94	4.51	3.26	3.17	2.86	4.28	3.11	2.38
10	5.71	7.10	8.22	7.59	6.44	4.90	5.03	3.76	4.65	6.34	4.99	5.82	4.09	4.11	4.33	4.47	6.45	4.78
11	4.90	9.03	9.08	8.37	8.89	8.85	7.87		6.63	6.62	4.26	8.28	5.11	4.05	5.80	8.67	4.47	5.45
12	5.76		10.16	11.46	13.07	10.27	9.82	3.97	8.87	5.94	9.10	9.06	7.35	4.91	5.24	13.20	6.75	5.54

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	0.06	0.09	0.05	0.11	0.10	0.05	0.06	0.03	0.07	0.07		0.15
2	0.14	0.30	0.16	0.14	0.12	0.18	0.16	0.19	0.13	0.24		0.17
3	0.30	0.38	0.37	0.36	0.36	0.37	0.35	0.32	0.45	0.47		0.32
4	0.67	0.62	0.75	0.77	0.62	0.61	0.68	0.74	0.59	0.70		0.57
5	0.97	0.91	1.00	1.25	1.01	0.90	1.08	1.24	1.01	0.96		1.03
6	1.44	1.23	1.27	1.79	1.51	1.20	1.55	1.47	2.00	1.53		1.52
7	2.20	1.90	1.64	2.07	1.90	1.72	1.38	1.78	2.58	2.29		1.52
8	2.22	2.61	2.89	2.81	2.47	3.36	2.84	1.72	2.99	3.09		2.67
9	2.34	2.87	4.99	4.56	3.00	4.32	4.03	2.95	2.77	4.00		6.05
10	4.46	3.08	4.44	6.95	5.44	4.20	4.84	3.93	3.32	4.62		7.84
11	3.90	5.46	2.53	4.26	8.77	6.30	3.58	2.47	3.91	10.75		7.15
12	6.79		4.19	12.39	6.78	8.96	6.03	5.99	4.46	12.75		8.23

Table 14. Mean gutted condition-at-age of cod sampled during DFO bottom-trawl surveys in Subdivision 3Ps in winter-spring 1978-2005. Boxed entries are based on fewer than 5 aged fish.

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1																		
2	0.702	0.629	0.595	0.599	0.660	0.632	0.651		0.699		0.644	0.681	0.623	0.641	0.598		0.627	0.630
3	0.745	0.678	0.620	0.718	0.731	0.742	0.734	0.706	0.698	0.736	0.713	0.725	0.680	0.706	0.711	0.657	0.675	0.687
4	0.733	0.715	0.680	0.748	0.740	0.777	0.735	0.704	0.704	0.725	0.739	0.739	0.726	0.710	0.732	0.711	0.677	0.690
5	0.753	0.702	0.703	0.724	0.722	0.766	0.703	0.680	0.733	0.735	0.731	0.734	0.744	0.720	0.716	0.700	0.705	0.702
6	0.730	0.712	0.709	0.745	0.676	0.794	0.711	0.714	0.709	0.717	0.731	0.741	0.743	0.746	0.733	0.663	0.680	0.708
7	0.744	0.699	0.724	0.729	0.699	0.737	0.728	0.739	0.721	0.735	0.736	0.748	0.735	0.741	0.735	0.677	0.660	0.703
8	0.716	0.775	0.734	0.763	0.690	0.725	0.726	0.714	0.717	0.720	0.736	0.780	0.726	0.738	0.727	0.698	0.676	0.665
9	0.737	0.749	0.765	0.748	0.731	0.744	0.730	0.733	0.676	0.768	0.777	0.793	0.735	0.753	0.738	0.758	0.687	0.701
10	0.793	0.803	0.715	0.810	0.751	0.793	0.741	0.740	0.719	0.770	0.789	0.834	0.764	0.777	0.732	0.684	0.732	0.725
11	0.681	0.648	0.784	0.790	0.758	0.819	0.808		0.798	0.779	0.783	0.827	0.794	0.765	0.766	0.786	0.691	0.750
12	0.725		0.759	0.843	0.833	0.865	0.834	0.681	0.789	0.774	0.813	0.852	0.793	0.794	0.744	0.852	0.717	0.753

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	0.754	0.727	0.898	0.673	0.594	0.963	0.638	0.876	0.684	0.768
2	0.697	0.674	0.660	0.675	0.666	0.665	0.680	0.671	0.675	0.707
3	0.706	0.717	0.699	0.704	0.696	0.684	0.694	0.700	0.716	0.730
4	0.709	0.725	0.720	0.697	0.707	0.686	0.688	0.702	0.707	0.722
5	0.695	0.702	0.704	0.694	0.688	0.680	0.676	0.703	0.677	0.708
6	0.713	0.683	0.680	0.688	0.677	0.722	0.690	0.697	0.705	0.709
7	0.715	0.693	0.689	0.690	0.674	0.659	0.666	0.701	0.705	0.731
8	0.722	0.714	0.725	0.686	0.674	0.699	0.712	0.674	0.715	0.730
9	0.671	0.713	0.757	0.722	0.698	0.702	0.728	0.674	0.720	0.752
10	0.758	0.751	0.742	0.762	0.754	0.695	0.740	0.649	0.730	0.752
11	0.725	0.785	0.748	0.722	0.784	0.732	0.669	0.669	0.710	0.806
12	0.760		0.784	0.737	0.712	0.773	0.734	0.712	0.734	0.810

Note: this table has not been updated with 2007 survey information.

Table 15. Mean liver index at age sampled during DFO bottom-trawl surveys in Subdivision 3Ps in winter-spring 1978-2005. Boxed entries are based on fewer than 5 aged fish.

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1															
2	0.0175	0.0142	0.0150	0.0118	0.0229	0.0247	0.0120	0.0236	0.0230	0.0304	0.0250	0.0279	0.0292	0.0250	0.0301
3	0.0223	0.0160	0.0114	0.0146	0.0244	0.0280	0.0167	0.0168	0.0233	0.0233	0.0227	0.0216	0.0213	0.0213	0.0200
4	0.0203	0.0181	0.0143	0.0188	0.0228	0.0323	0.0179	0.0175	0.0196	0.0225	0.0275	0.0266	0.0293	0.0280	0.0242
5	0.0227	0.0194	0.0189	0.0169	0.0230	0.0275	0.0142	0.0176	0.0214	0.0240	0.0281	0.0269	0.0335	0.0287	0.0315
6	0.0253	0.0218	0.0204	0.0194	0.0163	0.0348	0.0144	0.0217	0.0230	0.0241	0.0280	0.0300	0.0357	0.0309	0.0309
7	0.0256	0.0293	0.0262	0.0213	0.0207	0.0277	0.0195	0.0217	0.0237	0.0273	0.0279	0.0303	0.0376	0.0362	0.0263
8	0.0323	0.0359	0.0370	0.0322	0.0203	0.0303	0.0191	0.0233	0.0268	0.0291	0.0312	0.0341	0.0334	0.0337	0.0368
9	0.0284	0.0319	0.0381	0.0418	0.0225	0.0326	0.0188	0.0268	0.0303	0.0362	0.0357	0.0412	0.0349	0.0386	0.0400
10	0.0326	0.0362	0.0328	0.0470	0.0258	0.0327	0.0328	0.0301	0.0383	0.0462	0.0439	0.0432	0.0411	0.0410	0.0379
11	0.0256	0.0276	0.0381	0.0277	0.0356	0.0445	0.0330	0.0405	0.0435	0.0404	0.0495	0.0519	0.0471	0.0419	0.0473
12	0.0379		0.0385	0.0415	0.0539	0.0462	0.0451	0.0435	0.0463	0.0482	0.0545	0.0689	0.0477	0.0373	0.0376

Age	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1													
2		0.0304	0.0139	0.0252	0.0244	0.0247	0.0239	0.0241	0.0231	0.0235	0.0242	0.0242	0.0224
3	0.0106	0.0144	0.0111	0.0160	0.0208	0.0165	0.0205	0.0181	0.0150	0.0193	0.0214	0.0188	0.0222
4	0.0154	0.0138	0.0131	0.0161	0.0199	0.0206	0.0170	0.0152	0.0163	0.0155	0.0199	0.0156	0.0223
5	0.0180	0.0197	0.0209	0.0168	0.0201	0.0216	0.0167	0.0193	0.0158	0.0176	0.0210	0.0176	0.0244
6	0.0187	0.0221	0.0201	0.0201	0.0183	0.0249	0.0168	0.0191	0.0209	0.0203	0.0231	0.0259	0.0247
7	0.0184	0.0170	0.0211	0.0219	0.0230	0.0227	0.0210	0.0210	0.0181	0.0172	0.0265	0.0241	0.0272
8	0.0206	0.0211	0.0179	0.0231	0.0240	0.0346	0.0197	0.0222	0.0245	0.0198	0.0197	0.0217	0.0280
9	0.0280	0.0208	0.0189	0.0194	0.0273	0.0407	0.0294	0.0235	0.0270	0.0242	0.0310	0.0204	0.0314
10	0.0182	0.0423	0.0265	0.0303	0.0379	0.0424	0.0388	0.0342	0.0258	0.0271	0.0228	0.0222	0.0297
11	0.0346	0.0232	0.0343	0.0314	0.0396	0.0271	0.0234	0.0385	0.0294	0.0110	0.0225	0.0261	0.0554
12	0.0379	0.0326	0.0247	0.0202		0.0284	0.0260	0.0298	0.0363	0.0259	0.0334	0.0208	0.0530

Note: this table has not been updated with 2007 survey information.

Table 16. Parameter estimates and SE's for a probit model fitted to observed proportions mature at age for female cod from NAFO Subdivision 3Ps based on surveys conducted during 1959-2007 (nf=no significant model fit).

Cohort	slope	slope_SE	intercept	intercept_se
1954	1.109	0.2940	-8.170	2.4445
1955	1.506	0.2237	-10.263	1.6124
1956	1.317	0.3208	-9.459	2.2216
1957	1.460	0.3703	-10.325	2.3525
1958	2.393	0.5853	-16.452	3.6202
1959	2.111	0.5358	-13.020	2.9364
1960	1.674	0.2990	-10.668	1.7584
1961	1.864	0.3551	-11.472	2.0669
1962	1.714	0.2898	-10.512	1.7043
1963	nf	nf	nf	nf
1964	1.927	0.2411	-12.718	1.5667
1965	2.419	0.5982	-16.424	4.2387
1966	1.549	0.2401	-10.061	1.6025
1967	1.688	0.3782	-10.084	2.2543
1968	2.140	0.2885	-13.163	1.7869
1969	1.683	0.3043	-10.367	1.8439
1970	1.526	0.2305	-8.856	1.3137
1971	1.312	0.1401	-7.841	0.8346
1972	1.412	0.1445	-8.908	0.8853
1973	1.452	0.1667	-9.355	1.0320
1974	2.004	0.1969	-13.154	1.2944
1975	1.785	0.2174	-11.164	1.3757
1976	1.355	0.2056	-8.599	1.2510
1977	2.507	0.3505	-15.364	2.1732
1978	1.792	0.1680	-10.732	1.0205
1979	1.030	0.1138	-6.448	0.7670
1980	1.427	0.1415	-9.413	0.9131
1981	1.743	0.1781	-11.987	1.1846
1982	2.009	0.2059	-13.306	1.3496
1983	1.894	0.2608	-11.890	1.6045
1984	2.232	0.2981	-13.417	1.8044
1985	2.699	0.3728	-16.034	2.2010
1986	2.583	0.2930	-14.067	1.5934
1987	2.253	0.2232	-11.923	1.2350
1988	2.773	0.4110	-14.021	2.1672
1989	1.884	0.1578	-9.783	0.8113
1990	1.787	0.1900	-9.2022	0.9590
1991	3.548	1.0400	-18.3463	5.2260
1992	2.333	0.3590	-11.8756	1.7700
1993	1.817	0.2440	-9.5522	1.3520
1994	1.470	0.2062	-7.6317	1.0835
1995	1.540	0.2419	-8.6389	1.3477
1996	1.761	0.2887	-9.6216	1.5691
1997	2.786	0.4623	-13.3852	2.2178
1998	2.254	0.3128	-10.5846	1.4819
1999	1.558	0.2876	-7.7339	1.3981
2000	1.511	0.3274	-8.5722	1.6699
2001	1.626	0.2987	-8.6211	1.4323

Table 17. Estimated proportions mature for female cod from NAFO Subdivision 3Ps from DFO surveys from 1978 to 2007 projected forward to 2012. Estimates were obtained from a probit model fitted by cohort to observed proportions mature at age. Shaded cells are averages of the three closest cohorts; boxed cells are the average of estimates for the adjacent cohorts.

	Age													
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1954	0.0004	0.0015	0.0050	0.0175	0.0607	0.1936	0.4697	0.7570	0.9133	0.9723	0.9914	0.9973	0.9992	0.9997
1955	0.0009	0.0015	0.0050	0.0175	0.0607	0.1936	0.4697	0.7570	0.9133	0.9723	0.9914	0.9973	0.9992	0.9997
1956	0.0002	0.0026	0.0050	0.0175	0.0607	0.1936	0.4697	0.7570	0.9133	0.9723	0.9914	0.9973	0.9992	0.9997
1957	0.0003	0.0007	0.0078	0.0175	0.0607	0.1936	0.4697	0.7570	0.9133	0.9723	0.9914	0.9973	0.9992	0.9997
1958	0.0001	0.0011	0.0032	0.0233	0.0607	0.1936	0.4697	0.7570	0.9133	0.9723	0.9914	0.9973	0.9992	0.9997
1959	0.0000	0.0006	0.0040	0.0142	0.0675	0.1936	0.4697	0.7570	0.9133	0.9723	0.9914	0.9973	0.9992	0.9997
1960	0.0000	0.0000	0.0026	0.0149	0.0611	0.1801	0.4697	0.7570	0.9133	0.9723	0.9914	0.9973	0.9992	0.9997
1961	0.0001	0.0002	0.0001	0.0112	0.0535	0.2267	0.3996	0.7570	0.9133	0.9723	0.9914	0.9973	0.9992	0.9997
1962	0.0001	0.0007	0.0012	0.0010	0.0463	0.1741	0.5693	0.6686	0.9133	0.9723	0.9914	0.9973	0.9992	0.9997
1963	0.0002	0.0004	0.0035	0.0102	0.0111	0.1729	0.4403	0.8563	0.8595	0.9723	0.9914	0.9973	0.9992	0.9997
1964	0.0001	0.0008	0.0028	0.0185	0.0783	0.1097	0.4738	0.7459	0.9641	0.9488	0.9914	0.9973	0.9992	0.9997
1965	0.0000	0.0005	0.0046	0.0177	0.0913	0.4124	0.5742	0.7949	0.9164	0.9918	0.9825	0.9973	0.9992	0.9997
1966	0.0000	0.0001	0.0028	0.0252	0.1041	0.3489	0.8528	0.9366	0.9435	0.9761	0.9982	0.9942	0.9992	0.9997
1967	0.0002	0.0000	0.0010	0.0159	0.1254	0.4285	0.7408	0.9795	0.9938	0.9863	0.9935	0.9996	0.9981	0.9997
1968	0.0002	0.0009	0.0001	0.0066	0.0846	0.4432	0.8286	0.9384	0.9975	0.9994	0.9968	0.9982	0.9999	0.9994
1969	0.0000	0.0012	0.0044	0.0012	0.0438	0.3413	0.8155	0.9689	0.9878	0.9997	0.9999	0.9993	0.9995	1.0000
1970	0.0002	0.0001	0.0066	0.0205	0.0130	0.2394	0.7496	0.9608	0.9951	0.9977	1.0000	1.0000	0.9998	0.9999
1971	0.0007	0.0009	0.0012	0.0345	0.0898	0.1290	0.6837	0.9489	0.9927	0.9992	0.9996	1.0000	1.0000	1.0000
1972	0.0015	0.0030	0.0049	0.0099	0.1619	0.3171	0.6246	0.9369	0.9915	0.9987	0.9999	0.9999	1.0000	1.0000
1973	0.0006	0.0054	0.0137	0.0257	0.0785	0.5110	0.6861	0.9492	0.9903	0.9986	0.9998	1.0000	1.0000	1.0000
1974	0.0004	0.0023	0.0197	0.0600	0.1243	0.4199	0.8497	0.9114	0.9953	0.9986	0.9998	1.0000	1.0000	1.0000
1975	0.0000	0.0016	0.0093	0.0696	0.2269	0.4332	0.8602	0.9683	0.9798	0.9996	0.9998	1.0000	1.0000	1.0000
1976	0.0001	0.0001	0.0067	0.0370	0.2174	0.5744	0.8044	0.9812	0.9940	0.9956	1.0000	1.0000	1.0000	1.0000
1977	0.0007	0.0005	0.0008	0.0280	0.1361	0.5077	0.8613	0.9568	0.9978	0.9989	0.9991	1.0000	1.0000	1.0000
1978	0.0000	0.0028	0.0030	0.0058	0.1096	0.3927	0.7930	0.9662	0.9917	0.9997	0.9998	0.9998	1.0000	1.0000
1979	0.0001	0.0000	0.0106	0.0176	0.0417	0.3446	0.7263	0.9343	0.9924	0.9984	1.0000	1.0000	1.0000	1.0000
1980	0.0044	0.0008	0.0004	0.0400	0.0963	0.2442	0.6919	0.9159	0.9814	0.9983	0.9997	1.0000	1.0000	1.0000
1981	0.0003	0.0123	0.0047	0.0048	0.1390	0.3884	0.7056	0.9056	0.9781	0.9949	0.9996	0.9999	1.0000	1.0000
1982	0.0000	0.0014	0.0336	0.0275	0.0558	0.3849	0.7910	0.9467	0.9762	0.9946	0.9986	0.9999	1.0000	1.0000
1983	0.0000	0.0002	0.0059	0.0888	0.1453	0.4202	0.7081	0.9575	0.9925	0.9943	0.9987	0.9996	1.0000	1.0000
1984	0.0000	0.0001	0.0012	0.0240	0.2145	0.5050	0.8989	0.9039	0.9926	0.9990	0.9987	0.9997	0.9999	1.0000
1985	0.0000	0.0003	0.0007	0.0066	0.0930	0.4334	0.8596	0.9909	0.9733	0.9988	0.9999	0.9997	0.9999	1.0000
1986	0.0000	0.0001	0.0020	0.0051	0.0365	0.2992	0.6818	0.9735	0.9993	0.9930	0.9998	1.0000	0.9999	1.0000
1987	0.0000	0.0000	0.0012	0.0132	0.0369	0.1781	0.6401	0.8572	0.9955	0.9999	0.9982	1.0000	1.0000	1.0000
1988	0.0001	0.0001	0.0004	0.0111	0.0817	0.2224	0.5533	0.8811	0.9439	0.9992	1.0000	0.9995	1.0000	1.0000
1989	0.0000	0.0006	0.0018	0.0053	0.0947	0.3715	0.6807	0.8762	0.9686	0.9792	0.9999	1.0000	0.9999	1.0000
1990	0.0004	0.0002	0.0057	0.0233	0.0732	0.4938	0.7971	0.9408	0.9759	0.9923	0.9925	1.0000	1.0000	1.0000
1991	0.0006	0.0024	0.0033	0.0516	0.2401	0.5399	0.9009	0.9631	0.9916	0.9957	0.9981	0.9973	1.0000	1.0000
1992	0.0000	0.0036	0.0158	0.0507	0.3412	0.8071	0.9458	0.9883	0.9943	0.9989	0.9992	0.9996	0.9990	1.0000
1993	0.0001	0.0000	0.0210	0.0956	0.4611	0.8313	0.9823	0.9962	0.9987	0.9991	0.9998	0.9999	0.9999	0.9997
1994	0.0004	0.0007	0.0005	0.1136	0.4102	0.9319	0.9791	0.9986	0.9997	0.9999	0.9999	1.0000	1.0000	1.0000
1995	0.0021	0.0027	0.0076	0.0155	0.4336	0.8207	0.9955	0.9978	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
1996	0.0008	0.0091	0.0163	0.0729	0.3529	0.8205	0.9679	0.9997	0.9998	1.0000	1.0000	1.0000	1.0000	1.0000
1997	0.0004	0.0038	0.0384	0.0924	0.4475	0.9499	0.9647	0.9950	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1998	0.0000	0.0022	0.0177	0.1478	0.3853	0.8931	0.9985	0.9939	0.9992	1.0000	1.0000	1.0000	1.0000	1.0000
1999	0.0002	0.0004	0.0129	0.0774	0.4300	0.7941	0.9885	1.0000	0.9990	0.9999	1.0000	1.0000	1.0000	1.0000
2000	0.0021	0.0023	0.0065	0.0706	0.2811	0.7664	0.9596	0.9989	1.0000	0.9998	1.0000	1.0000	1.0000	1.0000
2001	0.0009	0.0098	0.0214	0.0961	0.3065	0.6459	0.9345	0.9932	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
2002	0.0009	0.0039	0.0448	0.1724	0.6329	0.7200	0.8948	0.9841	0.9989	1.0000	1.0000	1.0000	1.0000	1.0000
2003	0.0013	0.0046	0.0173	0.1821	0.6649	0.9655	0.9373	0.9754	0.9963	0.9998	1.0000	1.0000	1.0000	1.0000
2004	0.0013	0.0061	0.0231	0.0739	0.5140	0.9498	0.9978	0.9886	0.9946	0.9991	1.0000	1.0000	1.0000	1.0000
2005	0.0013	0.0061	0.0284	0.1074	0.2656	0.8340	0.9945	0.9999	0.9980	0.9988	0.9998	1.0000	1.0000	1.0000
2006	0.0013	0.0061	0.0284	0.1212	0.3796	0.6210	0.9598	0.9994	1.0000	0.9997	0.9998	1.0000	1.0000	1.0000
2007	0.0013	0.0061	0.0284	0.1212	0.3864	0.7567	0.8813	0.9913	0.9999	1.0000	0.9999	0.9999	1.0000	1.0000
2008	0.0013	0.0061	0.0284	0.1212	0.3864	0.7372	0.9405	0.9711	0.9981	1.0000	1.0000	1.0000	1.0000	1.0000
2009	0.0013	0.0061	0.0284	0.1212	0.3864	0.7372	0.9272	0.9877	0.9935	0.9996	1.0000	1.0000	1.0000	1.0000
2010	0.0013	0.0061	0.0284	0.1212	0.3864	0.7372	0.9272	0.9834	0.9976	0.9986	0.9999	1.0000	1.0000	1.0000
2011	0.0013	0.0061	0.0284	0.1212	0.3864	0.7372	0.9272	0.9834	0.9964	0.9995	0.9997	1.0000	1.0000	1.0000
2012	0.0013	0.0061	0.0284	0.1212	0.3864	0.7372	0.9272	0.9834	0.9964	0.9992	0.9999	0.9999	1.0000	1.0000

Table 18. Mean numbers per tow at age for the fall industry (GEAC) trawl survey of the offshore portion of NAFO Subdivision 3Ps. The 1997 and 1998 cohorts are highlighted (shaded cells). No survey was conducted in 2006.

Age/Year	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00
2	0.29	0.06	0.34	1.64	0.21	0.00	0.22	0.08	0.05
3	3.28	0.40	1.14	7.24	12.47	1.26	0.41	0.68	1.74
4	9.42	1.76	1.71	2.86	26.74	16.88	2.46	0.80	1.15
5	13.62	2.32	2.83	3.35	3.75	18.47	8.34	1.07	0.43
6	3.02	1.81	3.58	5.18	2.14	2.90	9.28	2.98	0.31
7	10.03	0.35	3.27	5.89	1.62	1.39	1.32	1.18	0.74
8	11.97	1.64	0.51	3.99	1.34	1.18	0.73	0.15	0.50
9	1.34	3.40	1.43	1.14	0.96	0.91	1.32	0.12	0.08
10	0.54	0.40	1.36	5.83	0.10	0.46	0.48	0.18	0.04
11	0.24	0.04	0.17	7.14	0.44	0.09	0.24	0.13	0.09
12	0.04	0.13	0.10	0.79	0.58	0.27	0.00	0.05	0.04
13	0.00	0.22	0.02	0.11	0.08	0.30	0.16	0.00	0.00
14	0.00	0.00	0.00	0.17	0.05	0.00	0.15	0.13	0.00
15	0.00	0.04	0.00	0.00	0.03	0.00	0.03	0.06	0.00
Totals	53.79	12.58	16.46	45.33	50.54	44.11	25.14	7.61	5.17

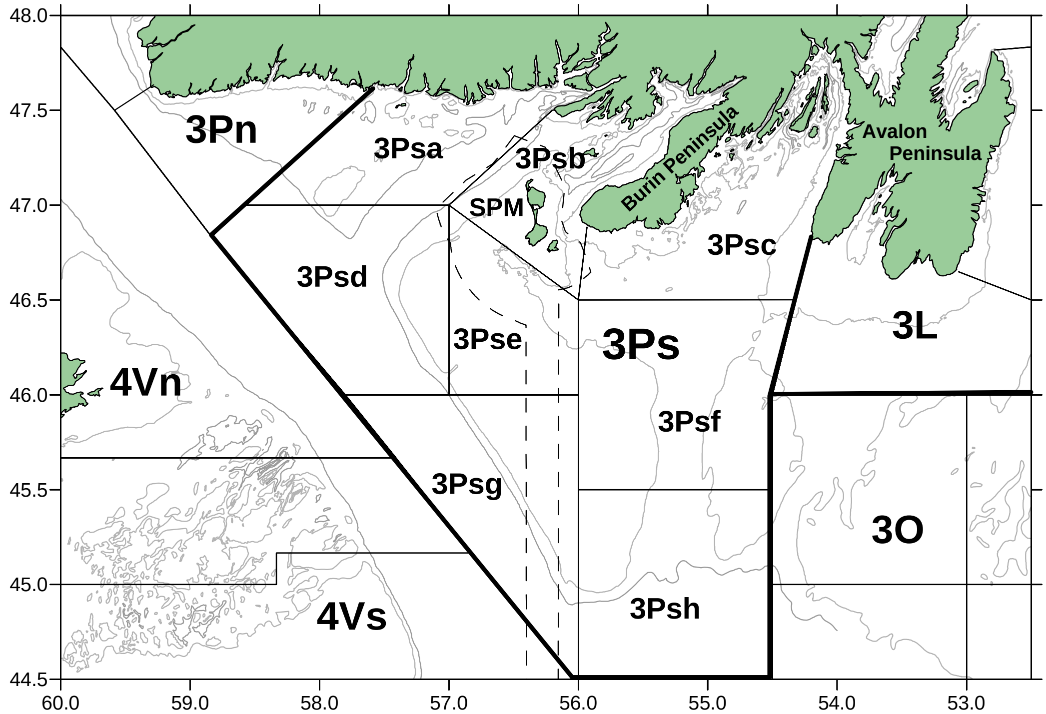


Figure 1. NAFO Subdivision 3Ps management zone showing the economic zone around the French islands of St. Pierre and Miquelon (SPM, dashed line), the 100 m and 250 m depth contours (grey lines) and the boundaries of the statistical unit areas (solid lines).

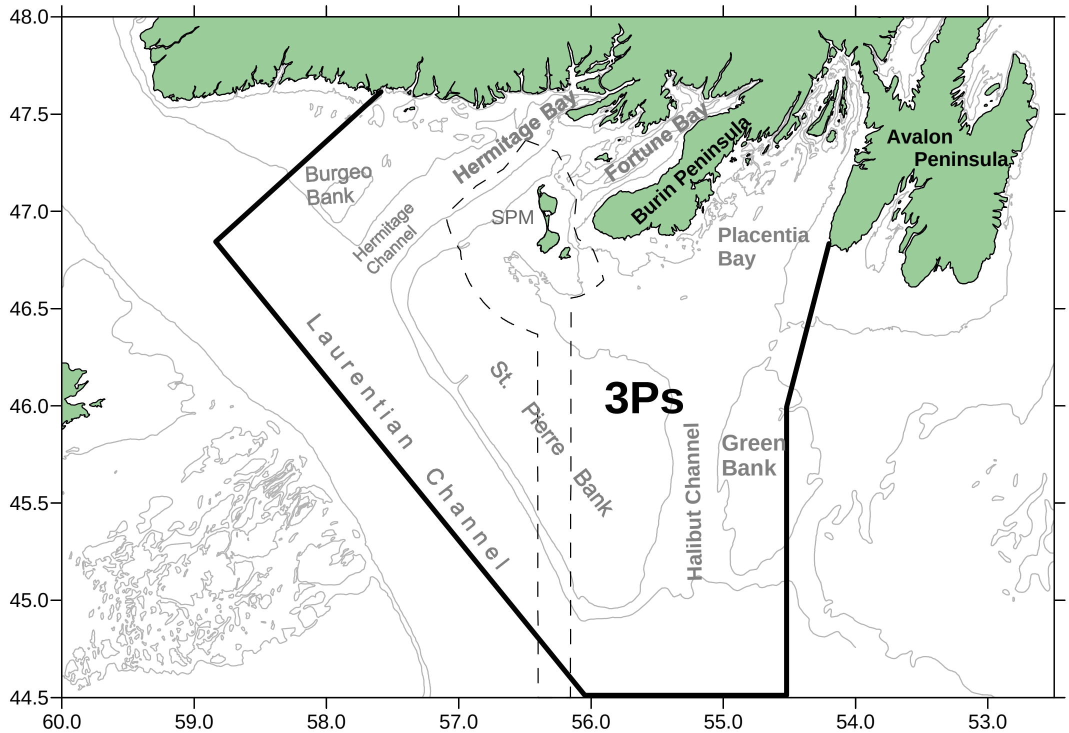


Figure 2. NAFO Subdivision 3Ps management zone showing the economic zone around the French islands of St. Pierre and Miquelon (SPM, dashed line), the 100 m and 250 m depth contours (grey lines) and the main fishing areas.

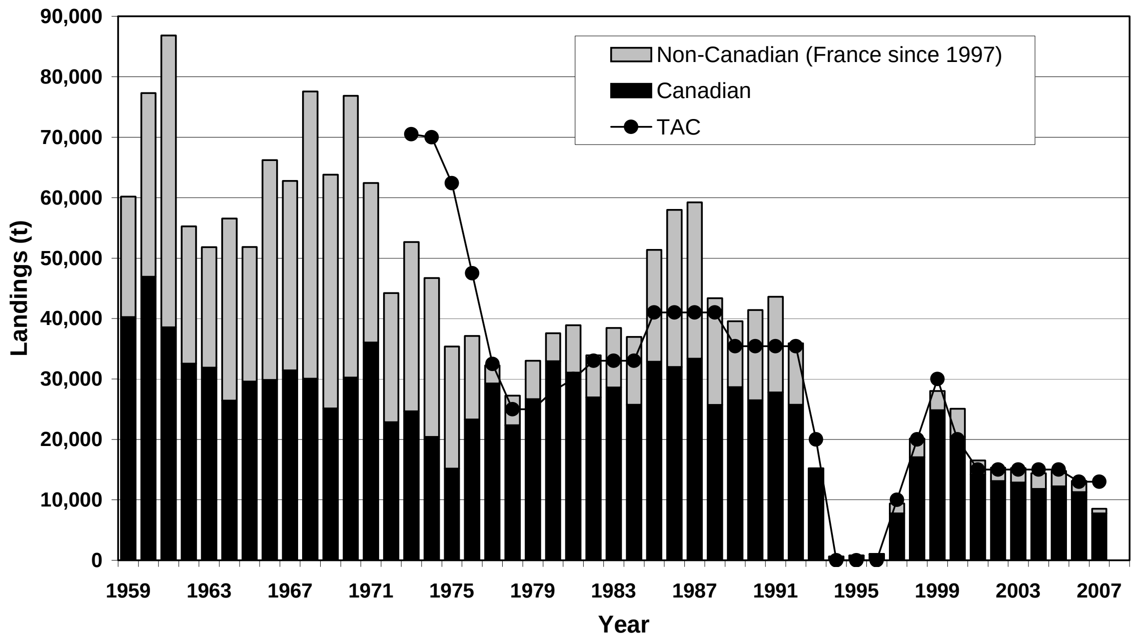


Figure 3a. Reported landings of cod by Canadian and non-Canadian vessels in NAFO Subdivision 3Ps during 1959-October 2007. Note that the 2007 was not completed at the time of the assessment.

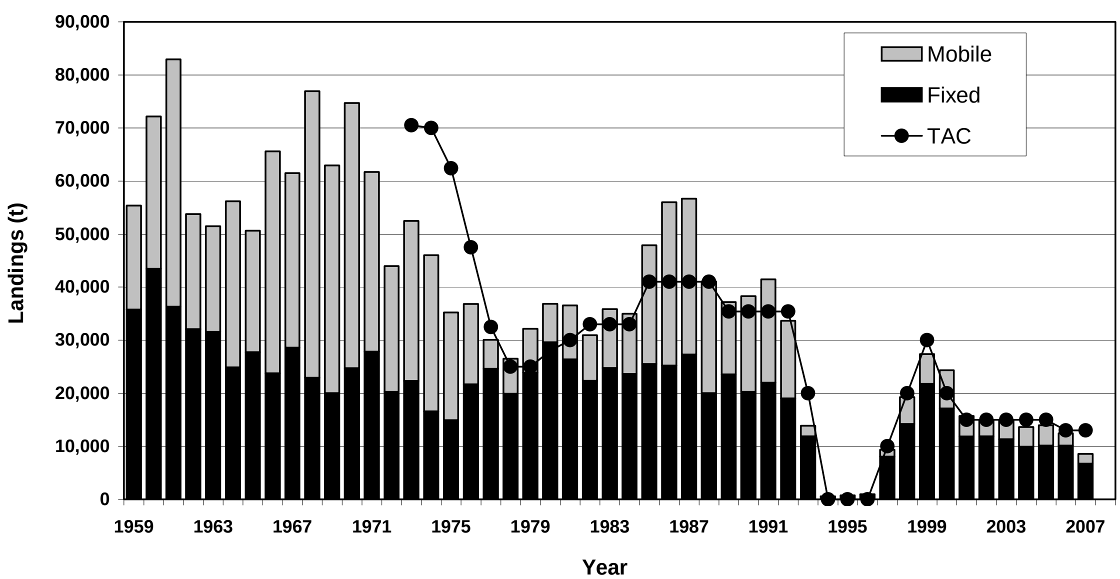


Figure 3b. Reported landings of cod by fixed and mobile gear vessels in NAFO Subdivision 3Ps during 1959-October 2007. Note that the 2007 was not completed at the time of the assessment.

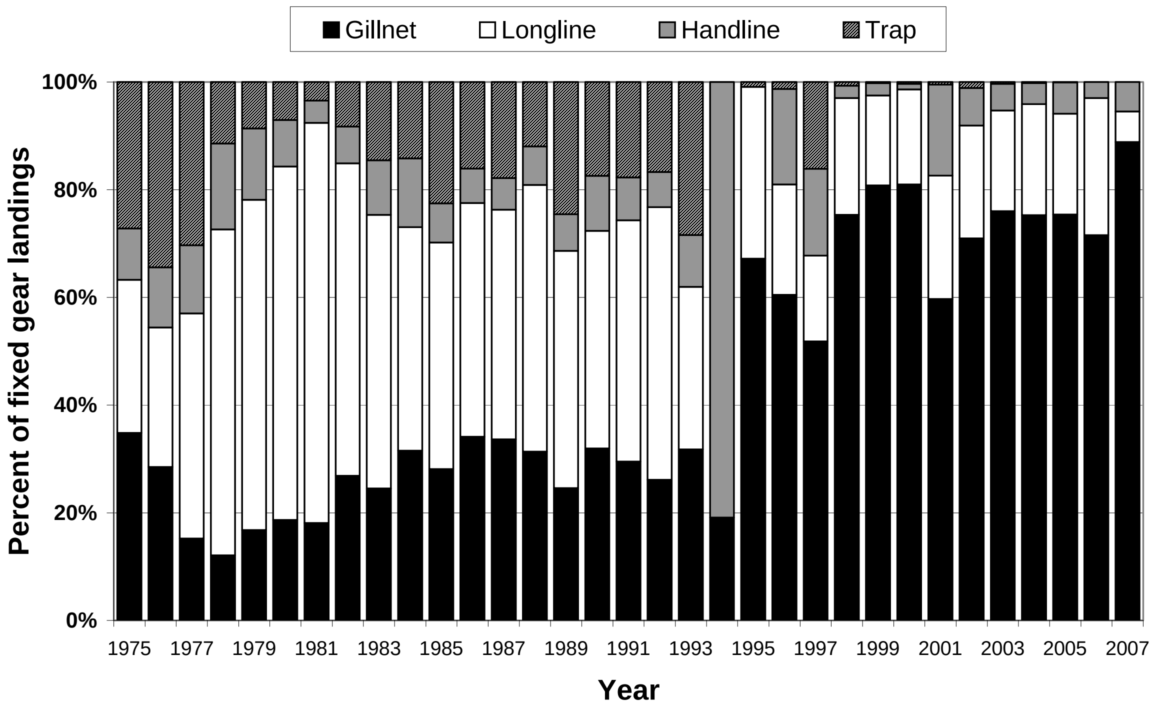


Figure 4. Percent of total fixed gear landings by the four main fixed gears used in the cod fishery in NAFO Subdivision 3Ps during 1975-1 October 2007. The fishery was under a moratorium during 1994-96 and values for those years are based on sentinel and by-catch landings of <800 t. The values for 2007 are based on fixed gear landings to 1 October (about 6,030 t) as the fishery was still in progress.

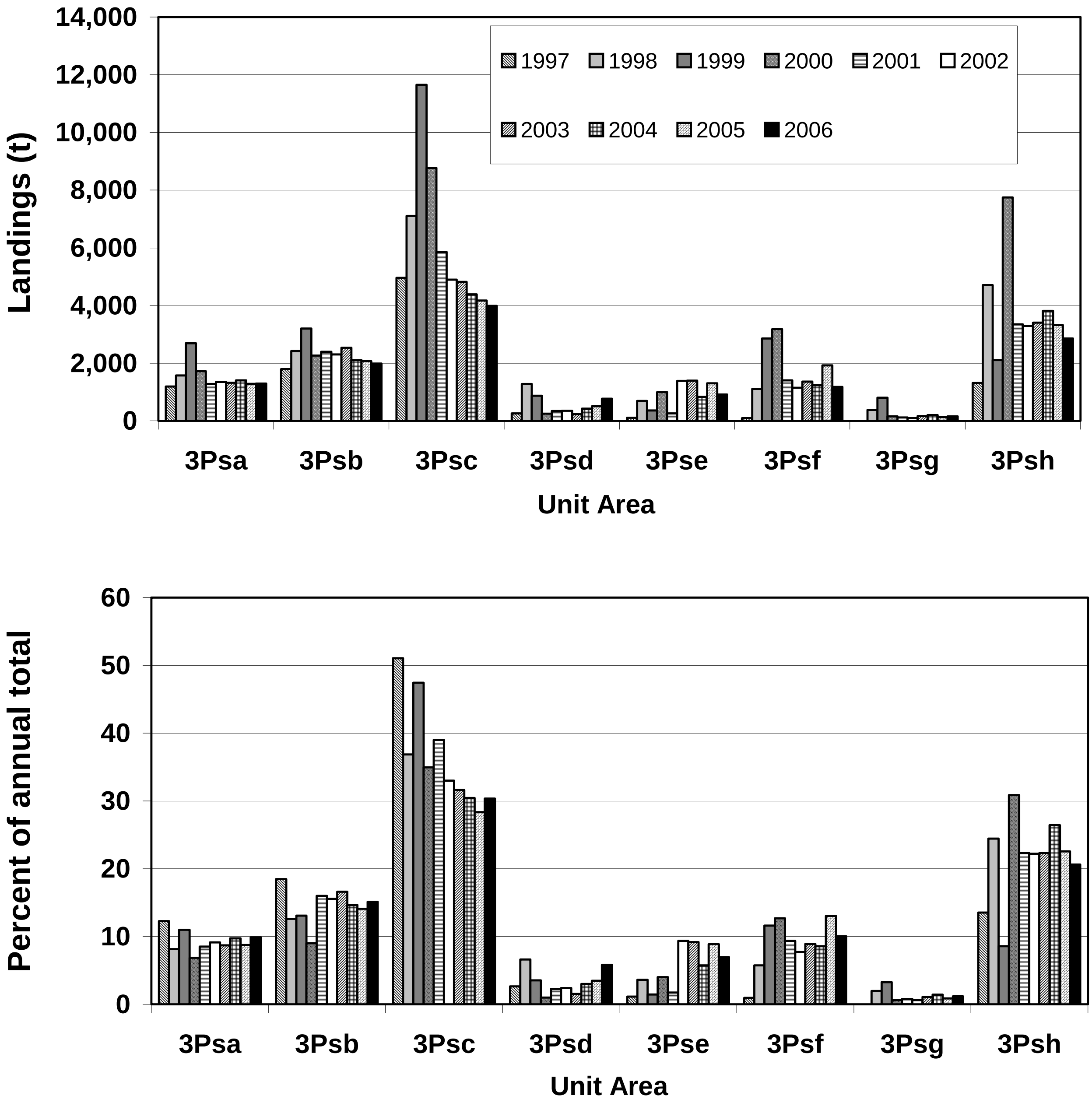


Figure 5. Annual reported landings of cod by unit area from NAFO Subdivision 3Ps during 1997-2006 (see Figure 1 for locations of unit areas).

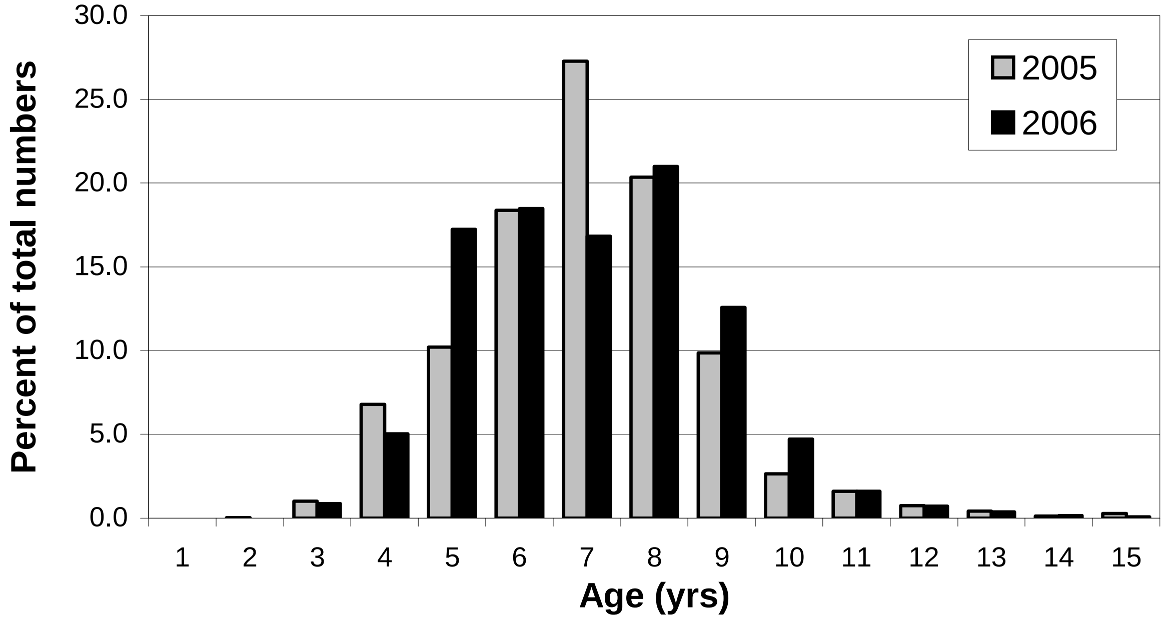


Figure 6a. Catch at age (percent of annual total) for the cod fishery in 3Ps during 2005 versus 2006.

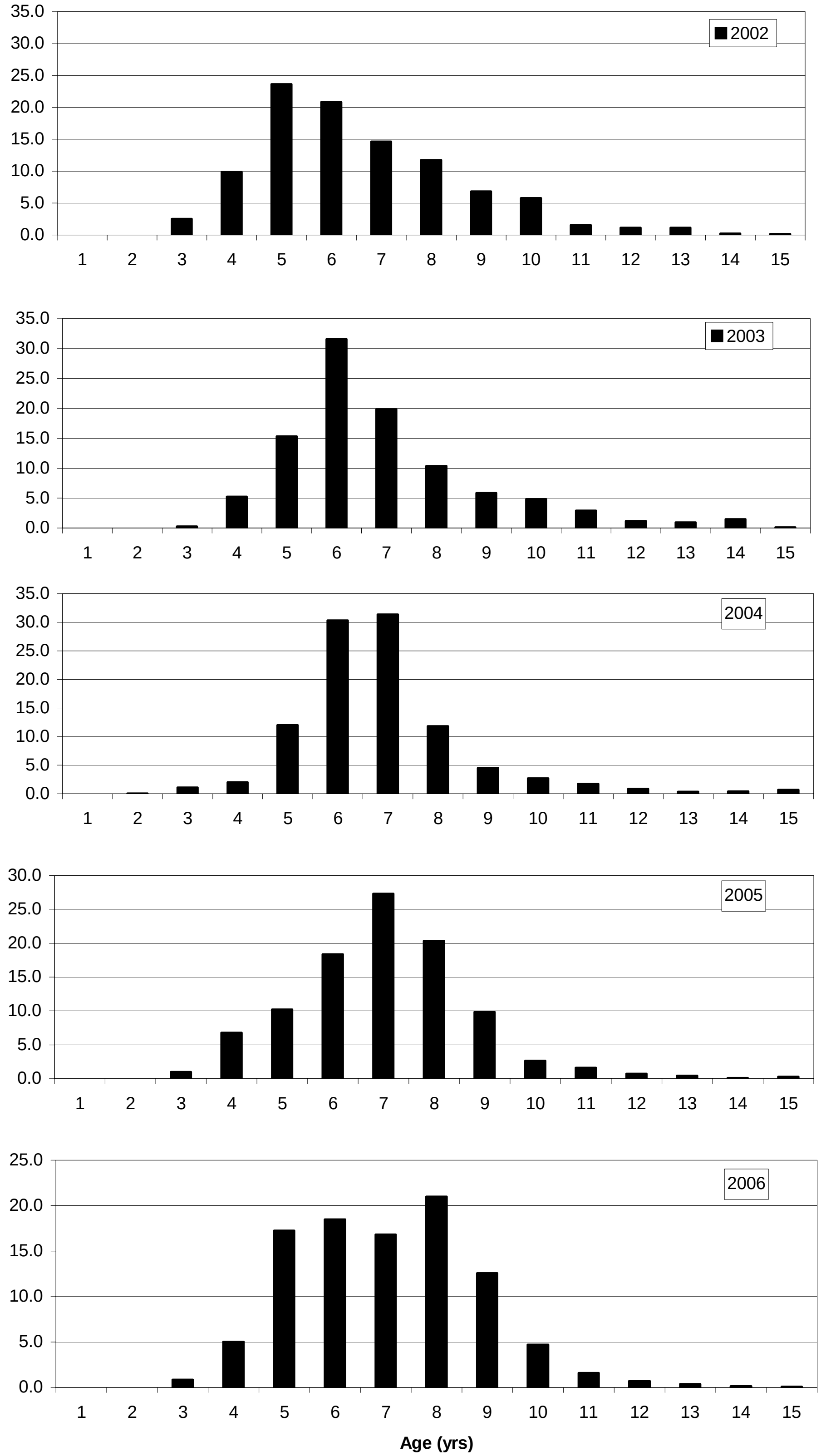


Figure 6b. Trends in catch at age (percents) for 3Ps cod from 2002 to 2006.

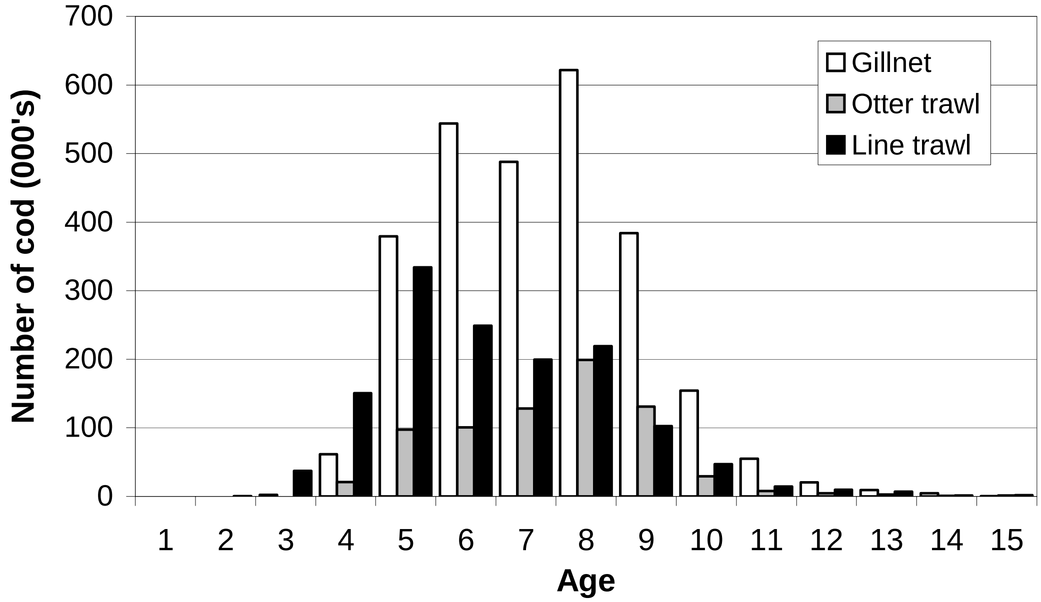


Figure 7a. Catch numbers-at-age for the main gear types used in the 3Ps cod fishery during 2006.

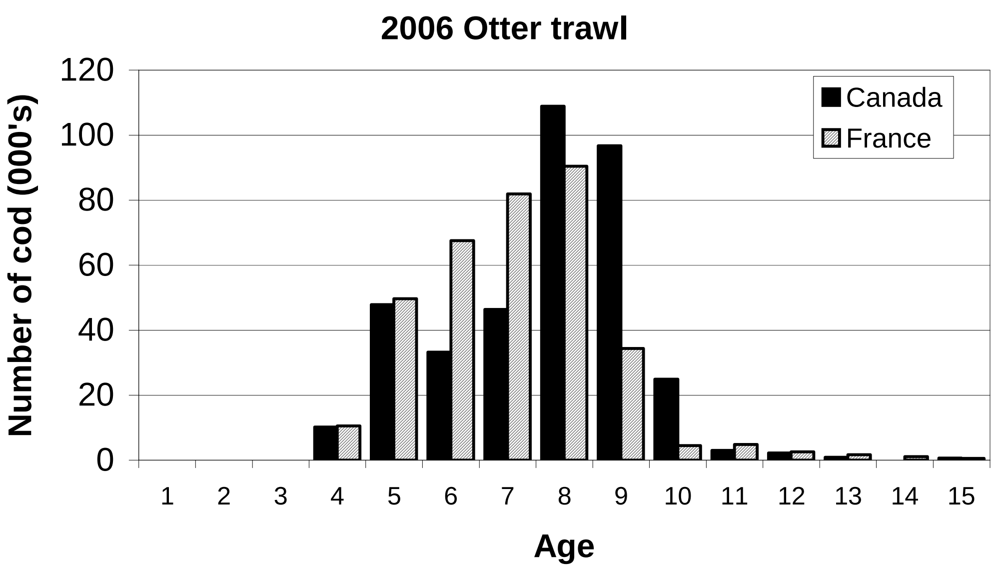


Figure 7b. Catch at age from otter trawl by Canada and France during the 3Ps cod fishery in 2006.

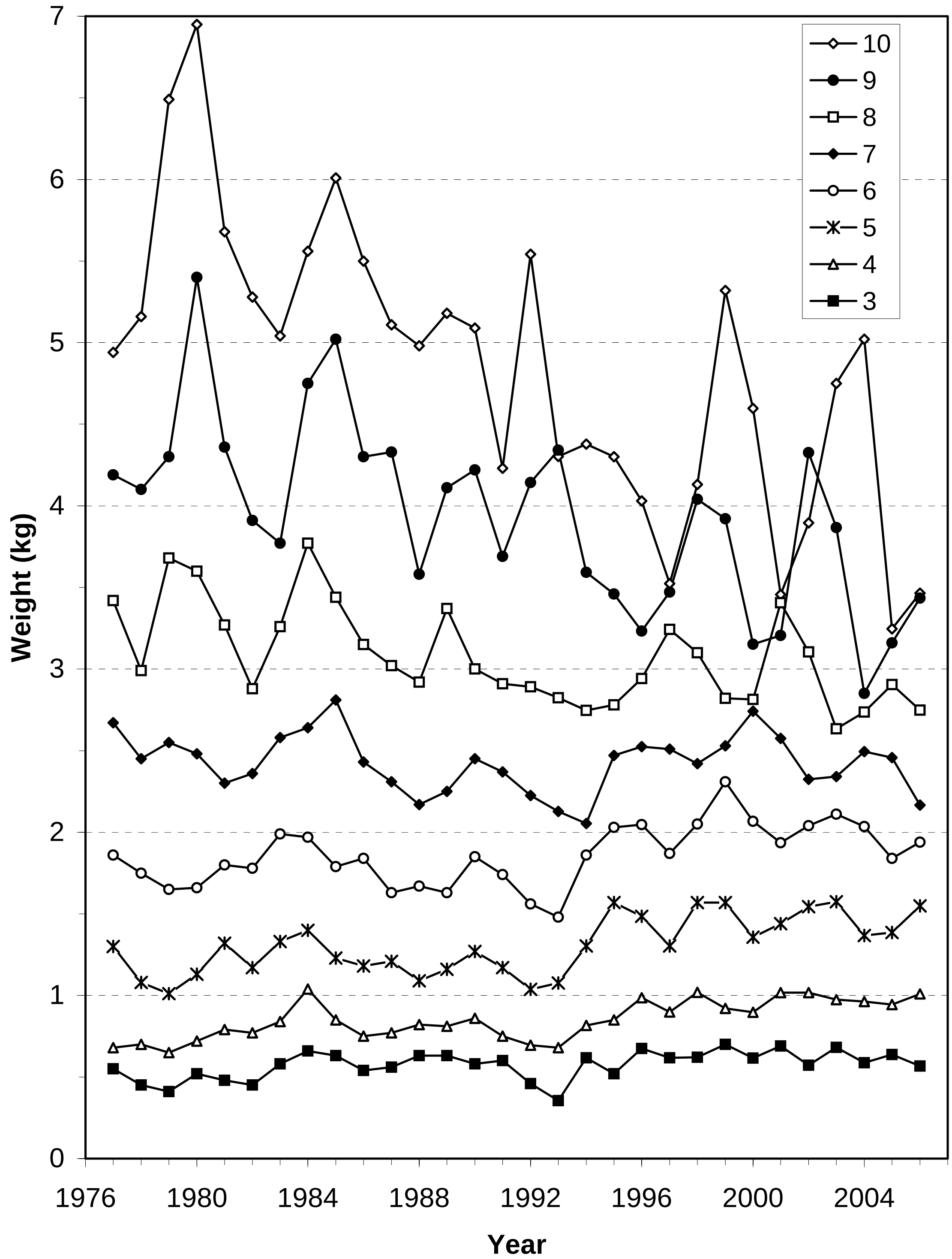


Figure 8a. Mean weights-at-age calculated from mean lengths-at-age for the commercial catch of cod in NAFO Subdivision 3Ps during 1977-2006.

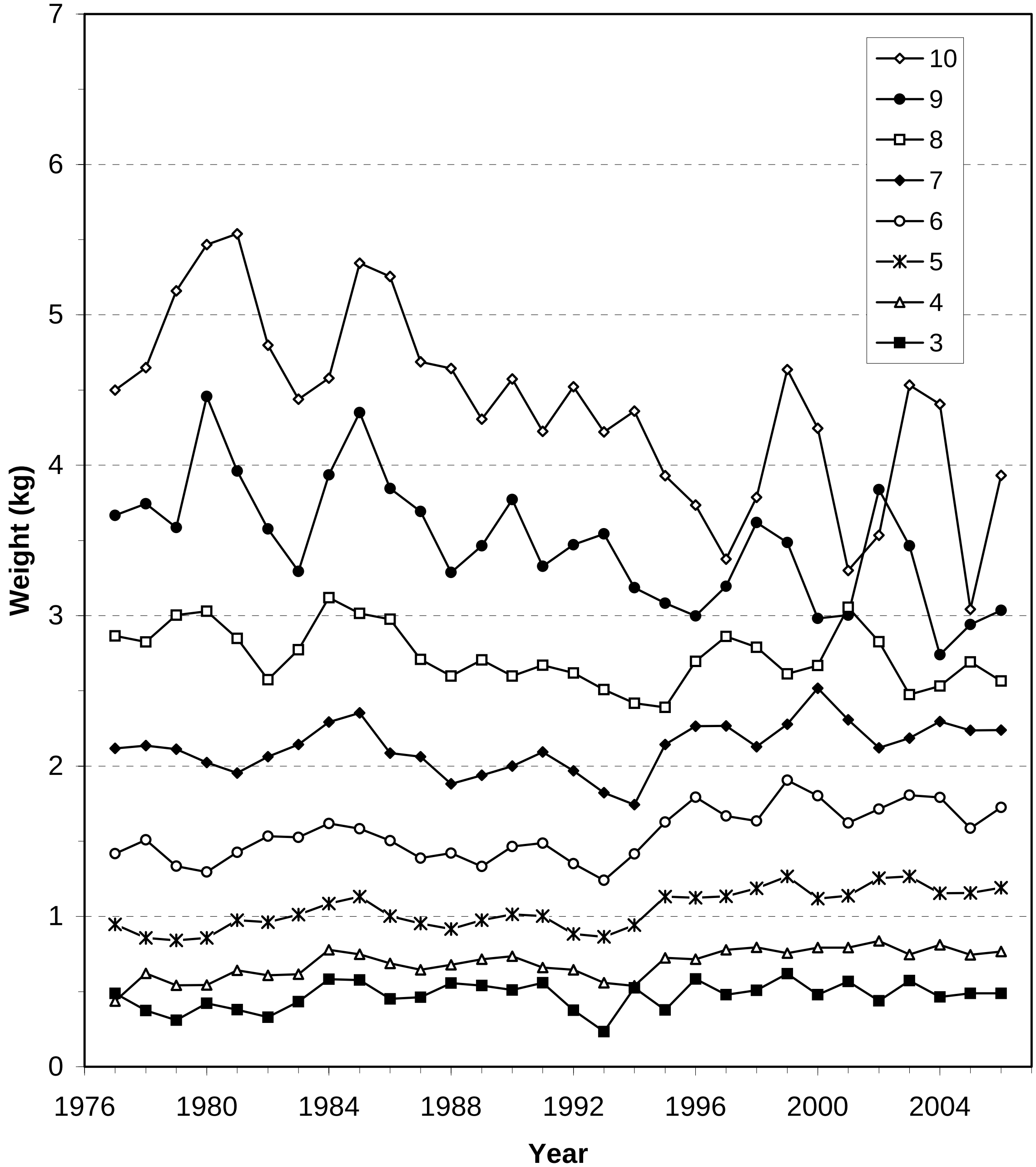
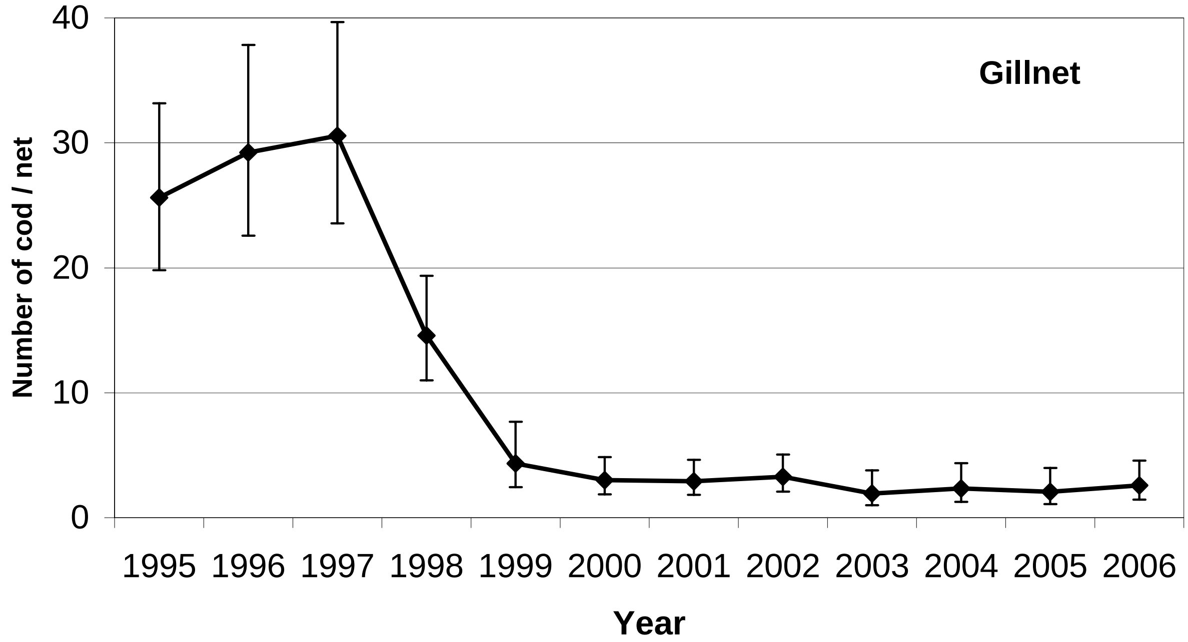


Figure 8b. Beginning of year mean weights-at-age (3-10) from the commercial catch of cod in NAFO Subdivision 3Ps during 1977-2006.



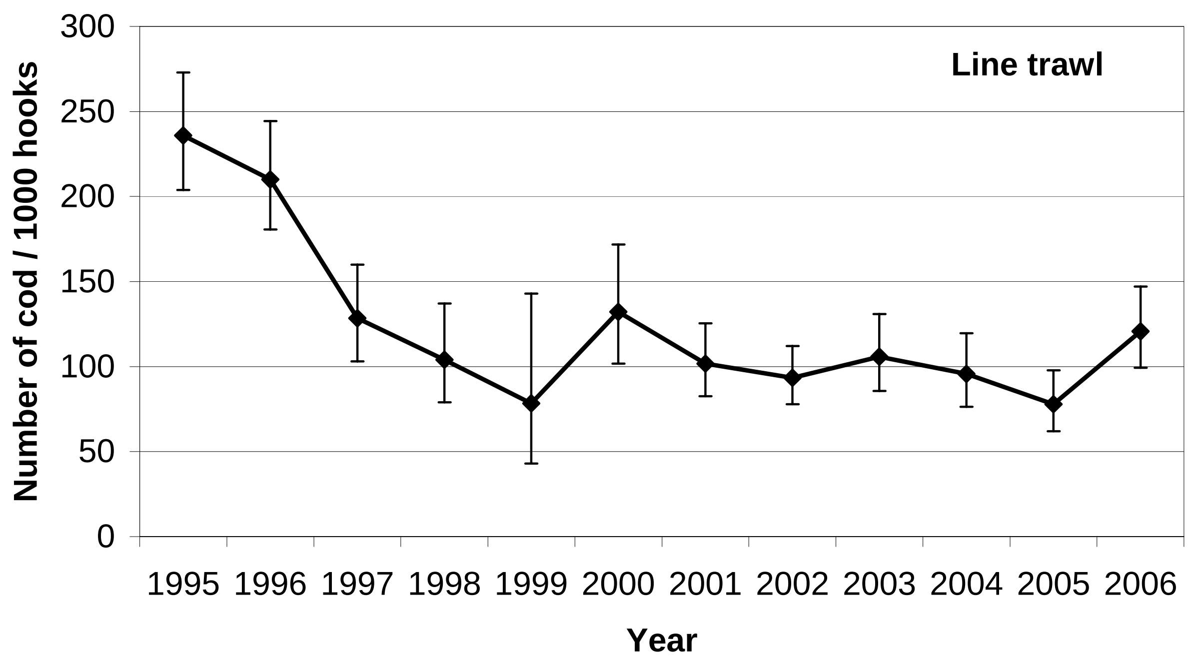


Figure 9a. Standardized age-aggregated catch rate indices for gillnets (5.5" mesh) and line-trawls (with 95% CL's) estimated using data from sentinel fishery fixed sites.

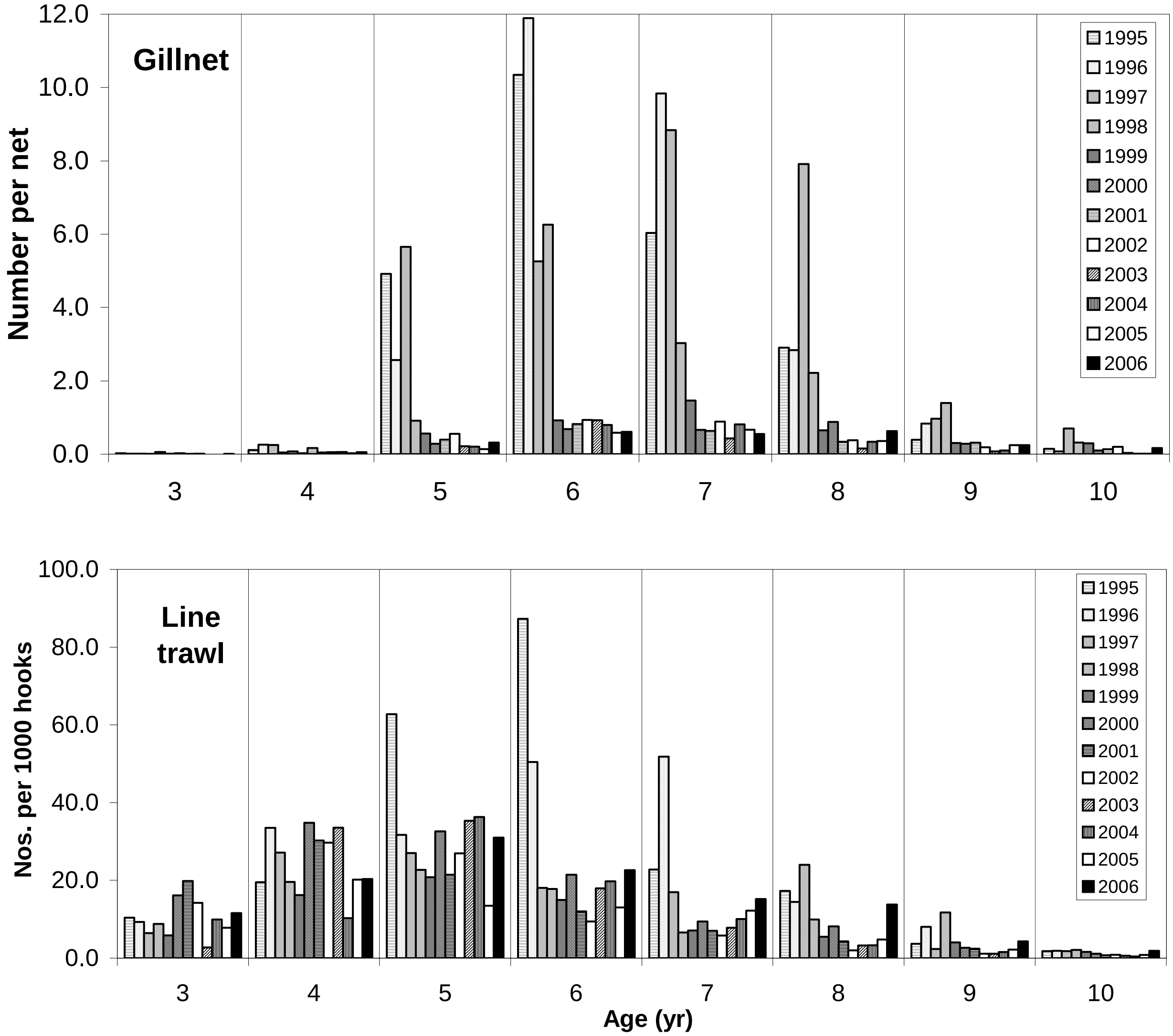
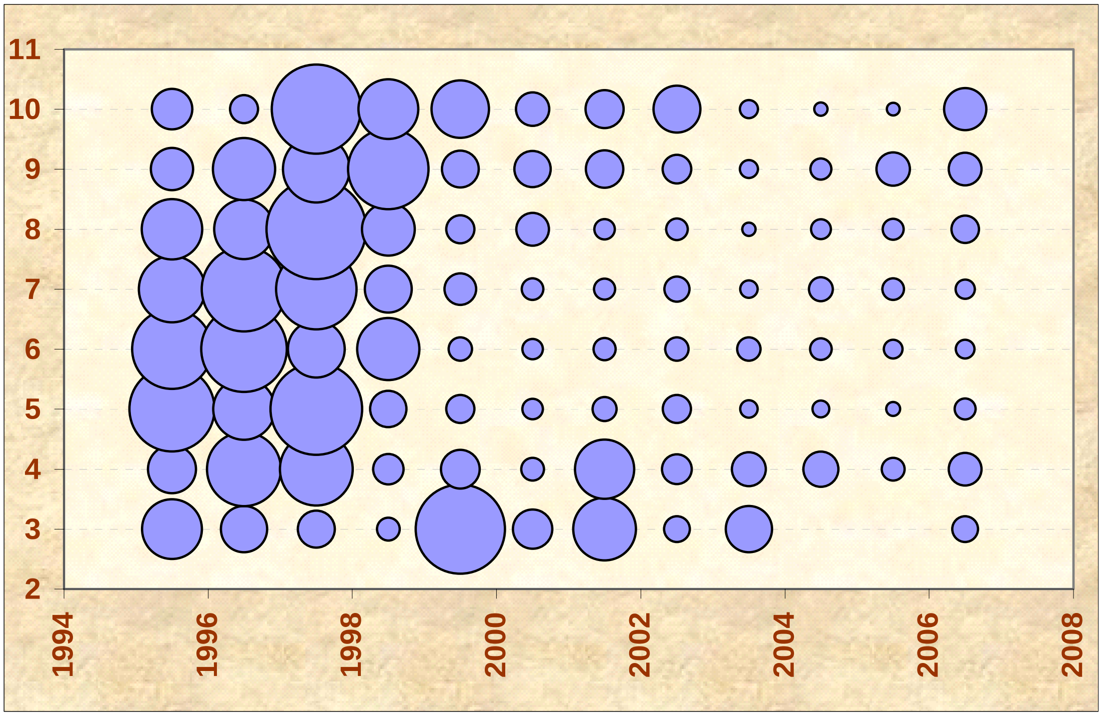


Figure 9b. Standardized age-disaggregated catch rate indices for gill nets (5.5" mesh) and line-trawls estimated using data from sentinel fishery fixed sites. Catch rates are fish per 50 fathom net for gill nets and fish per 1,000 hooks for line trawl.

Index at age - Normalized by age **Sent Gillnet**



Index at age - Normalized by age **Sent Linetrawl**

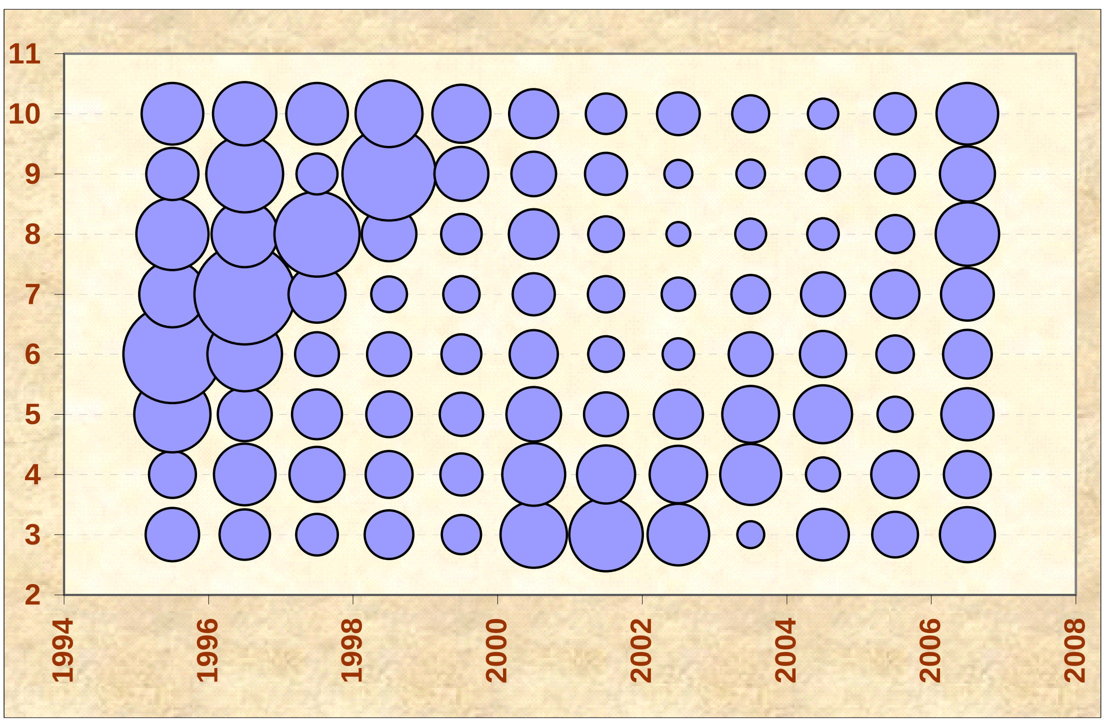


Figure 9c. Age-specific catch rates (ages 3-10) for gillnet and linetrawl using data from sentinel fishery fixed sites. Symbol sizes within each age were scaled by dividing each value by the average for that age.

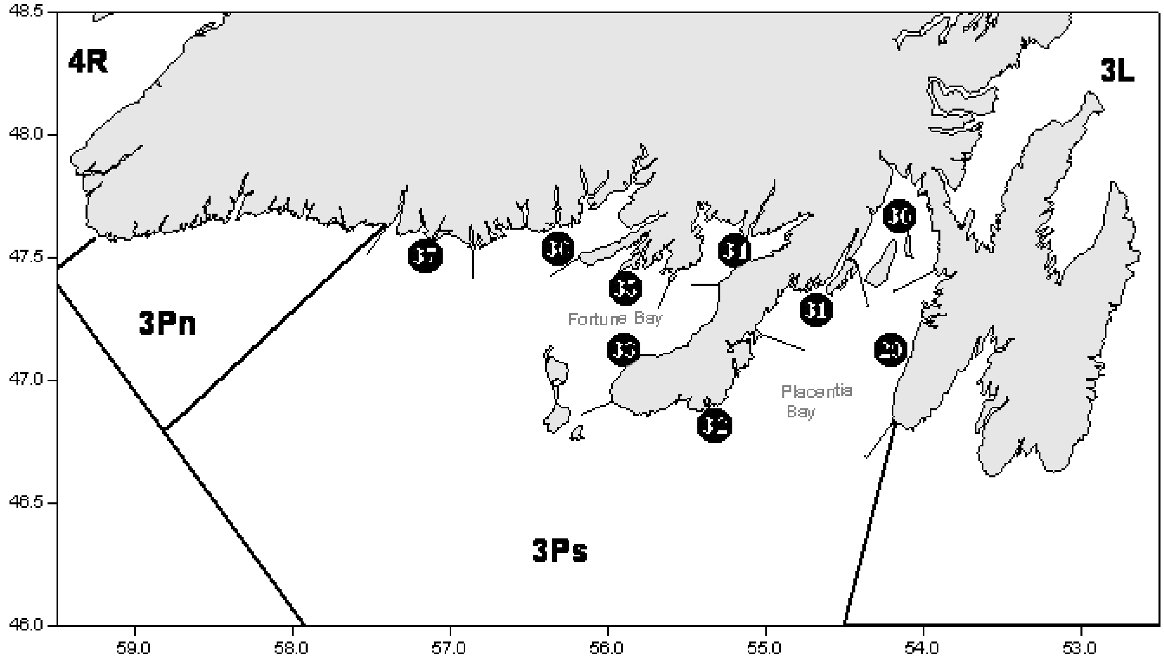
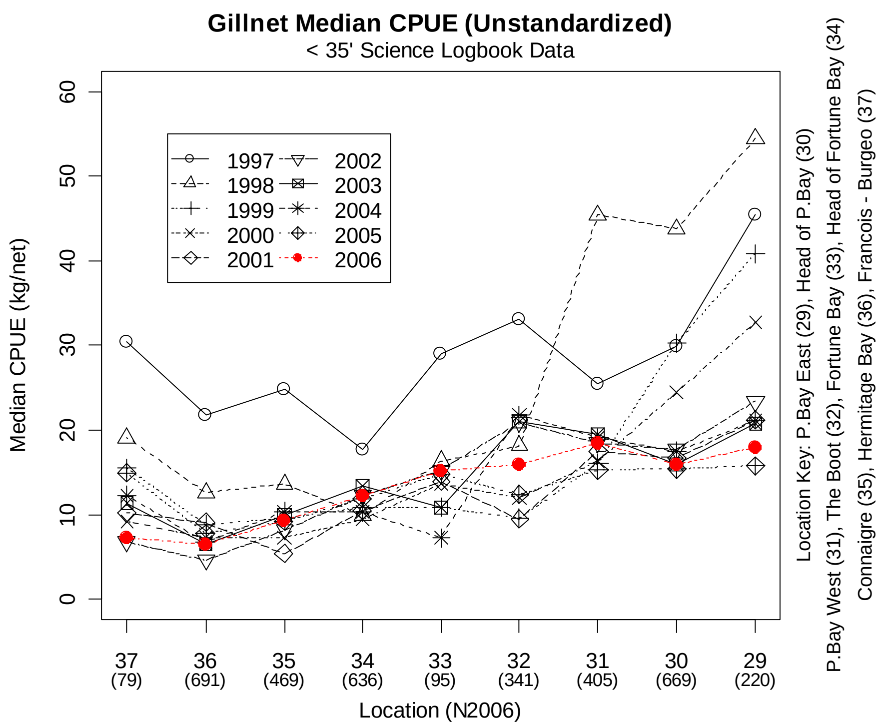


Figure 10a. Location and boundaries of numbered management areas along the inshore of the south coast of Newfoundland (NAFO Subdivision 3Ps) (29=Placentia Bay East, 30=Head of Placentia Bay, 31=Placentia Bay West, 32=The Boot, 33=Fortune Bay, 34=Head of Fortune Bay, 35=Connaigre, 36=Hermitage Bay, 37=Francois-Burgeo).



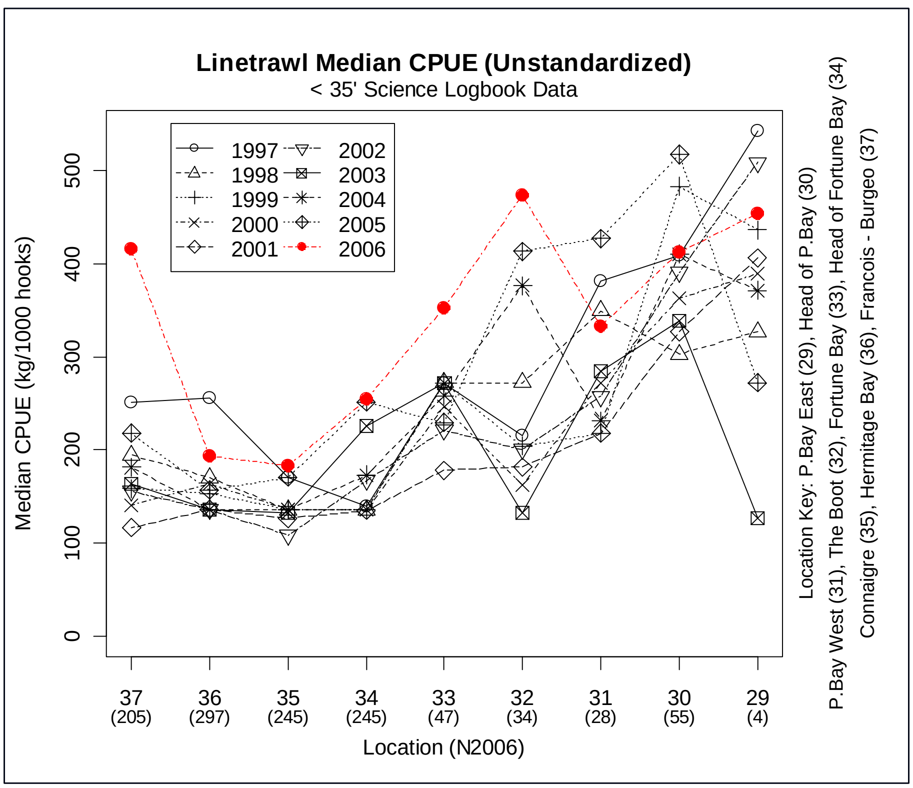


Figure 10b. Area-specific median annual catch rates of cod from gillnets (upper panel, kg per net) and line-trawls (lower panel, kg per 1,000 hooks) from science log-books for vessels <35 ft. Labels on *x*-axis are lobster fishing areas ordered from west to east (see key on right hand *y*-axis). Values in parenthesis on *x*-axis are number of valid sets per site during the 2006 fishery.

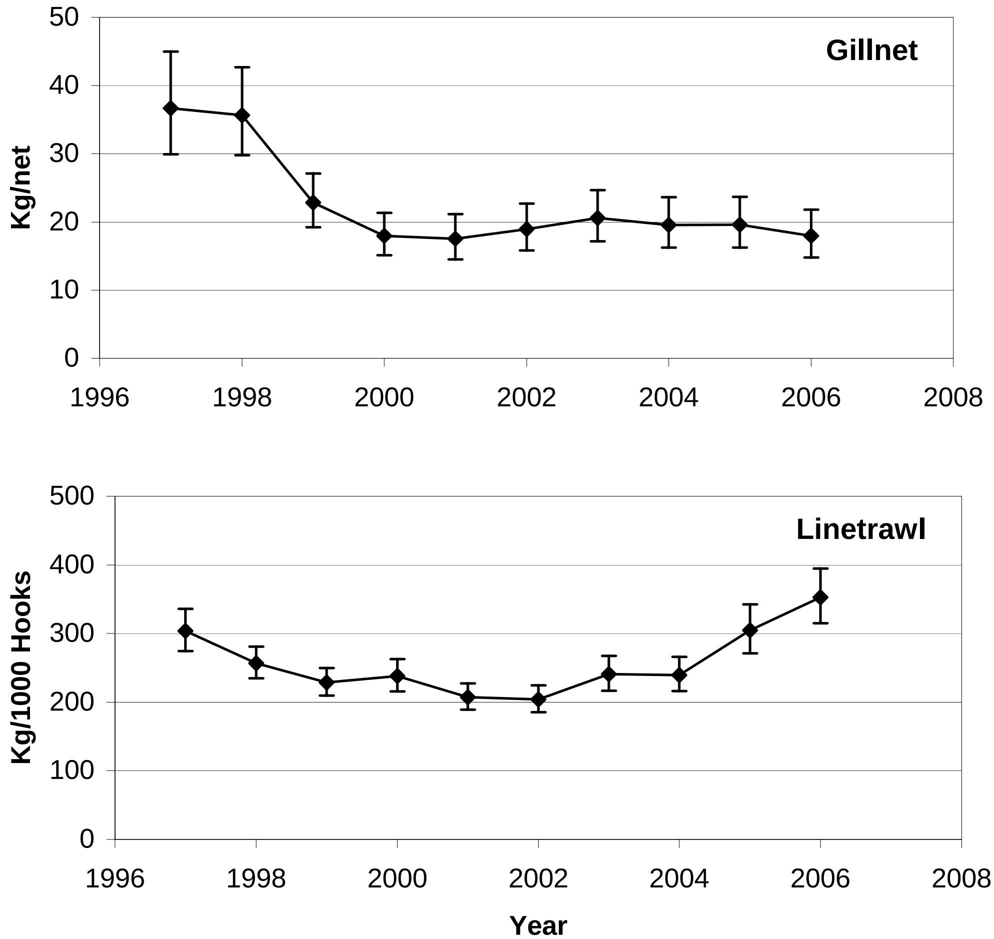


Figure 10c. Standardized catch rates for gillnets and line-trawls from science log-books for vessels <35 ft. Error bars are 95% confidence intervals of the means. Catch rates are expressed in terms of weight (kg per net or kg per 1000 hooks).

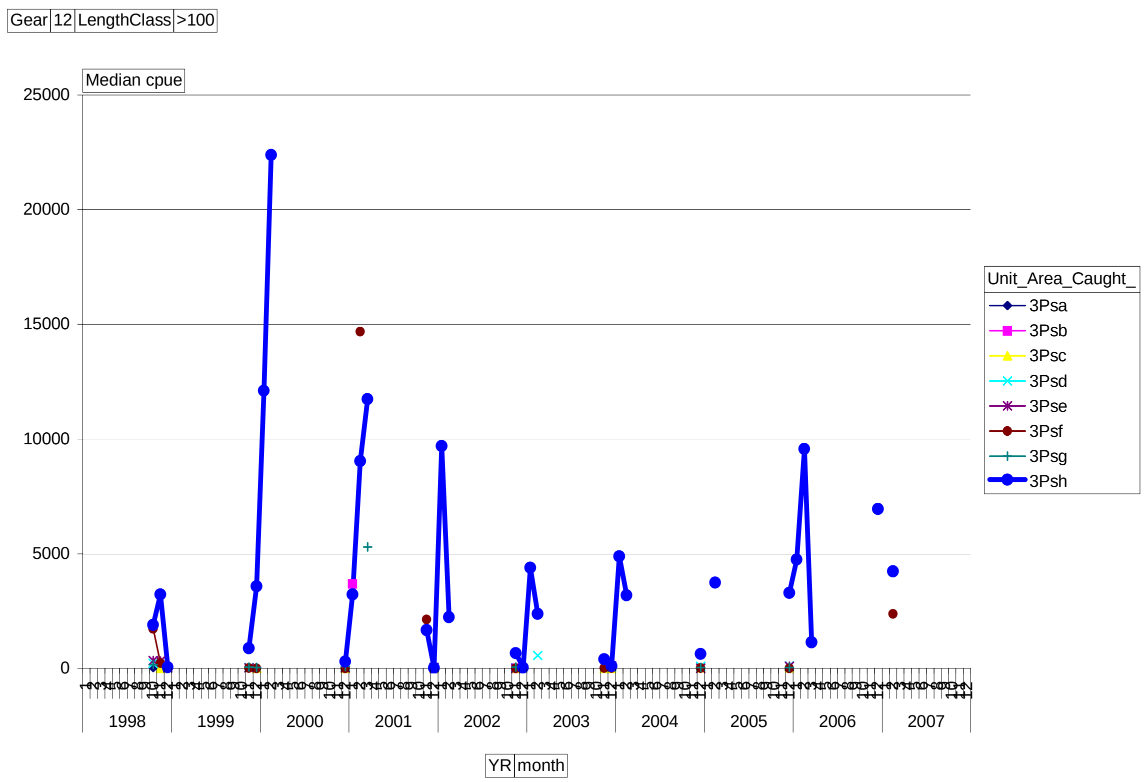


Figure 11. Temporal trends in median catch rates of cod (kg/ per hr tow) by large (>100 ft) otter trawlers fishing in 3Ps during late fall and winter 1998-2006.

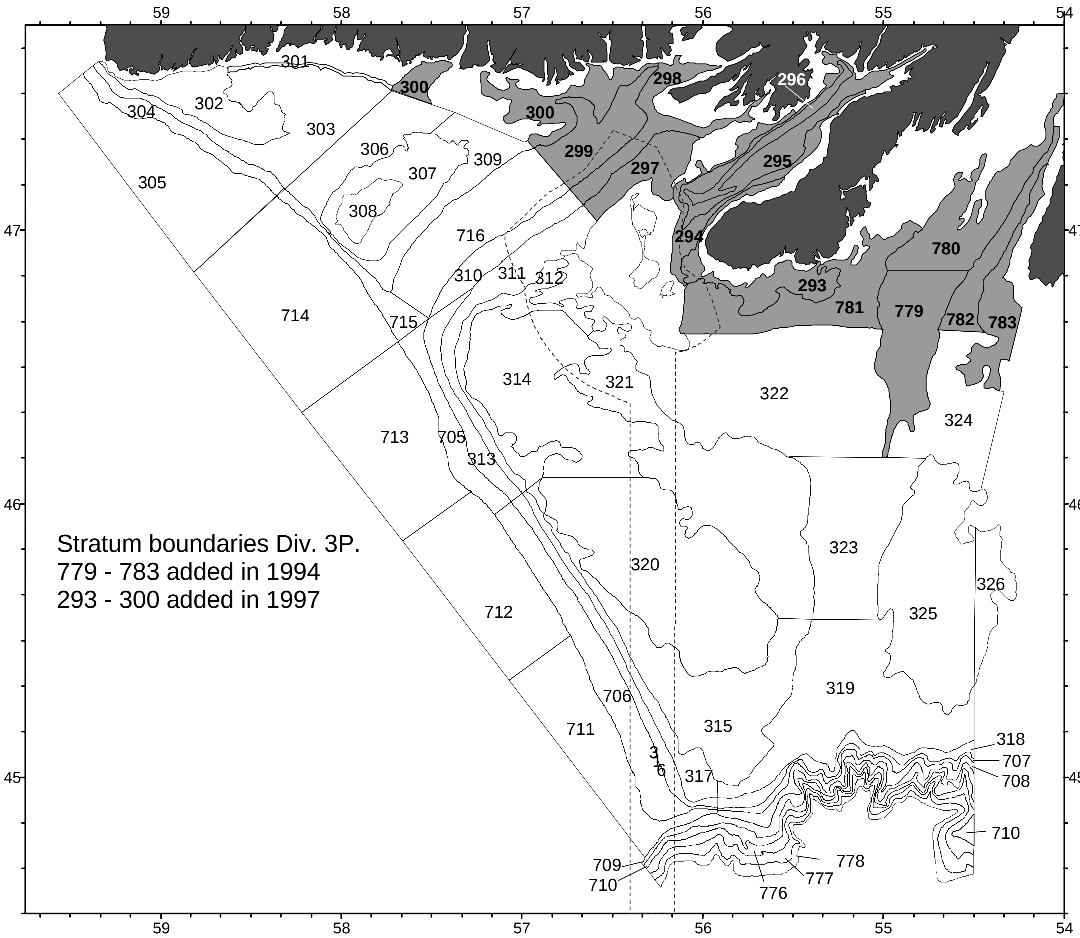
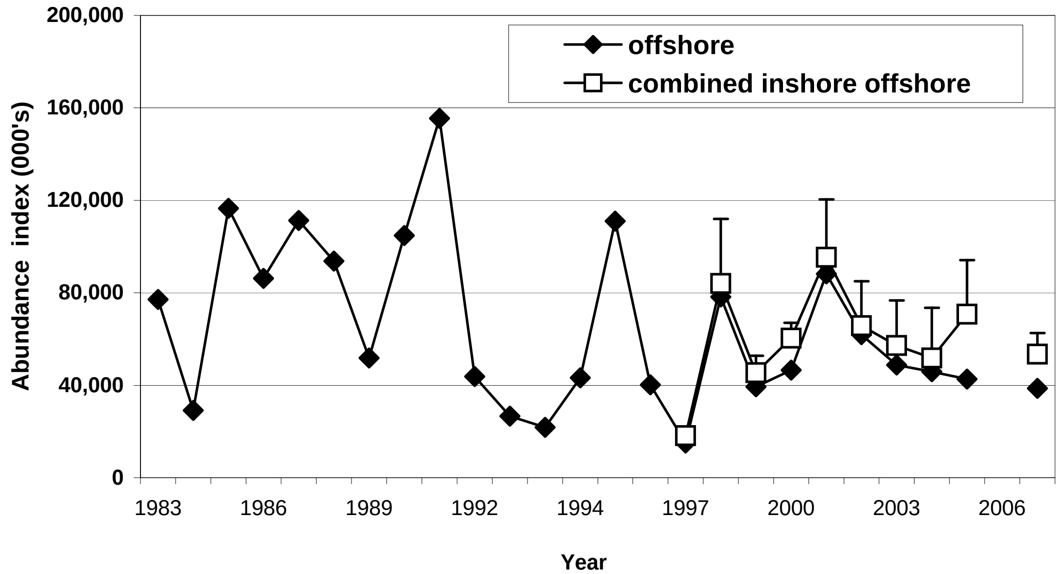


Figure 12. Stratum area boundaries and area surveyed during the DFO research vessel bottom-trawl survey of NAFO Subdivision 3Ps. Dashed line is the boundary of the French economic zone which is included in the surveyed area.



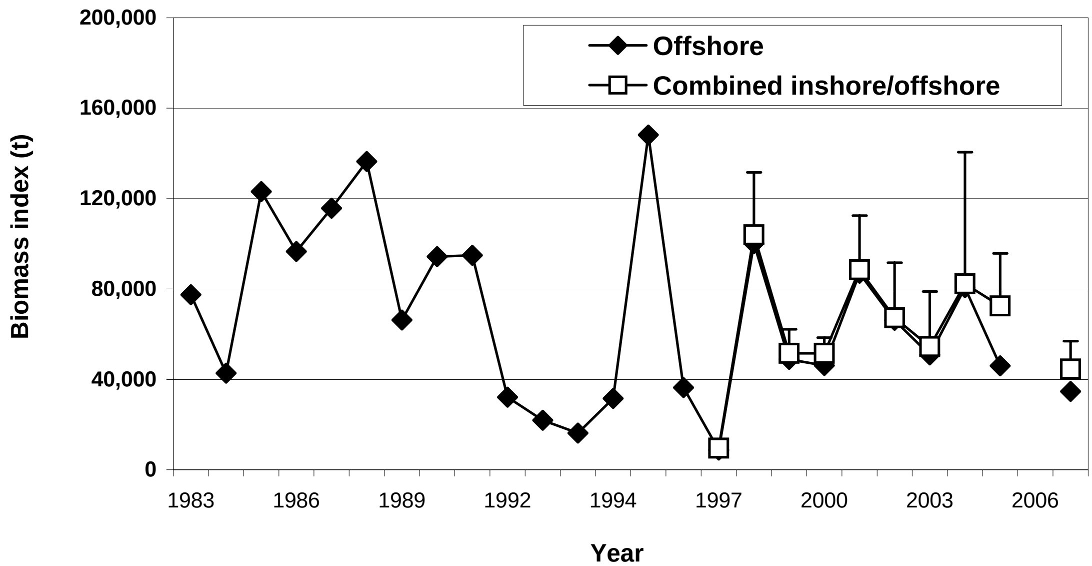


Figure 13. Abundance (upper panel) and biomass (lower panel) indices for cod in NAFO Subdivision 3Ps from DFO research vessel bottom trawl surveys of index strata during winter/spring from 1983 to 2007. There were two surveys in 1993 and the 2006 survey was not completed. Error bars show plus one standard deviation. Open symbols show values for augmented survey area that includes additional inshore strata added to the survey area since 1997.

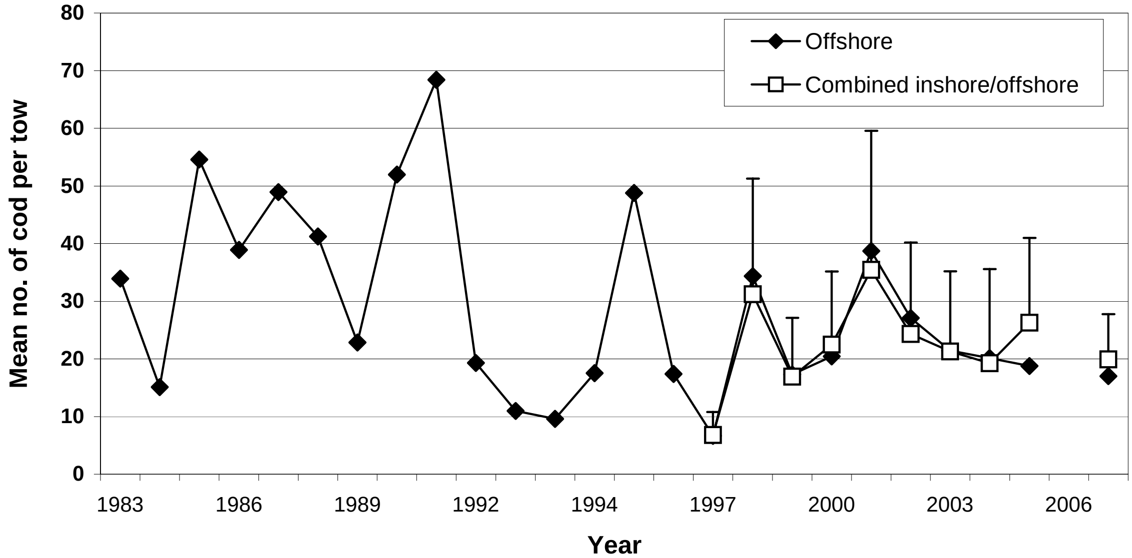


Figure 14a. Age-aggregated catch rate index (mean nos. per tow) for cod in NAFO Subdivision 3Ps from DFO research vessel bottom trawl surveys of offshore (index) strata during winter/spring from 1983 to 2007. There were two surveys in 1993 and the 2006 survey was not completed. Error bars show plus one standard deviation.

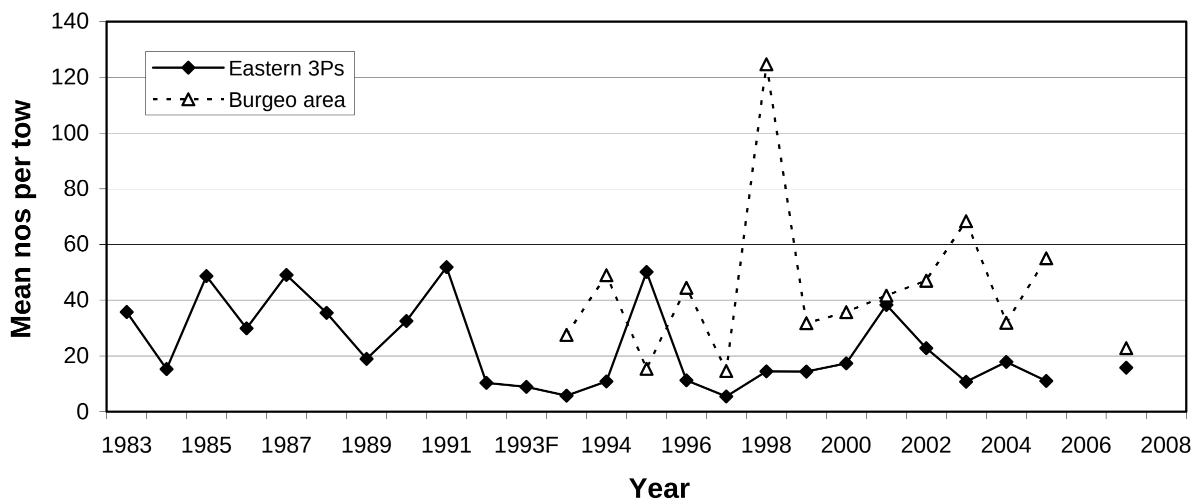


Figure 14b. Age-aggregated catch rate index for cod in the eastern and western (Burgeo area) portions of 3Ps from the DFO research vessel bottom trawl surveys. The survey was not completed in 2006 and there were two surveys in 1993 (February and April).

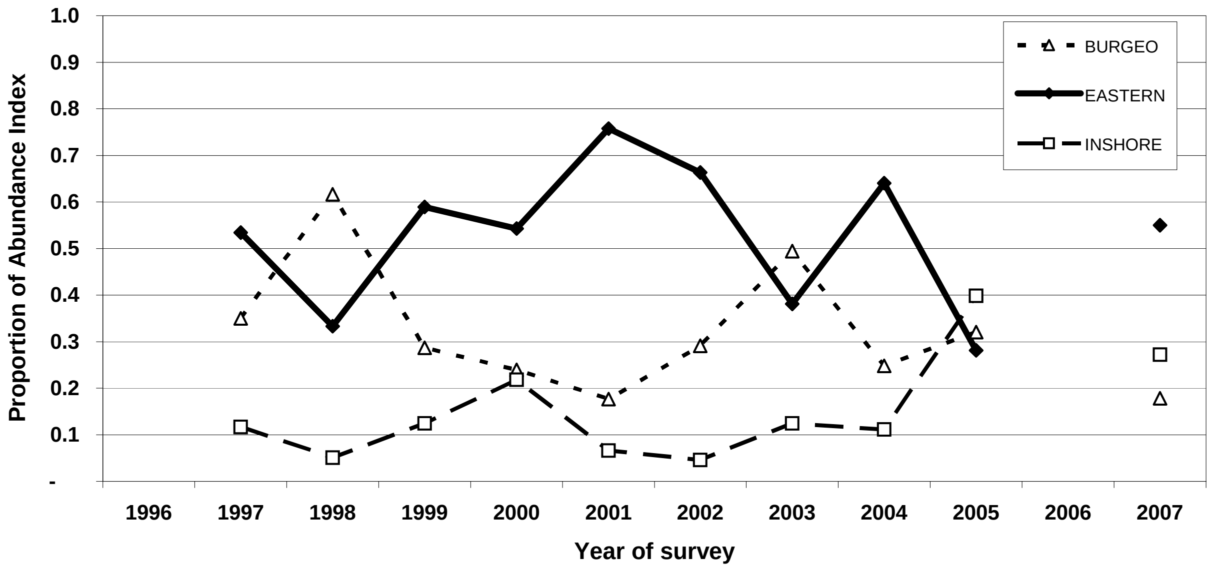


Figure 15. Relative proportions of total abundance index for cod in various regions of NAFO Subdivision 3Ps from DFO research vessel bottom trawl surveys during winter/spring from 1997 to 2007. The 2006 survey was not completed. The Campelen trawl was used in all surveys.

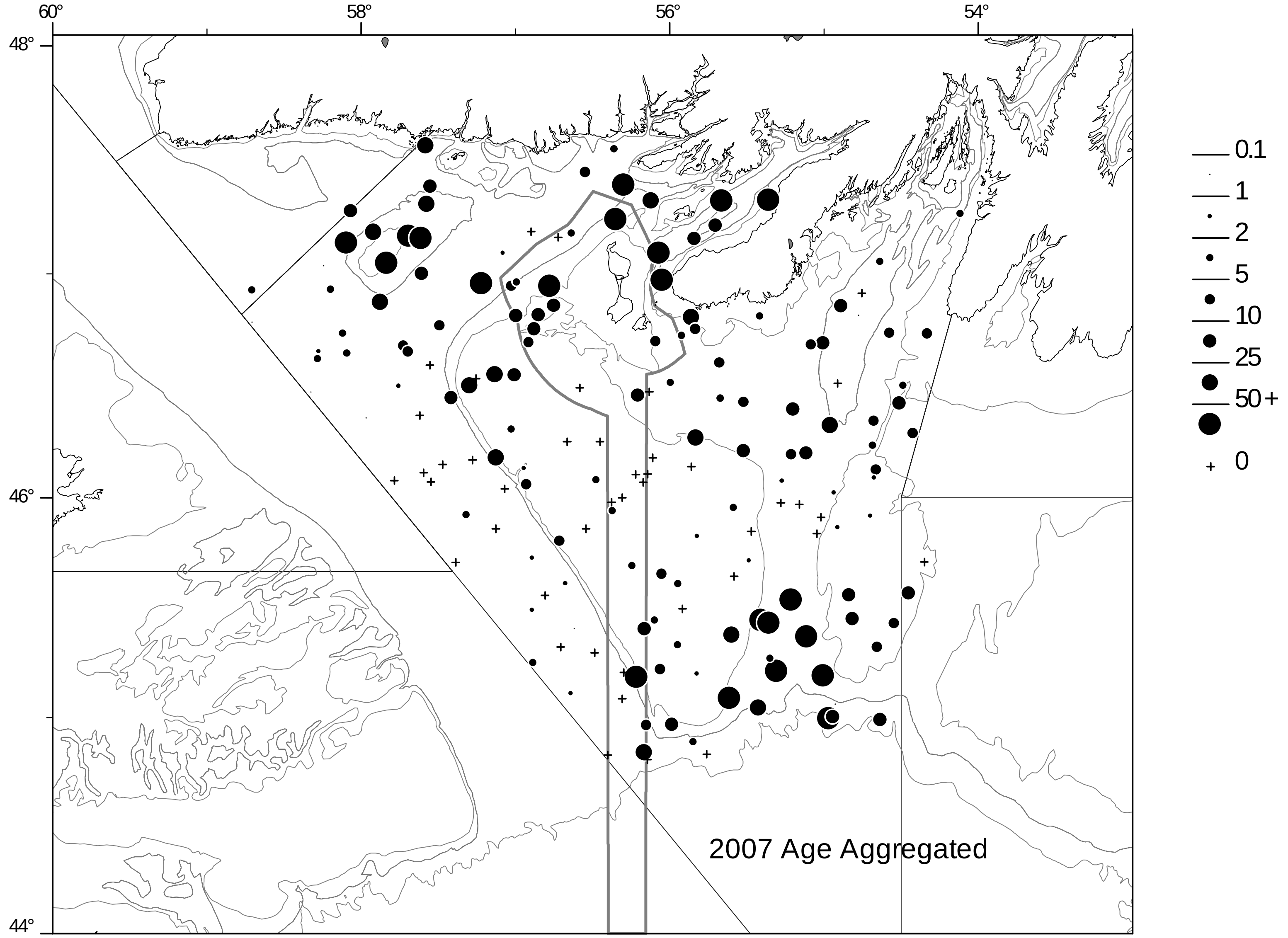


Figure 16a. Age aggregated distribution of cod catches (nos. per tow) from the DFO research vessel survey of 3Ps during April 2007.

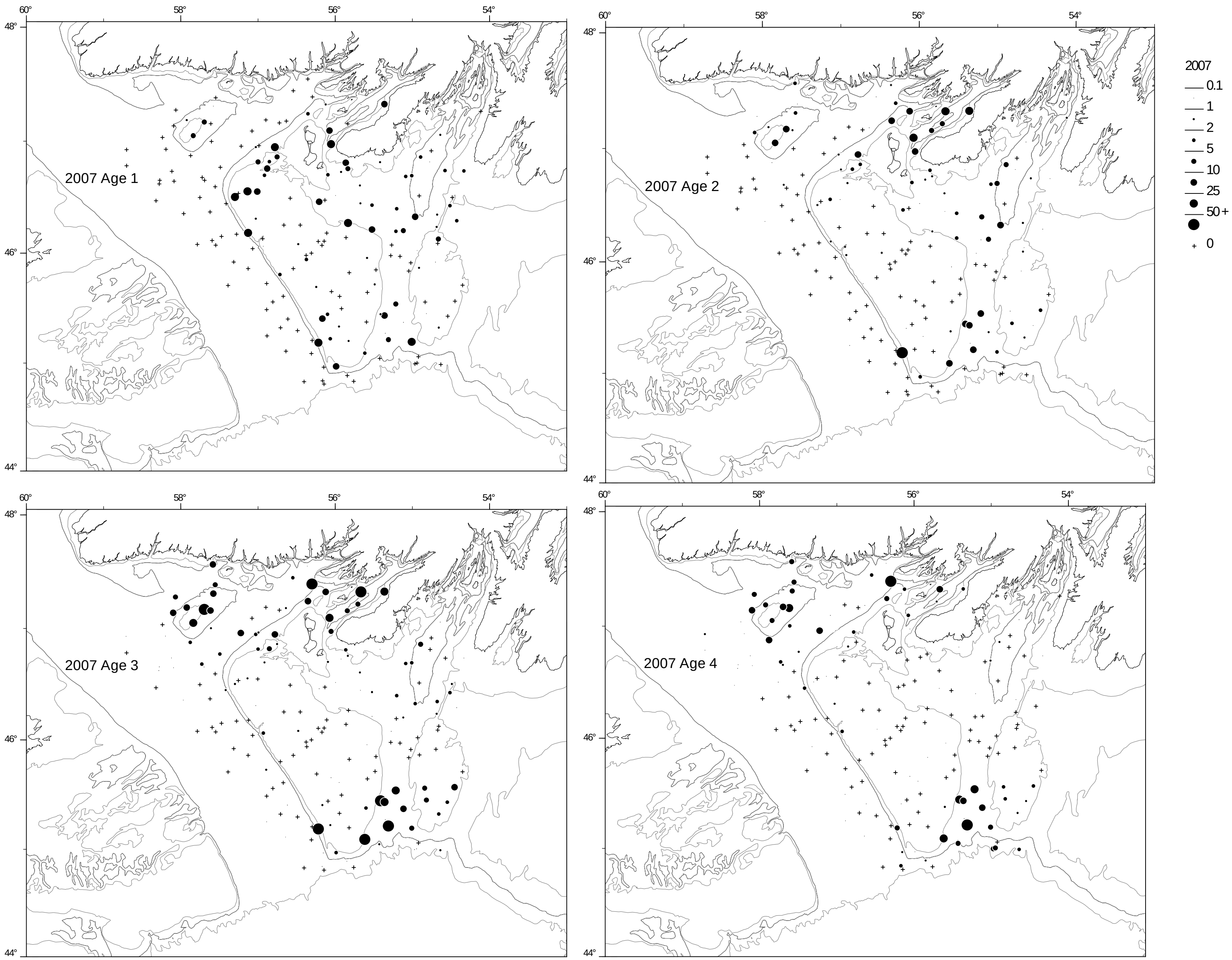


Figure 16b. Age disaggregated distribution of cod catches (nos. per tow, ages 1-4) from the DFO research vessel survey of 3Ps during April 2007.

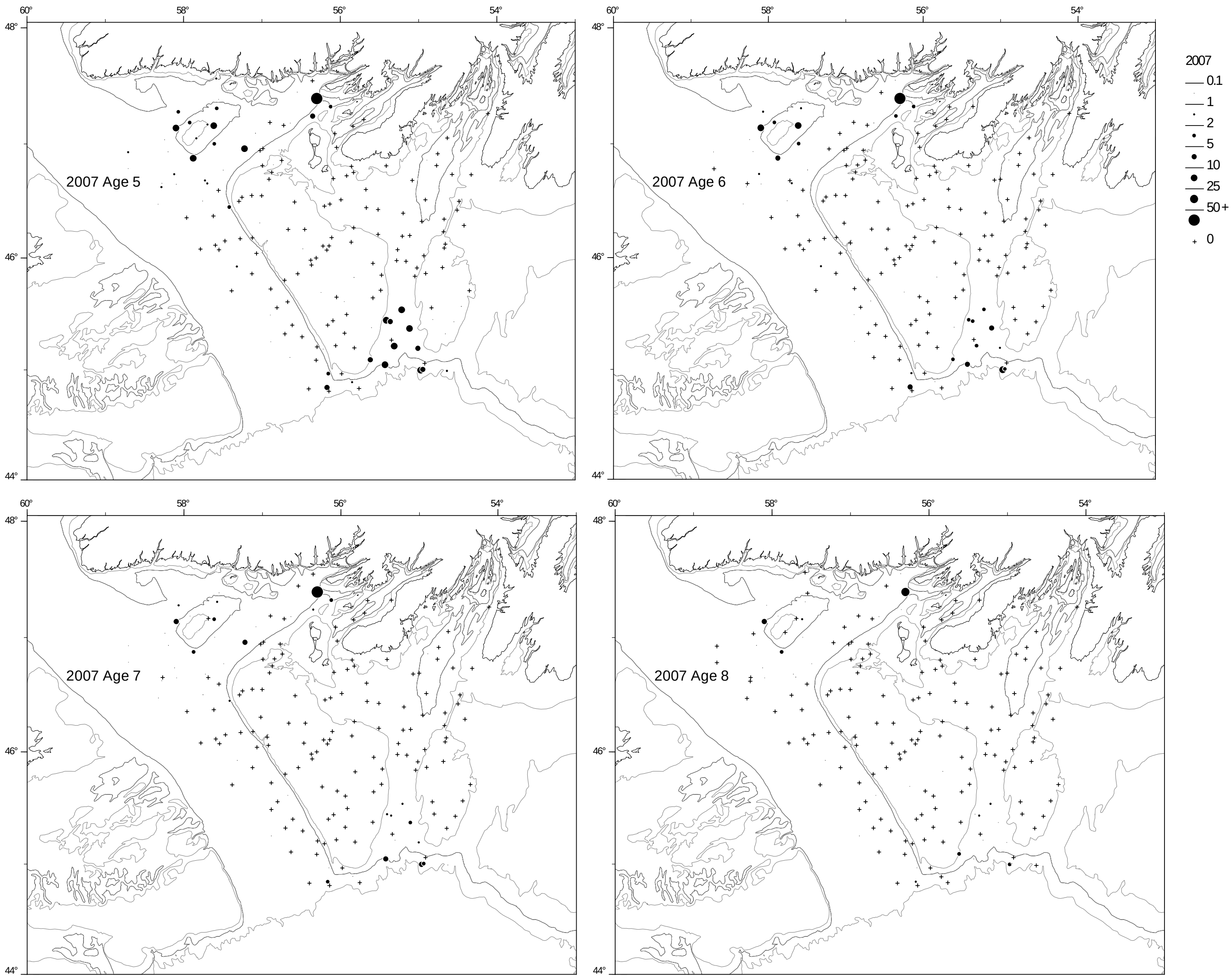


Figure 16c. Age disaggregated distribution of cod catches (nos. per tow, ages 5-8) from the DFO research vessel survey of 3Ps during April 2007.

Index at age - Normalized by age **Can RV offshore**

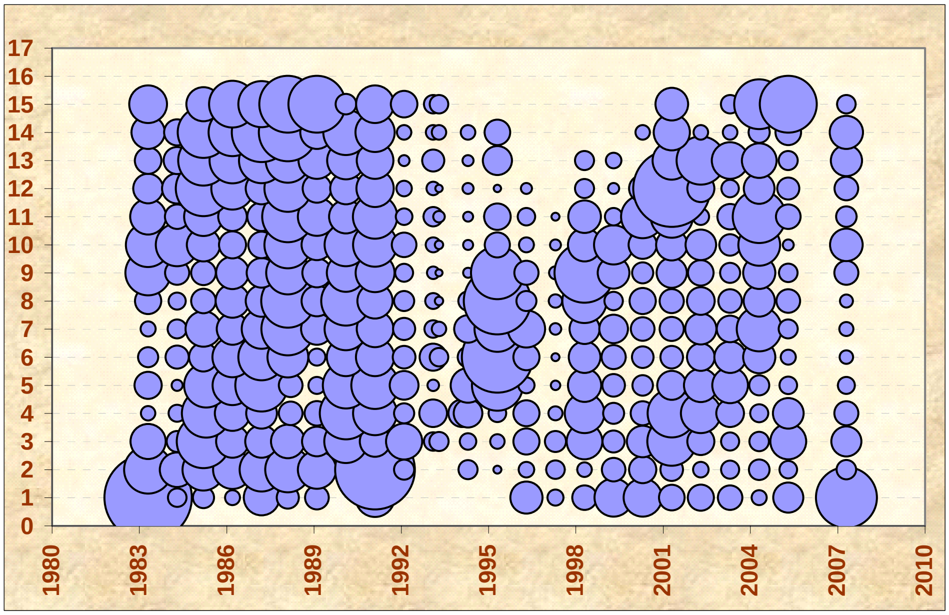


Figure 17a. Age-specific catch rate index (mean nos per tow) for cod in NAFO Subdivision 3Ps from DFO research vessel bottom trawl surveys of offshore (index) strata during winter/spring from 1983 to 2007. There were two surveys in 1993 and the 2006 survey was not completed. Symbol sizes within each age were scaled by dividing each value by the average for that age.

Index at age - Normalized by age **inshore only**

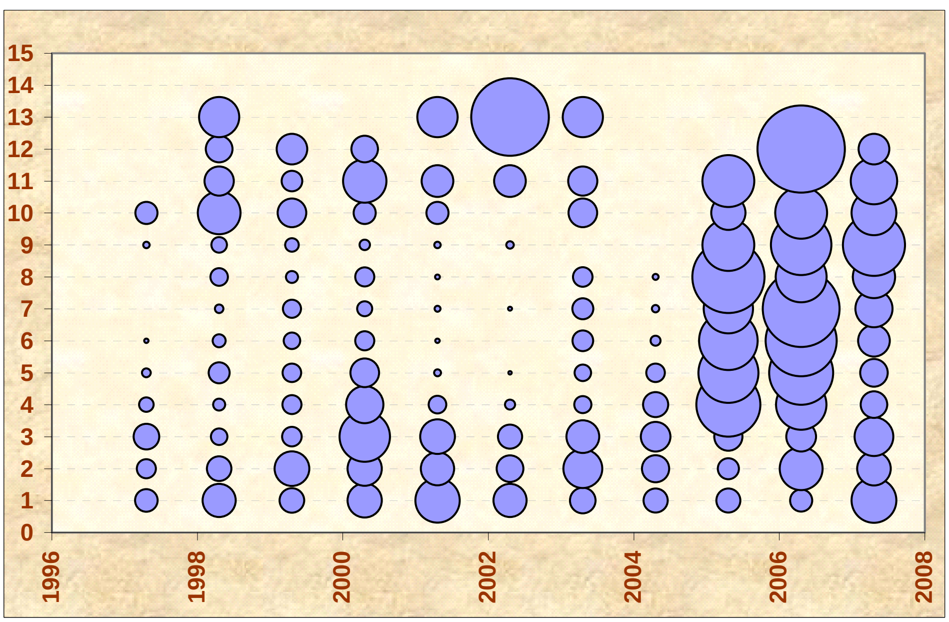


Figure 17b. Age-specific catch rates for cod in the inshore strata of 3Ps from the DFO research vessel bottom trawl survey from 1997 to 2007. The survey was not completed in 2006. Symbol sizes within each age were scaled by dividing each value by the average for that age.

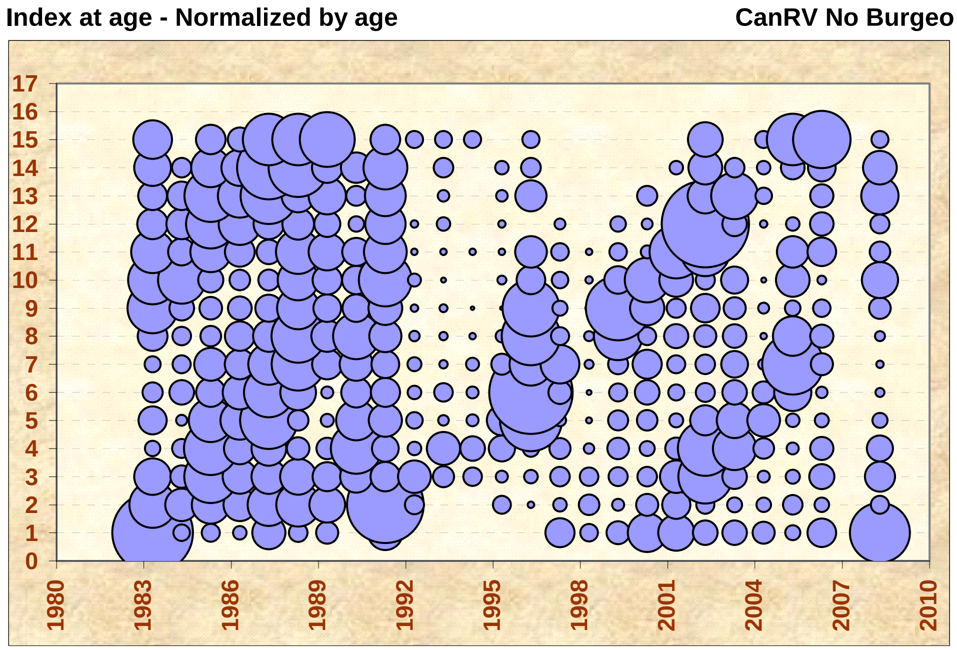


Figure 17c. Age-specific catch rates for cod in the eastern portion of 3Ps from the DFO research vessel bottom trawl survey. There were two surveys in 1993 (February and April) and the survey was not completed in 2006. Symbol sizes within each age were scaled by dividing each value by the average for that age.

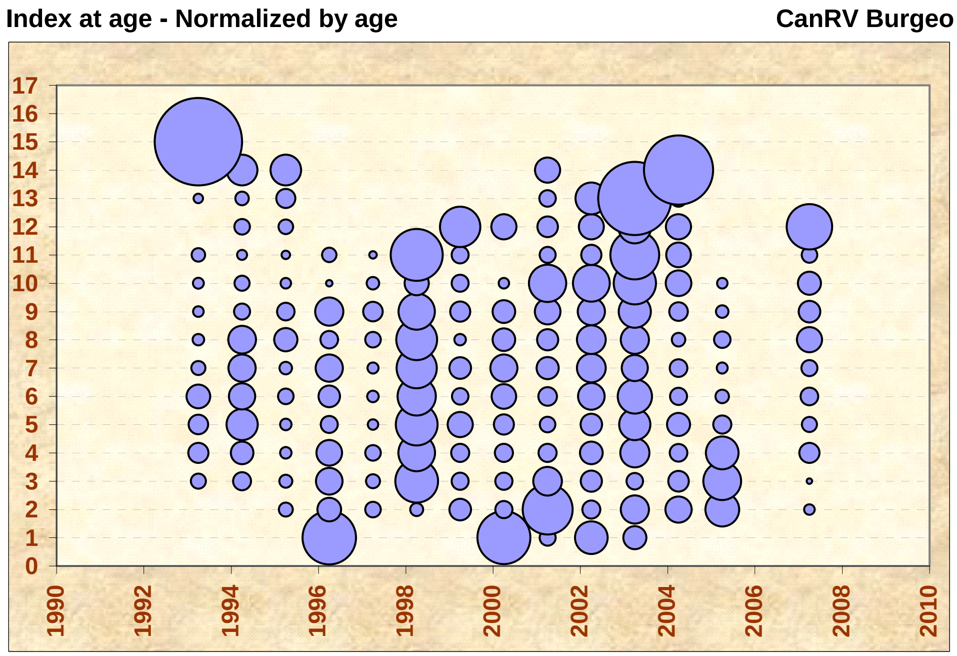


Figure 17d. Age-specific catch rates for the western (Burgeo area) portion of 3Ps from the DFO research vessel bottom trawl survey. The survey was not completed in 2006. There were two surveys in 1993 (February and April) and results from the April survey are shown here. Symbol sizes within each age were scaled by dividing each value by the average for that age.

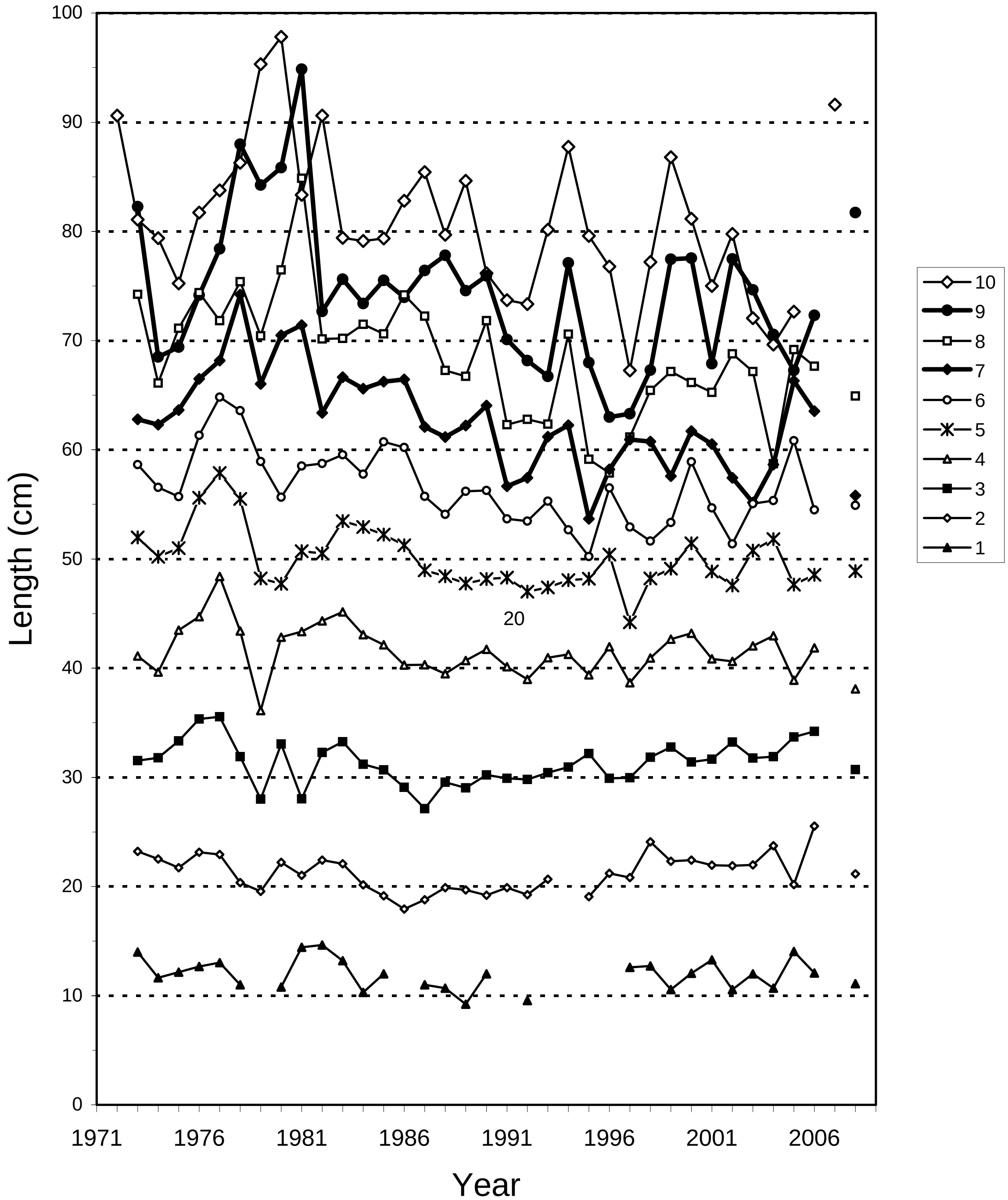


Figure 18a. Mean length at ages 1-10 of cod in Subdivision 3Ps during 1972-2007 from sampling during DFO bottom-trawl surveys in winter-spring.

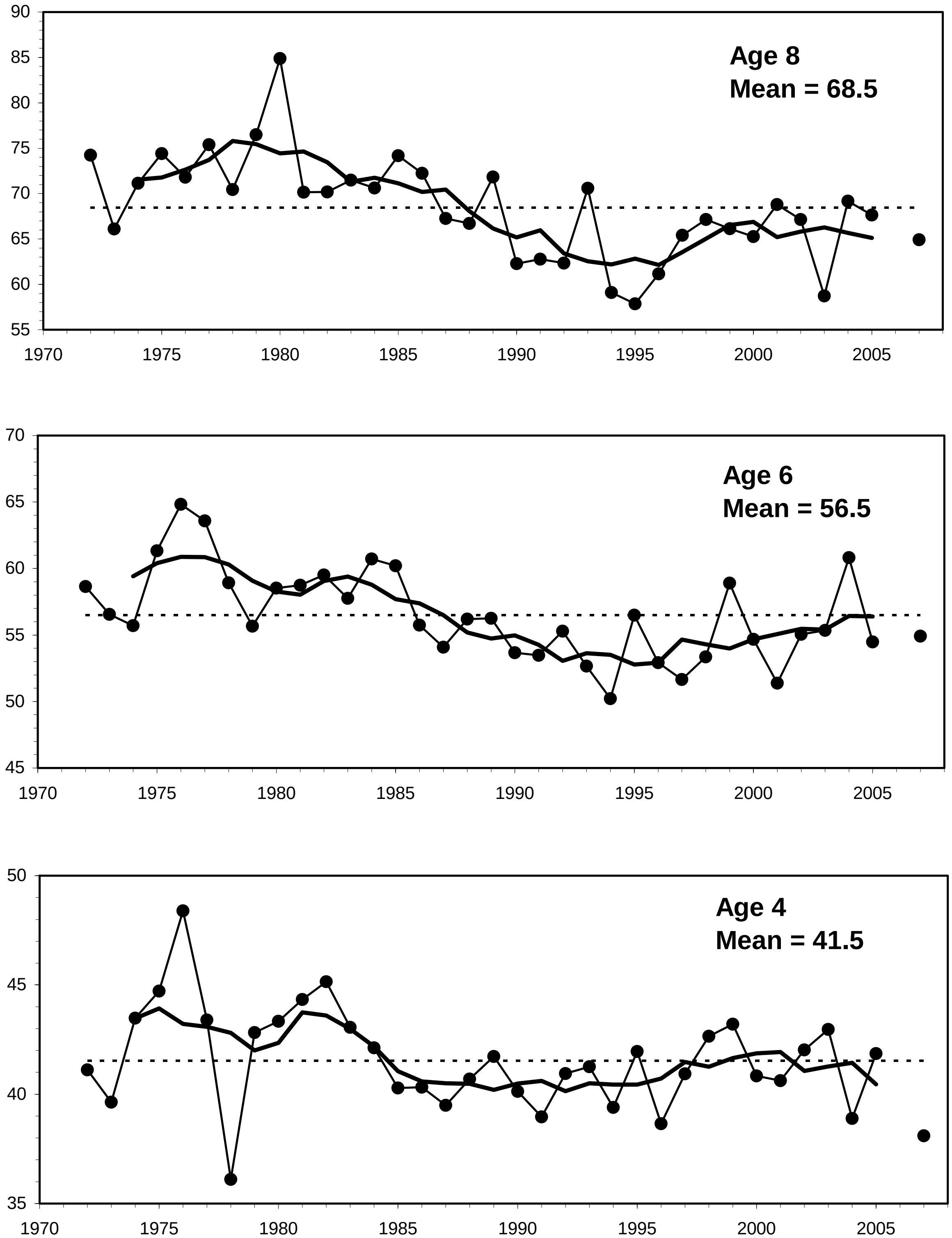


Figure 18b. Mean lengths (cm) at ages 4, 6 and 8 of cod in Subdivision 3Ps during 1972-2007, as determined from sampling during DFO bottom-trawl surveys in winter-spring. The lines in each panel indicate the annual means (solid line with symbols), a 5-year running mean (heavy solid line) and the mean for the period 1972-2007 (dashed line).

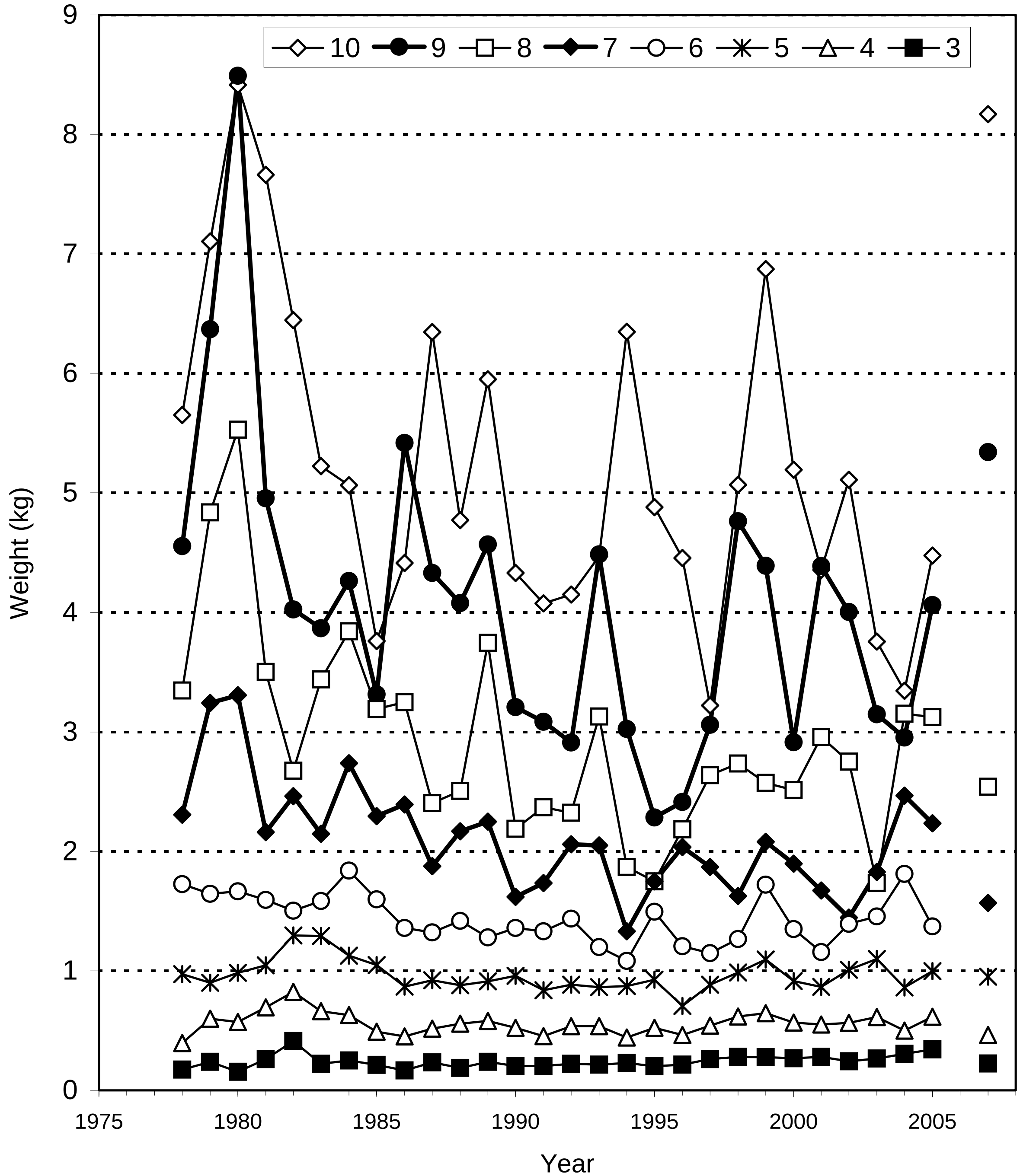


Figure 19a. Mean round weight-at-age (kg) of cod sampled during DFO bottom-trawl surveys in NAFO Subdivision 3Ps in winter-spring 1978-2007.

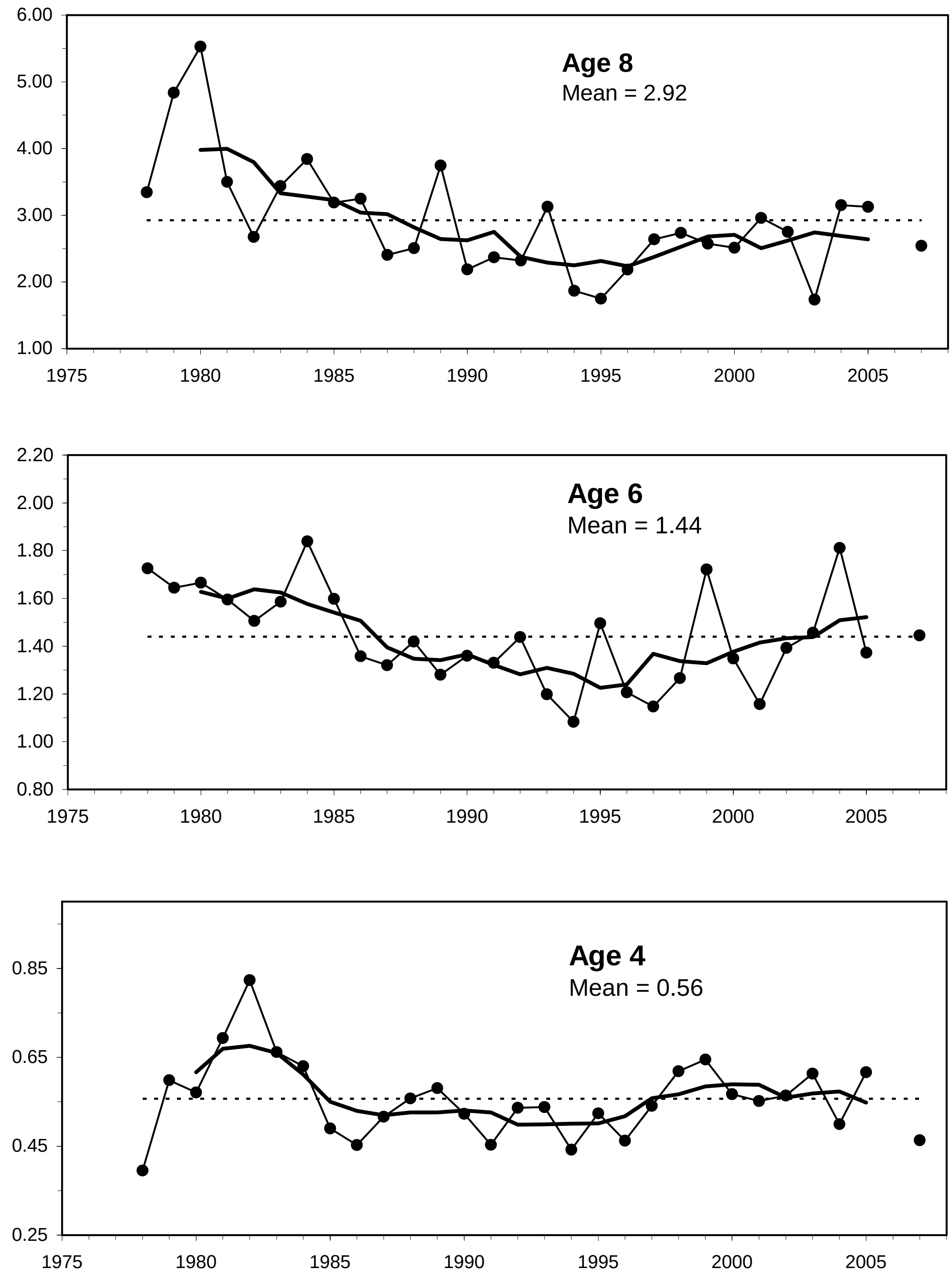


Figure 19b. Mean weights (kg) at ages 4, 6 and 8 of cod in Subdivision 3Ps during 1978-2007, as determined from sampling during DFO bottom-trawl surveys in winter-spring. The lines in each panel indicate the annual means (solid line with symbols), a 5-year running mean (heavy solid line), and the mean for the period 1978-2007 (dashed line).

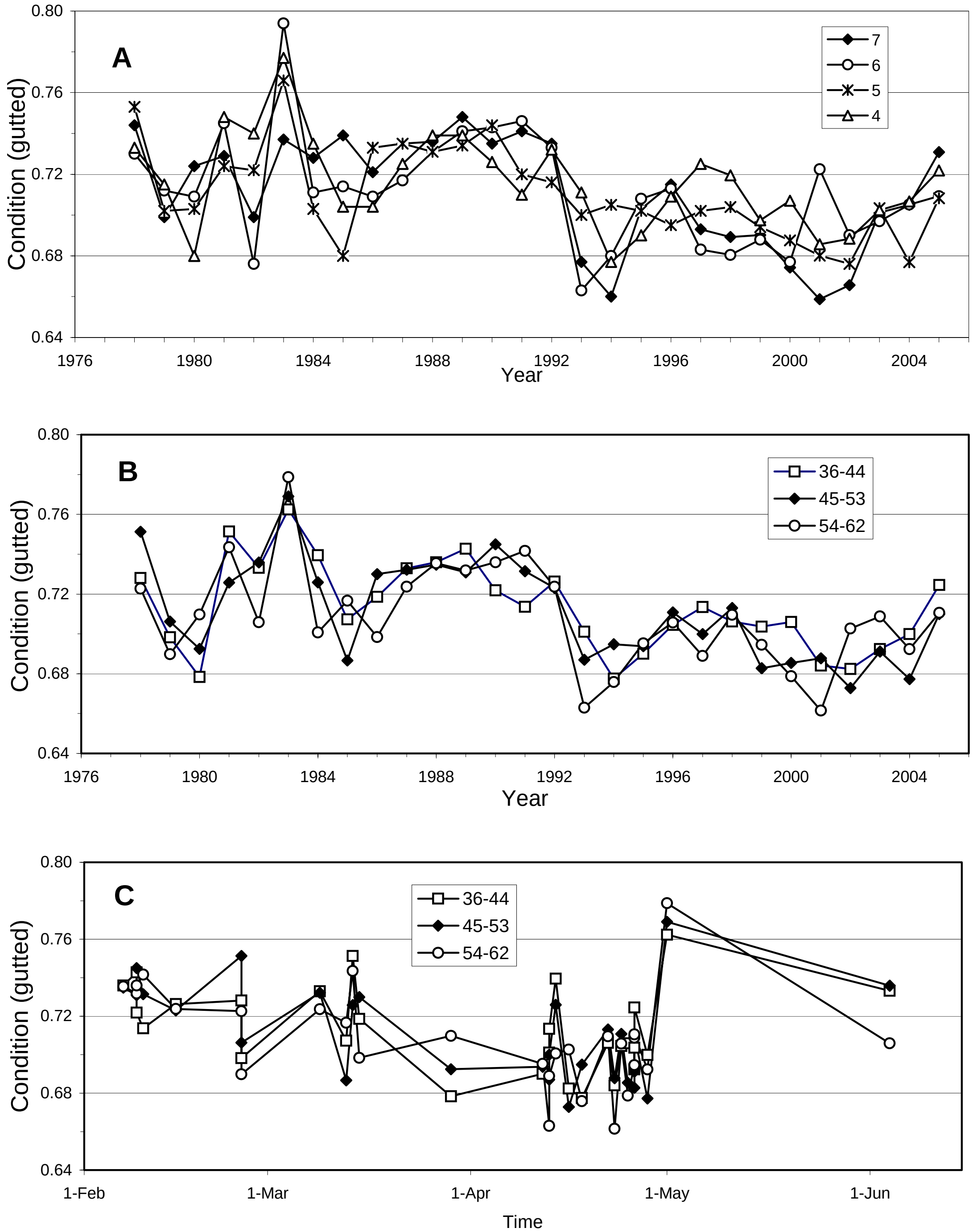


Figure 20. Mean gutted condition of cod sampled during DFO bottom-trawl surveys in Subdivision 3Ps in 1978-2005; (A) by age and year, (B) by length-group and year, and (C) by length-group and median date of collection.

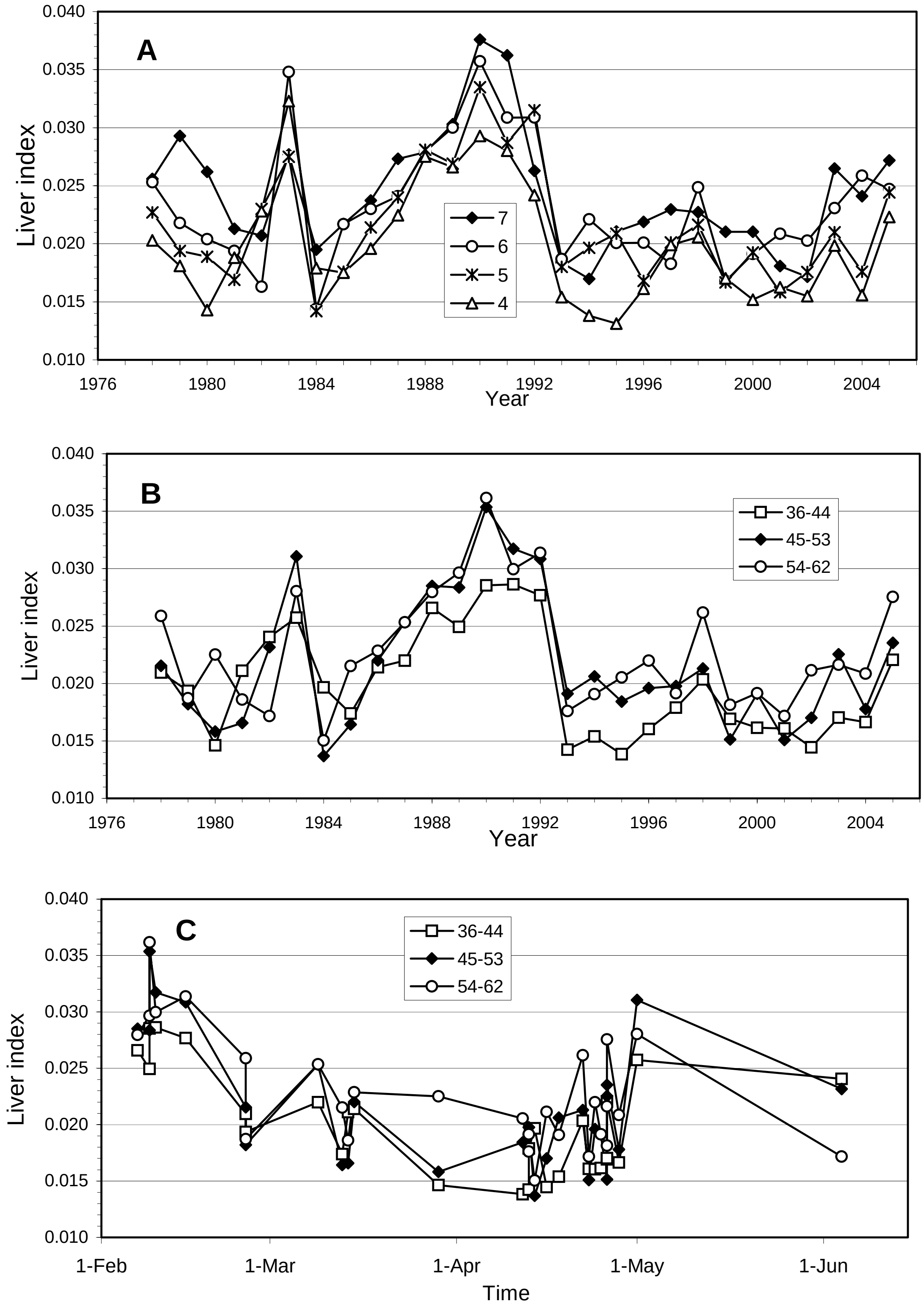


Figure 21. Mean liver index of cod sampled during DFO bottom-trawl surveys in Subdivision 3Ps in 1978-2005; (A) by age and year, (B) by length-group and year, and (C) by length-group and median date of collection.

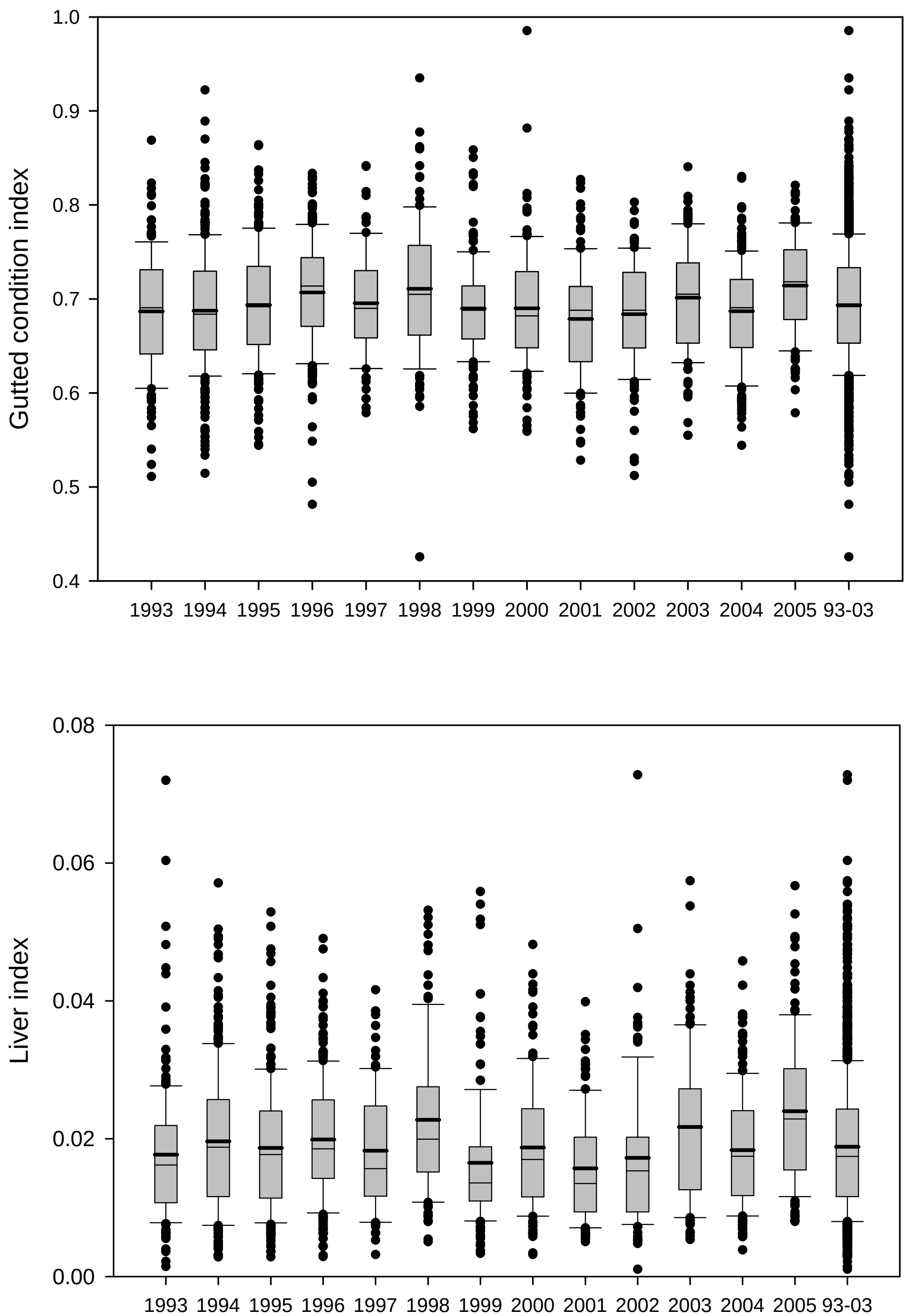


Figure 22. Gutted condition (above) and liver index (below) of cod (40-59 cm only) caught during DFO research surveys during April-May in 1993-2005. The box furthest to the right in each panel represents all data from 1993 to 2003 combined. Each box plot illustrates the median (light line), mean (dark line), 25th and 75th percentiles (box), 10th and 90th percentiles (whisker caps) and all data beyond the 10th and 90th percentiles

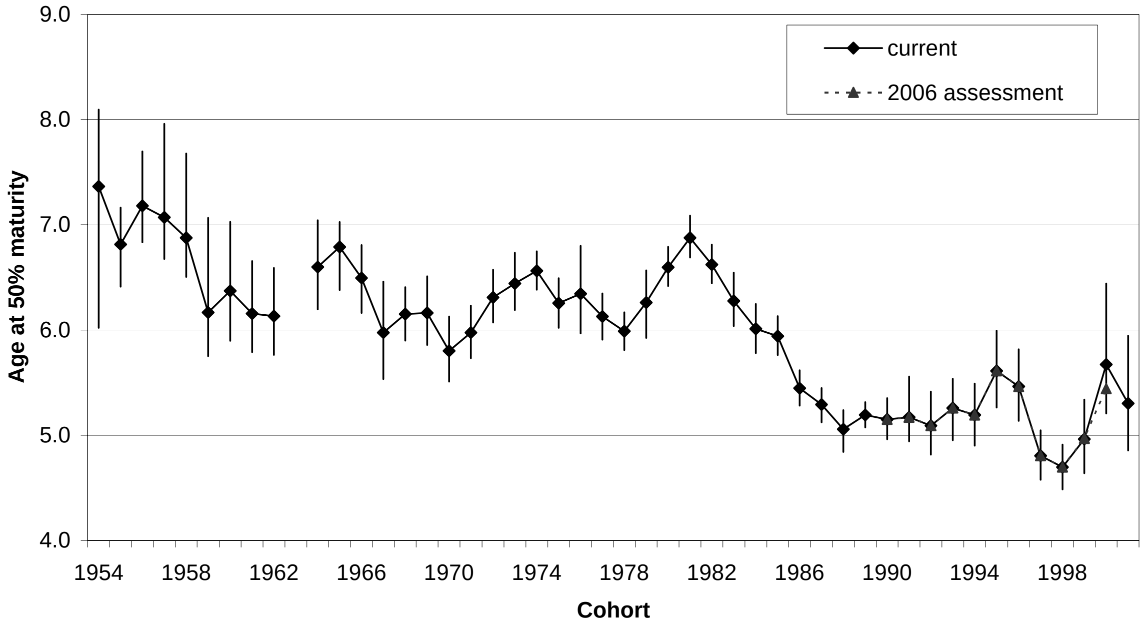


Figure 23a. Age at 50% maturity by cohort (1954-2001, excluding 1963) for female cod sampled during DFO research vessel bottom-trawl surveys of NAFO Subdivision 3Ps. Error bars are 95% fiducial limits.

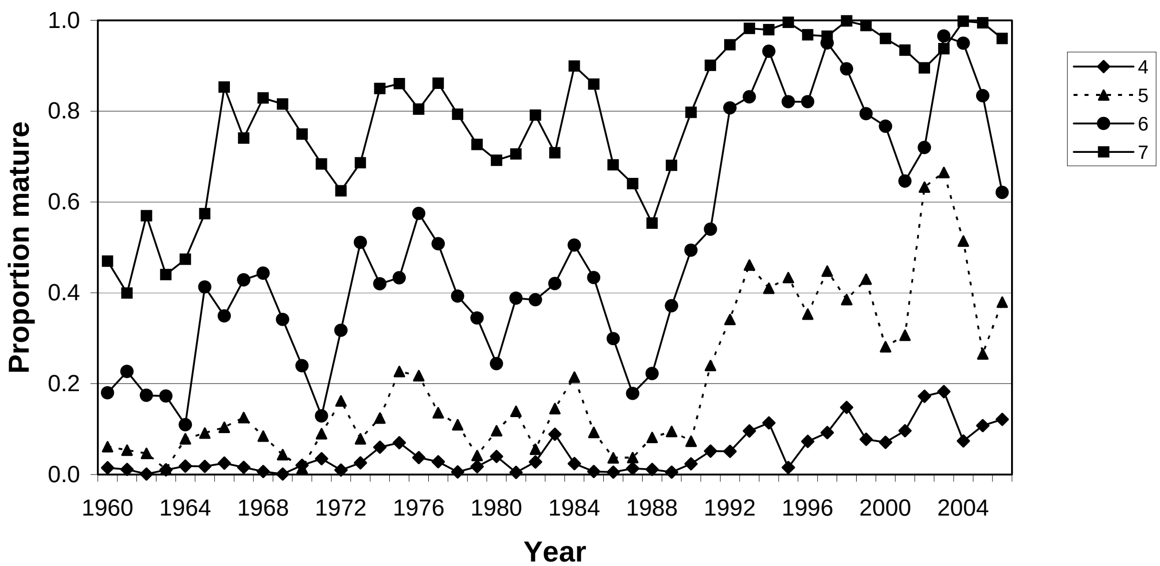


Figure 23b. Estimated proportions mature at ages 4-7 for female cod sampled during DFO research vessel bottom-trawl surveys in NAFO Subdivision 3Ps.

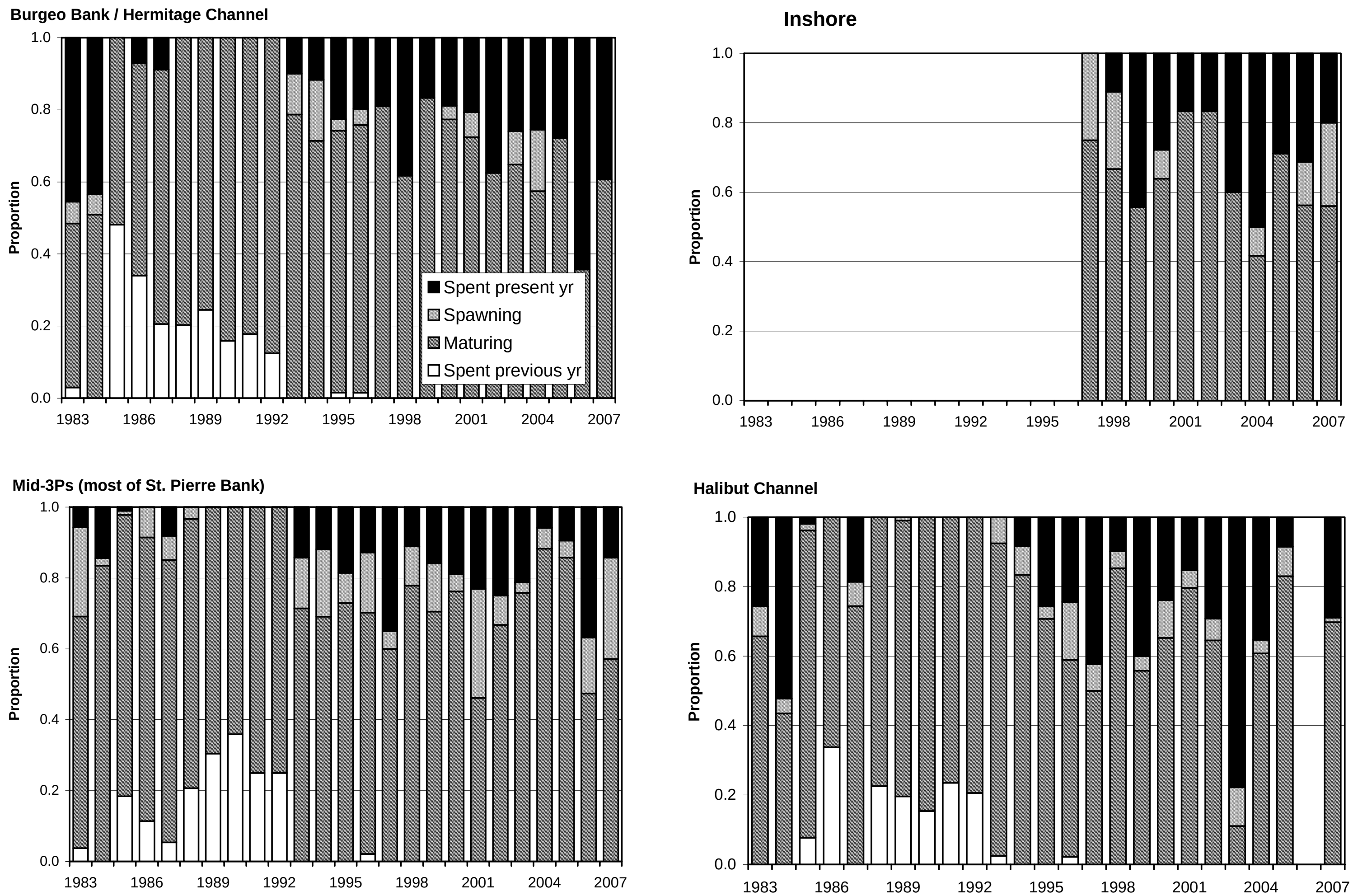


Figure 24. Maturity stages of adult female cod sampled during DFO research vessel bottom trawl surveys in four areas of NAFO Subdivision 3Ps during winter/spring 1983-2007. The 2006 survey was not completed and there were two surveys in 1993 (February and April; only the April survey is shown here). Inshore strata were not surveyed prior to 1997. Surveys were conducted mainly in April in 1983, 1984 and 1994-2007 and in February-March in the intervening years.

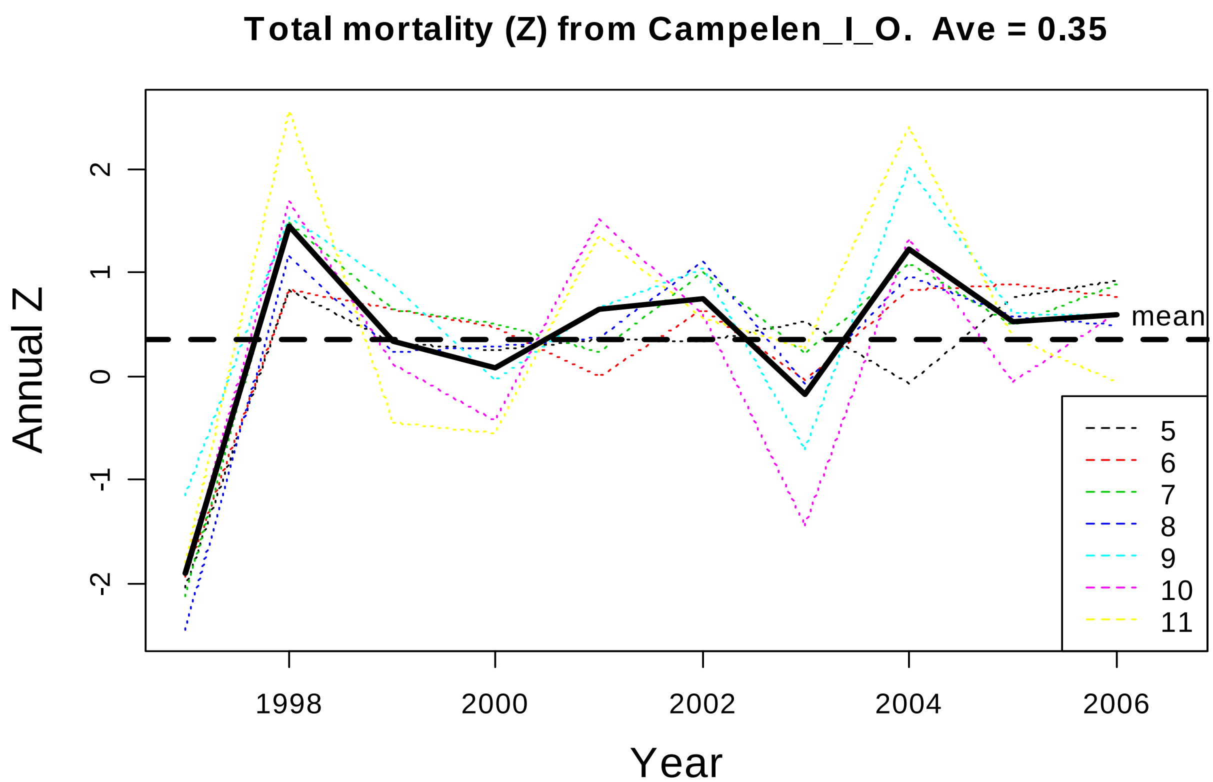


Figure 25. Annual estimates of total mortality rate (Z) for cod aged 5-11 using data from the combined inshore/offshore DFO RV survey of 3Ps during 1997-2007. See text for details.

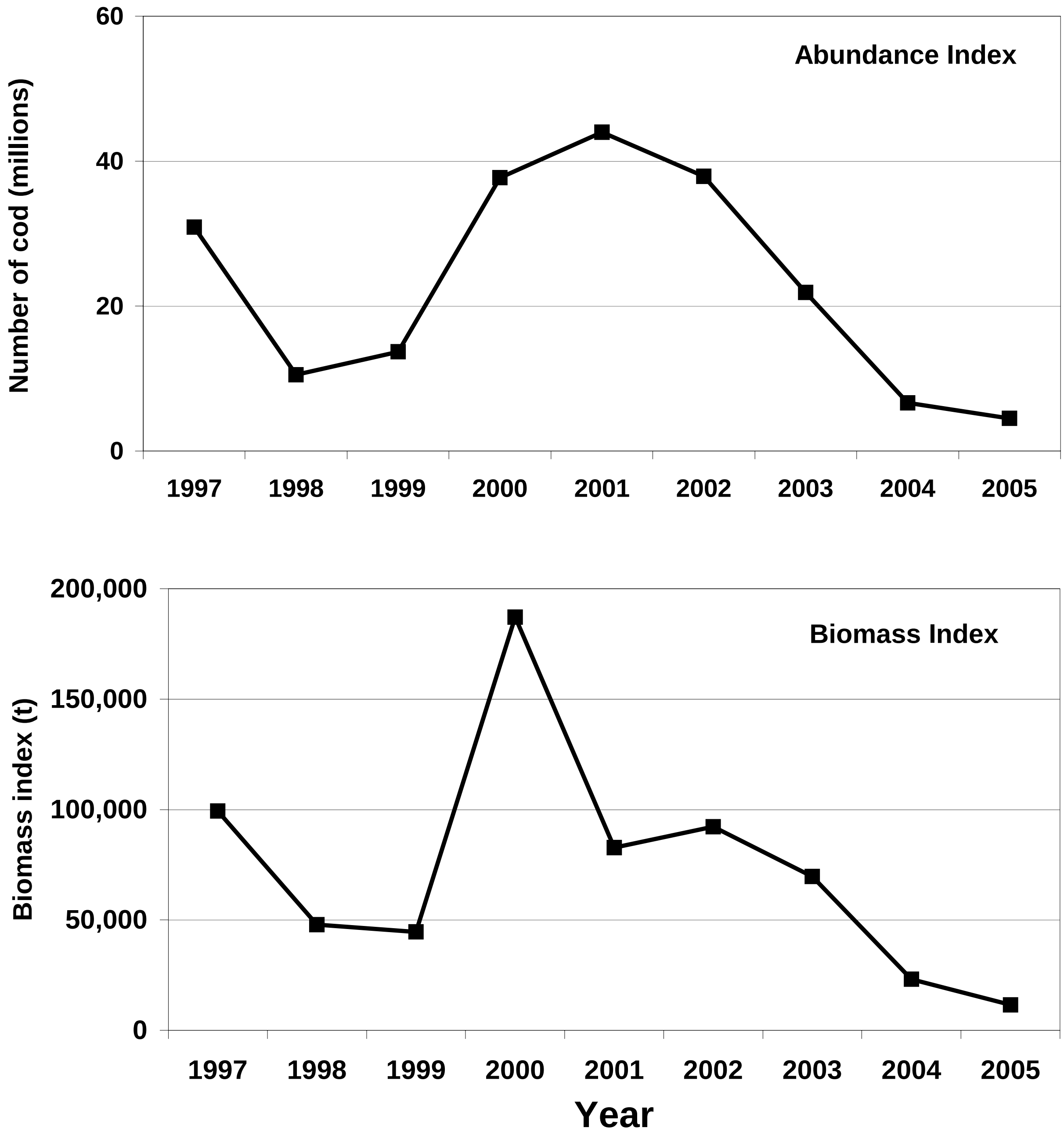


Figure 26a. Trends in cod abundance and biomass indices from the fall industry (GEAC) bottom trawl survey of the offshore portion of NAFO Subdivision 3Ps.

Index at age - Normalized by age **GEAC Survey**

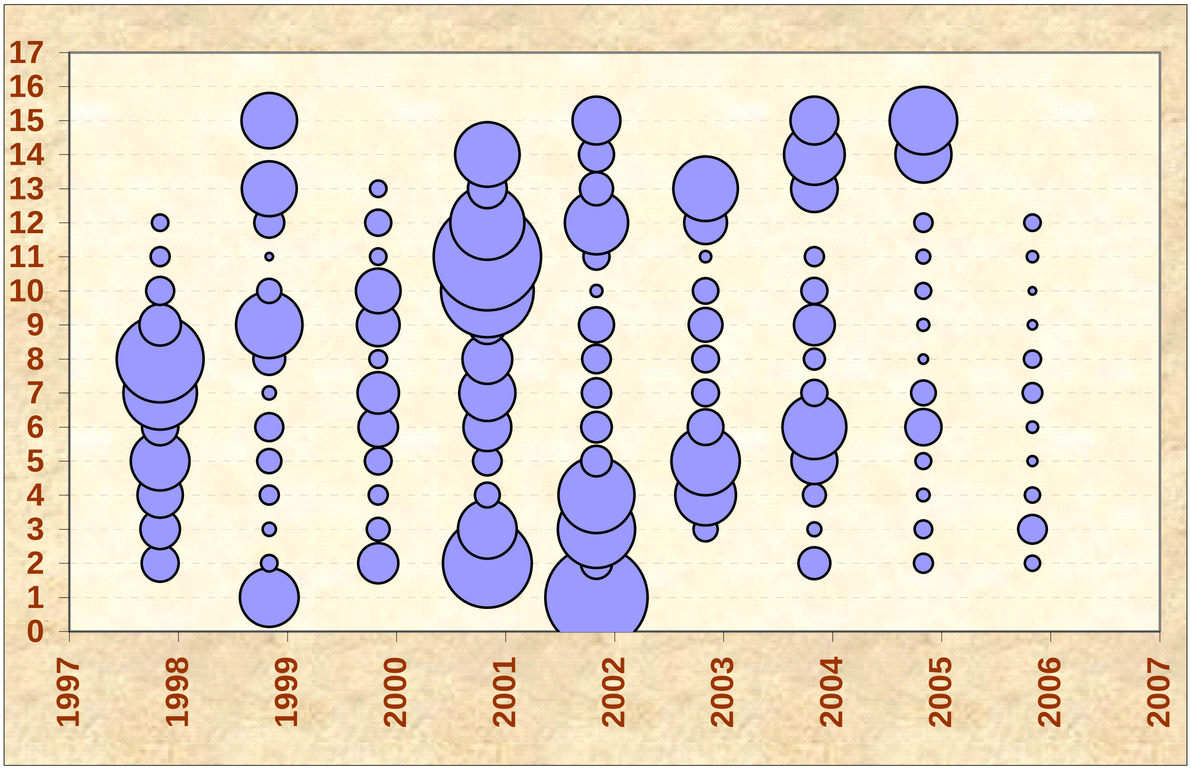


Figure 26b. Age-specific catch rates for cod from the fall industry (GEAC) trawl survey of a portion of the offshore of 3Ps. The survey was not conducted in 2006. Symbol sizes within each age were scaled by dividing each value by the average for that age.

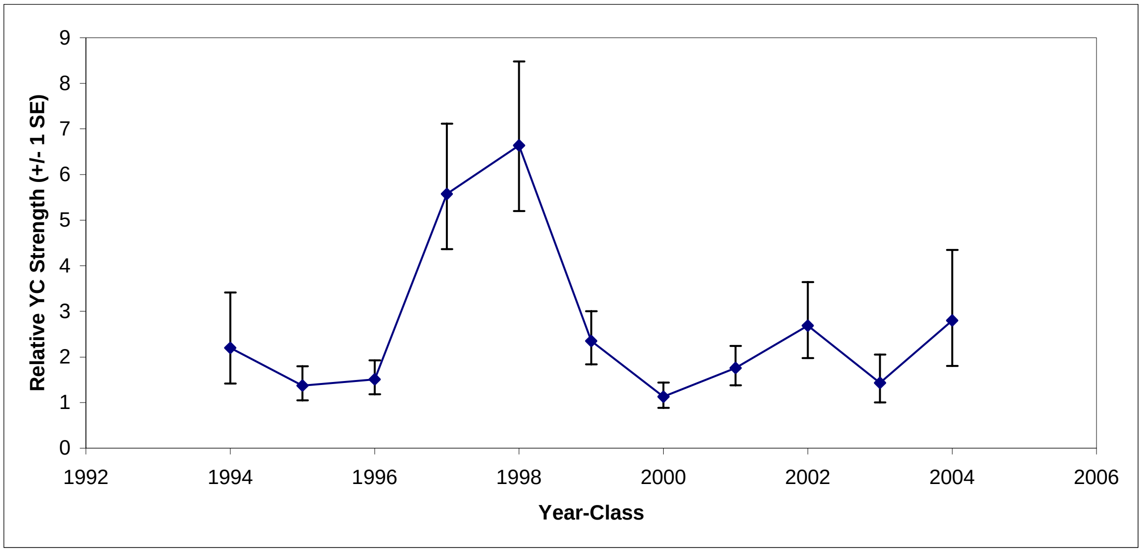


Figure 27. Standardized year-class strength estimated from catches of juvenile cod in combined inshore/offshore DFO RV survey and the GEAC survey. See text for details.