The Status of the Northern Gulf of St. Lawrence (3Pn, 4RS) Cod Stock (*Gadus morhua*) in 2014

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Canada

Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the Secretariat.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

Assessment of the cod (*Gadus morhua*) stock of the Northern Gulf of St. Lawrence (3Pn, 4RS) is based on data from commercial fisheries, a tagging program, an abundance index calculated from the DFO research survey, abundance indices from the fixed gear sentinel fisheries program (longlines and gillnets), an abundance index from the mobile gear sentinel fisheries program and biological data. This document describes the data and methods used to assess several indicators including abundance, biomass, spawning biomass, natural mortality, exploitation rate and recruitment. It also includes a prediction of the stock trends until 2017.

The cod stock of the northern Gulf of St. Lawrence remains in the critical zone and well below the limit reference point. The spatial distribution of this stock is now similar to that observed in the 1990s. The exploitation rate is currently low, while natural mortality is high. An annual harvest of 1,500 t for the next two seasons should allow the spawning stock biomass to increase. However, this increase is largely dependent on the abundance of the 2011 and 2012 cohorts, whose estimates will have to be clarified in the coming years.

RÉSUMÉ

L'évaluation du stock de morue (*Gadus morhua*) du nord du golfe du Saint-Laurent (3Pn, 4RS) est basée notamment sur les données provenant des pêches commerciales, d'un programme de marquage, d'un indice d'abondance calculé à partir du relevé de recherche du MPO, des indices d'abondances du programme des pêches sentinelles avec engins fixes (palangres et filets maillants), d'un indice d'abondance provenant des pêches sentinelles avec engins mobiles et de données biologiques. Ce document décrit les données et les méthodes retenues pour évaluer plusieurs indicateurs dont l'abondance, la biomasse, la biomasse reproductrice, la mortalité naturelle, le taux d'exploitation et le recrutement. Il comprend aussi une prédiction de la tendance du stock jusqu'en 2017.

Le stock de morue du nord du golfe du Saint-Laurent demeure dans la zone critique nettement sous le point de référence limite. La distribution spatiale de ce stock est maintenant similaire à celle observée dans les années 90. Le taux d'exploitation est présentement à un niveau faible et la mortalité naturelle est élevée. Un prélèvement annuel de 1 500 t pour les deux prochaines saisons devrait permettre une augmentation de la biomasse du stock reproducteur. Toutefois, cette augmentation est largement dépendante de l'abondance des cohortes de 2011 et 2012 dont les estimations devront être précisées au cours des prochaines années.

1. INTRODUCTION

Due to a marked decline in the population of Atlantic Cod (*Gadus morhua*) in the northern Gulf of St. Lawrence in the late 1980s and early 1990s, the directed cod fishery has had two moratoriums imposed (1994 to 1996 and 2003). Since it first reopened in 1997, fishing has been carried out exclusively by Canadian fixed-gear fleets. Several management measures are in place, including total allowable catch (TAC), number and types of gear, area closures during spawning and in winter (3Ps portion), observers (5% coverage), dockside monitoring, minimum size, bycatch monitoring, and rules for the recreational fishery.

In recent years, the commercial and recreational exploitation of this stock has been mainly carried out by Newfoundland, Labrador and Quebec fishers. Since 2012, the annual TAC has been 1,500 t, and landings have been approximately 1,250 t per year. Cod landings in the recreational fishery are not known.

In 2010, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the Laurentian North (3Pn, 4RS and 3Ps) cod population, part of which consists of 3Pn and 4RS stock, as endangered, based essentially on the extent of the decline (78–89%) in adult abundance over three generations (30 years). The Recovery Potential Assessment for the Laurentian North Designatable Unit (3Pn, 4RS and 3Ps) of Atlantic Cod (*Gadus morhua*) was carried out in 2011 (DFO 2011). Concerning the northern Gulf cod population (3Pn, 4RS), the report concluded that: 1) exploitation must be reduced to encourage stock recovery; 2) seal predation is contributing to the recent increase in cod natural mortality; 3) any decrease in natural mortality will aid in recovery; 4) it is important to maintain the fishery closure during the spawning season to facilitate successful reproduction; and 5) overfishing of local stocks must be avoided.

The northern Gulf cod spawning stock biomass has been in the critical zone, well below the limit reference point, since 1990 (Duplisea and Fréchet, 2011). Consequently, a recovery plan has been developed in collaboration with a number of partners, including several fishing industry representatives. It includes decision rules to increase the spawning biomass for this stock (DFO 2015b).

Since 2011, the assessment of 3Pn, 4RS cod stock status has been performed every two years. The most recent peer review was conducted on February 19, 2015. In support of the notice resulting from this review (DFO 2015a), this research document presents the methods, data and results of the last assessment. The previous research document on this topic was produced in 2009 (Fréchet et al. 2009).

1.1 BIOLOGY AND ECOSYSTEM

1.1.1 Biology

In summer, 3Pn 4RS cod are distributed throughout the northern Gulf of St. Lawrence at depths of 50 to 200 m. In winter, the fish gather off southwestern (3Pn) and southern (3Psa and 3Psd) Newfoundland at depths of 300 to 500 m. Tagging studies indicate that this stock is generally isolated from neighbouring stocks. There seems to be little mixing with adjacent stocks, though there is some to the southwest (4T) and northeast (2J, 3KL) in summer, and to the southeast (3Ps) in winter.

Spawning takes place mainly in April and May at depths of 200 to 250 m. The main breeding area is located off Port au Port (west coast of Newfoundland). Age at 50% maturity has varied

over time for this stock and is currently between four and five years. After spawning, the eggs disperse with the surface currents, and in fall, juveniles return to deeper environments.

Cod have a varied diet (zooplankton, crustaceans, and pelagic and benthic fish). Large cod eat mainly herring, flatfish, cod and crab.

Cod's main natural predator is the seal, which could compromise the recovery of a cod stock (Cook et al. 2015). Predation on northern Gulf cod is poorly documented, but several studies conducted in the southern Gulf of St. Lawrence (4T) report potentially high grey seal predation (Bousquet et al. 2014; Hammil et al. 2014), going so far as to cause the distribution of cod to deeper sites that are less suitable for its diet (Swain et al. 2015).

1.1.2 Ecosystem

Every year, Fisheries and Oceans Canada uses the Atlantic Zone Monitoring Program (AZMP) to assess prevailing physical oceanographic conditions in the Gulf of St. Lawrence. Conditions encountered in the northern Gulf in the last four years (2011 to 2014) were generally warmer compared to historical averages for surface water temperatures, the cold intermediate layer and deep waters. However, the sea ice volume in the winter of 2013–2014 was the third highest since 1969. As a result, the characteristics of the cold intermediate layer in the summer of 2014 were more representative of the historical average (Galbraith et al. 2015).

Capelin and herring populations in the Gulf are relatively stable, though mackerel stocks have collapsed. Greenland Halibut stock is stable while Atlantic Halibut stock is increasing. Although redfish stock biomass (unit 1 and 2) is low, strong cohorts (2011, 2012, 2013) have been observed in the Gulf in recent years (Bourdages et al. 2015).

1.2   MANAGEMENT MEASURES

Prior to 1999, the management year followed the calendar year, namely January 1 to December 31. Since 2000, the management year has been from May 15 of the current year to May 14 of the following year. To bridge the gap between these two calendars, the 1999 management year stretched from January 1, 1999 to May 14, 2000. Since the reopening after the first moratorium, the fishing pattern changed, and the fishery now takes place mainly from July to November. Management measures include, among other things, imposing an annual TAC, number and type of gear, observer coverage (5%), dockside monitoring, minimum size, a small fish protocol, regulations for the recreational fishery, and a vessel monitoring system (VMS) for large longliners. In addition, other measures are in place:

1. In order to protect the spawning period for cod, the groundfish fishery is closed for April, May and June in part of NAFO's 4R division off St. George's Bay and Port au Port Bay.

2. To limit catches of 3Pn, 4RS cod, which could be mixed with 3Ps stock in winter, the 3Ps (d) and (g) management units are closed to fishing from November 15 to May 16, while in the 3Ps (a) management unit, fishing is permitted during this period only for residents of that unit. In addition, the entire 3Ps subdivision is closed from March 1 to May 16.

2.   METHODOLOGY

2.1 COMMERCIAL FISHERIES

2.1.1 Landing, fishing effort and observers

Since 1997, Newfoundland cod fishers have been required to complete a logbook for vessels under 10.66 m (35 ft). This logbook is an initiative from the Newfoundland DFO Science Sector.

When completed, these logbooks are returned to the Science Sector by the fisher, where they are processed. They contain information such as fishing effort data that allows the assessment of catch per unit effort (CPUE). The information in these logbooks is not captured in official DFO statistics or in the ZIFF (Zonal Interchange File Format).

Since 1999, Quebec fishers in the fleet of craft under 13.71 m (45 ft) fill out combined form groundfish logbooks. The logbooks are used to identify the characteristics of the fishery (type of gear, number, soak time), position, dates of activity and catch weights. In Quebec, logbooks also include a section on purchase slips (completed by the buyer's representative) and the weight out summary (during dockside monitoring). In this case, the information is entered by DFO's statistics sector (regional offices) and then made available in ZIFF files.

Performance indices for the commercial fishery based on logbook data for the fixed-gear fleets (gillnet and longline, Newfoundland vessels under 10.66 m, and Quebec vessels under 13.71 m) represent about 70% of annual landings in the 3Pn, 4R and 4S NAFO Divisions. The mean CPUE and confidence intervals are calculated based on the raw data. Usable data from logbooks represents over 50% of the landings from these fleets. Logbook data for the fleet of vessels over 13.71 m (45 ft) in Quebec (longliners) are presented for this first time in this stock assessment. To produce this index (longliners), the raw data are standardized (factors: month and NAFO Division) by using a multiplicative model (Gavaris 1980).

$$\text{Ln CPUE}_{ijkl} = \ln \mu + \ln D_j + \ln M_k + \varepsilon_{ijkl}$$

> where:
>
> CPUE_{ijkl} = CPUE in the lth activity
>
> $\ln \mu$ = mean CPUE log
>
> D_j = effect of jth level of factor 1
>
> M_k = effect of kth level of factor 2
>
> ε_{ijkl} = log of normally distributed residuals

In Quebec and Newfoundland, the DFO commercial catch sampling program allows regular collection of data on cod length and otoliths (see age readings, section 2.3.1). Using a program (CATCH) developed by DFO on these age and length frequency data allows the calculation of catch-at-age, weight-at-age, and mean-length-at-age for cod captured annually. The length-weight relationship from the corresponding year's DFO research survey is also necessary, as are the values for commercial landings (by month, NAFO Division and gear type).

The observer program permits monitoring of the catch rates for bycatches in the directed cod fishery. This program is also applied to the turbot, shrimp and Atlantic Halibut fisheries in order to estimate the cod bycatch in these fisheries.

2.1.2 Telephone survey

Since 1998, Newfoundland's Fish, Food and Allied Workers Union (FFAW) and the Lower North Shore Fisherman's Association (LNSFA) have carried out an annual telephone survey with fixed-gear fishers (random draw) who hold a directed cod fishery license. The objective is to document various issues related to northern Gulf of St. Lawrence commercial cod fisheries. Fishers are asked to answer a number of questions (Appendix 1) regarding their general view of the fishing season, their performance and the size and condition of the fish they caught.

2.2 SURVEYS

2.2.1 Fisheries and Oceans Canada (DFO) survey

Since 1990, DFO has conducted a multidisciplinary research survey (groundfish and shrimp) on the entire northern Gulf of St. Lawrence using a bottom trawl. This survey involves the use of a stratified random sampling plan (Figure 1). In 2004, there was a change in fishing vessel and gear type, and comparative fishing was carried out to ensure continuity of the series. Since 2004, the fishing gear has been a Campelen 1800 shrimp trawl with Rockhopper foot gear (McCallum and Walsh 2002). A detailed description of the fishing and sampling protocol and calculation methods are presented in Bourdages et al. (2015). In 2014, 65 stations (17 strata) were completed in 4R and 77 stations (21 strata) in 4S. Note that this sampling plan does not include 3Pn (Figure 2a).

2.2.2 Sentinel survey

In place since 1994 in eastern Canada, the sentinel fishery program is a collaborative program between DFO and fishers. The fishing is carried out by fishers (contracts awarded following an invitation to tender) in accordance with scientific protocols developed by DFO Science. In the northern Gulf of St. Lawrence, this program consists of two components: mobile gear (trawl) and fixed gear (gillnet and longline). Because of budget cuts to this program over the years, the number of activities has declined significantly.

DFO Science ensures that data are validated, analyzed and interpreted. Data from the sentinel fisheries program are available on the [St. Lawrence Global Observatory](#) website. The list of fishers (Quebec and Newfoundland) who participated in this program from 2012 to 2014 can be found in Appendix 2.

Mobile gear (trawl) sentinel fisheries

The trawl sentinel program is conducted by the Association des capitaines propriétaires de la Gaspésie (ACPG) in NAFO Division 4S and by FFAW in Subdivision 3Pn and Division 4R. This survey is conducted every July. It includes close to 300 stations distributed based on a stratified random sampling plan (Figures 1 and 2a). Calculation methods take into account the weight of each stratum in the same way as the DFO survey. The fishing gear is a *Star Balloon 300*-type trawl mounted on a *Rockhopper* bicycle. The trawl's mesh is 145 mm with a lining at the codend of 40 mm. Standard 30-minute tows are done at a speed of 2.5 knots. The 30-minute time frame is calculated from when the winches are stopped (after the gear is deployed) to when they are reactivated to raise the trawl.

It includes two periods: (1) From 1995 to 2002, where only strata deeper than 20 fathoms (37 m) were sampled (mobile sentinel over 20 ftm); and (2) from 2003 onward, when three inshore strata 10 to 20 fathoms (18 to 37 m) (mobile sentinel over 10 ftm) were added in 4R to those previously sampled.

One of the functions of this survey is to collect fish length and weight data (cod, redfish, halibut, turbot, capelin, herring) and to harvest cod and Atlantic Halibut otoliths.

Fixed gear sentinel fisheries

The fixed gear sentinel fisheries program is conducted by the APBCN in Division 4S and by FFAW in Subdivision 3Pn and Division 4R. In 2014, 386 gillnet and 152 longline activities were carried out in six zones (Figures 2a and 2b and Appendix 3).

Since 1998, catches per unit effort (CPUEs) from the fixed gear sentinel fisheries program (gillnet and longline) have been used as abundance indices in cod assessments. These data

are indices that are more representative of coastal fisheries. In order to produce these indices, a multiplicative model is used to standardize the raw data (Gavaris 1980) (Appendices 4 and 5). This model establishes an index that reflects the annual cod trends since 1995.

$$\text{Ln CPUE}_{ijkl} = \ln \mu + \ln A_i + \ln Z_j + \ln M_k + \varepsilon_{ijkl}$$

where:

CPUE_{ijkl} = CPUE in the lth activity

$\ln \mu$ = mean CPUE log

A_i = effect of ith level of factor 1

Z_j = effect of jth level of factor 2

M_k = effect of kth level of factor 3

ε_{ijkl} = log of normally distributed residuals

Data are collected at 24 sites along the coastlines in 3Pn, 4R and 4S. Average gear deployment depths are 90 m for longline (16/0 J-hooks and 12/0 circle hooks) and 80 m for gillnet. These depths vary between areas.

The use of fixed gear sentinel fishery activities as an abundance index is based on the theory that the abundance of the resource is directly proportional to the catch rate. However, the data could be biased should the gear being used become saturated, i.e. if the gear reached a maximum catch level regardless of the resource abundance.

In fact, the catch probability of a fish would decrease and the catch rate would no longer be directly proportional to abundance. The fishing gear saturation aspect is examined every year for the longline sentinel program activities (Brulotte et al. 2000).

2.3 BIOLOGICAL DATA

2.3.1 Age reading

Cod otoliths are sampled in DFO research surveys, sentinel surveys, the reproductive potential project and the commercial fishery. Sampling stratification is based on NAFO Division, time of year, fishing gear and fish size (stratification). The otolith is sawed in two in the narrow part using an IsoMet™ low-speed saw. A count of annual growth rings is done by applying a drop of alcohol and exposing the side of the otolith to light.

A collection of reference otoliths is updated regularly and shared with experts from Newfoundland and Europe to validate the accuracy of the readings. This collection is reread each year to ensure that the age readings are standardized.

2.3.2 Condition

Since 1994, cod have been caught in the fixed gear sentinel fishery from June to September along the Lower North Shore (4S) and from January to December along the west coast of Newfoundland (3Pn and 4R) to assess fish condition. The following measures are taken: fork length, weight (gonads, stomach content, liver and total), sex and maturity.

The health status of cod is assessed using two indices: Fulton's somatic index (K_{som}) and the hepatosomatic index (HSI).

Fulton's index represents specific health condition.

$$K_{som} = 100 * \text{somatic weight (g)} / L^3 \text{ (cm)}$$

The hepatosomatic index is more of a lipid energy reserve indicator:

HSI = liver weight (g) / somatic weight (g) *100.

To minimize the size effect, the cod used in the calculation of K_{som} and HSI are between 30 and 55 cm in length.

In 2002 and since 2004, data for assessing condition have been collected during breeding season (May) as part of a project to assess cod reproductive potential (see section 2.3.3).

2.3.3 Maturity and fecundity

Fish maturity data will produce maturity ogives used to determine the proportion of mature individuals at age. These data are necessary to complete estimates of the stock's mature biomass.

From 1983 to 1990, the proportion of mature female cod at age in 3Pn, 4RS was assessed annually from data collected during DFO missions on the vessel *Gadus Atlantica* in the winter (January). This type of information was also gathered in May 1994 on the *Gadus* and in May 1995, 1997 and 1998 on the CCGS *Teleost.*

Subsequently, as part of the project to estimate the reproductive potential of cod in the northern Gulf, surveys were conducted in 1998, 2001, 2002 and have been conducted annually since 2004 (FSCP in collaboration with FFAW). This annual survey includes a grid consisting of 40 stations and is conducted during breeding season (Appendix 6). The goal is to collect cod in a *Star Balloon 300*-type trawl mounted on a *Rockhopper* bicycle with 145-mm mesh and with a 40-mm lining in the codend. The activities take place near the west coast of Newfoundland (the St. George's Bay area). Fish caught are counted, sexed, assessed for maturity, weighed (gonads, stomach content, liver and total) and measured. Cod otolith (age) and gonad (egg count) samples are also collected.

Because of the type of data available, the proportion of mature females at length was determined first; the proportion of mature females at age was estimated afterward. Females were classified as immature or mature (mature females including those in maturation and in the spawning and post-spawning stages). Proportions of mature females at length weighted by catch were estimated using the following equation:

$$P = 1 / (1 + e^{a+bl})$$

where *P* is the proportion of mature females, *L* is the length in cm (2-cm class) and *a, b* are the equation parameters. Proportions of mature females at age were estimated from the mean lengths at age obtained from age-length keys and from matching proportions of mature females at length according to logistic equations.

Proportions of mature females at age for the missing years (1996, 1999, 2000 and 2003) were determined by interpolation using adjacent years to calculate new maturity ogives at age per cohort and applying the proportions of mature females at age for the missing ages and years. Lastly, in the absence of fish maturity data for the 1974–1982 period, the maturity ogive at age obtained for 1983 was used for all of those years.

These samples can also be used to build a fecundity-at-age matrix from a multiple regression model (Lambert 2008). This model, based on number of eggs (F), length (L) and condition factor (K_{som}), explains 79% of the total variability in potential fecundity:

$$F = exp\ (−0.709 + 3.630\ ln\ (L) + 1.515\ ln\ (K_{som})$$

In addition, the population's annual egg production (TEP_t) was estimated using the following expression:

X=13

$$TEP = \ \Sigma \ N_x \ r_x \ P_x \ F_x$$

X=3

Where N_x represents the number of fish at age x; r_x, the proportion of females at age x; P_x, the proportion of mature females at age x and F_x, potential fecundity at age x (Lambert 2008). The numbers at age were obtained using sequential population analysis and the proportion of sexes by age comes from the DFO research surveys from 1984 to 2014. In the absence of sex ratio before 1984, a relation of 0.5 was used.

2.4   POPULATION ANALYSIS

2.4.1 Coherence at age

Annual surveys (DFO research, mobile sentinel >20 fathoms, mobile sentinel >10 fathoms, longline sentinel, gillnet sentinel) are used to monitor cohort abundance. Coherence for each survey was checked by establishing the relation between the number at age x for one year ($_t$) and the number at age x+1 for the following year ($_{t+1}$) for the entire series.

2.4.2 Sequential population analysis

In the most recent assessments, the Gavaris ADAPT program (1999) was used to conduct a sequential population analysis (SPA). Because this program is no longer updated, this assessment was conducted using the NFT ADAPT program (VPA/ADAPT, version 3.4.5, NOAA Fisheries Toolbox 2014). Comparative tests conducted on the data from 1974 to 2011 showed that the results are essentially the same regardless of the program used.

The NFT ADAPT model for estimating a population's age structure was developed from the Gavaris model, from which features of other ADAPT versions were incorporated. Population cohorts are estimated by backward projection, which requires provision of an estimate of the number of fish in the last year. These estimates are used to launch the application; the values are then adjusted by the model. It is also possible to make retrospective and bootstrap analyses, the latter with 1,000 repetitions, to estimate the accuracy of the model's parameters and the estimated values.

SPA is based on catches at age in the commercial fishery and is adjusted based on the various abundance indices. The parameters used for application in the NFT ADAPT program are presented in Appendix 7. The formulation used for this assessment is similar to that in Fréchet et al. (2009). Therefore, the natural mortality values (M) were set at 0.2 from 1974 to 1985, 0.4 from 1986 to 1996 and 0.2 from 1997 to 2001 (DFO 2007). For the 2002–2014 period, the M values were estimated in four-year blocks (ages 3 to 12) through a sensitivity analysis (VPA/ADAPT/NFT).

The NFT ADAPT model was therefore used to estimate several northern Gulf of St. Lawrence cod stock status parameters, including exploitation rate, population abundance, spawning stock biomass (SSB) and natural mortality (*M*). Natural mortality includes all potential mortality sources that are not accounted for in catch statistics.

2.5   TAGGING

A total of 87 147 cod (3Pn: 32 628; 4R: 42 299; 4S: 12 220) were tagged between 1995 and 2014 in the northern Gulf under a tagging program. This program includes double-tagged fish for estimating a tag loss rate (5 326 between 1995 and 2014) and high-value tags for estimating

rates of return (3 597 between 2000 and 2014). In recent years, this tagging was carried out by FFAW as part of a Fisheries Science Collaborative Program (FSCP) project.

In addition to providing information on the migratory behaviour of cod in the northern Gulf (Yvelin et al. 2005, Tamdrari et al. 2012), a tagging program has been used since 2008 to estimate the stock's exploitation rate independently of the sequential population analysis. Two methods were used to calculate the exploitation rate: a conventional method used since 2008 (Le Bris et al. 2009) and a new method, the Bayesian approach, which is the subject of a publication in preparation.

For both methods, individual sizes of between 40 and 80 cm were selected. Incomplete data and data for individuals recaptured outside 3Pn, 4RS were deleted. Of these numbers, the three years after the tagging year were used for the traditional method except for 1996 when only two years (1995 and 1996) were available. For the Bayesian method, all years are considered. In addition, an initial mortality rate (mortality caused by tagging) of 22% was applied to individuals tagged from June to October and a 3% rate was applied to individuals tagged from November to May (J. Brattey, pers. comm.). For the conventional method, the exploitation rate μ in year t is calculated using the following formula:

$$\mu_t = \frac{\sum_k R_t}{\sum_k N_t}$$

Where R_t is the number of tags recovered in year t corrected by the rate of tag return; N_t is the number of tags available to the fishery in year t, and k is the type of tagging (i.e., single, double, high-value). The number of tags available to the fishery matches the number of tags placed in year t, corrected by the initial mortality caused by tagging, by the natural mortality rate (estimated by SPA) and by the tag loss rate (Le Bris et al. 2009).

With respect to the Bayesian approach; the exploitation rate is calculated using a space state model. The first component of the model (i.e., the dynamic process) estimates the number of tags available for year t using the following formula:

$$N_{t+1,r,k} = N_{t,r,k} \ e^{-M_t - F_t} \varepsilon_t$$

where $N_{t,r,k}$ is the number of tags of type k placed in year r and available to the fishery for year t. M_t is the natural mortality rate. It is modelled by the normal law $N(m_t, \sigma_t)$, where the mean m_t is the natural mortality rate estimated by SPA for year t and the standard deviation σ_t follows the gamma distribution $\Gamma(0.02, 0.02)$. F_t is the mortality rate induced by the fishery. It is modelled with the uniform distribution $U(0,1)$. ε_t is the associated dynamic error. It is modelled by the uniform distribution $U(0, \ e^{-F_t - M_t})$ (Michielsens et al. 2006).

The second component of the space state model (i.e., the observation process) estimates the expected number of recaptures using the following formula:

$$C_{t,r,k} = N_{t,r,k} \ e^{-M_t} (1 - e^{-F_t}) \lambda_k \ (1 - e^{-\gamma_{t-r}})$$

Where $C_{t,r,k}$ is the expected number of tags of type k placed in year R and recaptured in year t. This number is modelled using negative binomial distribution $NB(R_{t,r,k}, \theta)$ where $R_{t,r,k}$ is the observed number of recaptures and θ is all distribution law parameters. λ_k is the rate of return for tags of type k. It follows the beta distribution law $B(\alpha_k, \beta_k)$. γ_{t-r} is the tag loss rate after $t - r$ years at liberty. It is modelled using a linear regression whose parameters follow the normal law $B(\rho, \vartheta)$. The values of parameters α_k, β_k, ρ and ϑ are based on estimates obtained using double and high-value tagging (Appendix 8).

The space state model parameters are estimated by using the Markov chain Monte Carlo method and the WinBUGS software application. Five thousand repetitions are performed after 10 000 are rejected to ensure proper convergence of the two chains.

2.6   PROJECTIONS

During previous assessments of this cod stock, a risk analysis included in the Gavaris ADAPT model (1999) assessed the impact of various catch levels on the mature biomass and the exploitation rate. Currently, the NFT AGEPRO model (version 4.2.2, NOAA Fisheries Toolbox 2013) is used for this purpose.

The NFT AGEPRO model (version 4.2.2, NOAA Fisheries Toolbox 2013) is used to assess a population's structure over several years based on various annual landings and recruitment hypotheses based on a population's age structure. It is also possible to incorporate the results of a SPA combined with a bootstrap analysis as a representation of an initial population.

Therefore, using the AGEPRO model based on the SPA (ADAPT/NFT) results was helpful in making cod spawning stock biomass projections for 2016 and 2017. The projection takes into account the decision rules included in the Recovery Plan for Cod Stocks in the Northern Gulf of St. Lawrence (DFO 2015b). For example, this recovery plan states that for a spawning biomass ranging from 18 000 to 25 000 t, the control rule implies a TAC of 1 500 t (Appendix 9).

The parameters used for this projection are presented in Appendix 10. It should be noted that it was necessary to incorporate a recruitment hypothesis (1 year) as of 2015. However, this recruitment estimate will, of course, have no impact on the 2016 and 2017 mature biomass estimates.

3.   RESULTS

3.1 COMMERCIAL FISHERIES

3.1.1 Landings

Landings peaked in 1983 with over 100,000 t, after which they and the TAC steadily declined from 1984 to 1993 (Figure 3). The stock collapsed and was under a moratorium from 1994 to 1996 and in 2003. Landings ranged between 1,772 and 6,470 t between 2004 and 2011 for TACs ranging from 2 000 to 7 000 t (Table 1). Since 2012, the annual TAC has been 1,500 t and landings were 1,311 t, 1,206 t and 1,229 t for 2012, 2013 and 2014 (2015 preliminary data). The TAC is split according to different procedures (fleets, period, etc.) and the 2014 quota report is presented in Table 2. Most of the landings are from NAFO Division 4R. Since the reopening of the fishery after the first moratorium in 1997, the directed fishery has been practised almost exclusively with fixed gear (gillnets and longlines). In NAFO Divisions 4R and 4S, the gillnet is used the most. In subdivision 3Pn, only longline is used (Tables 3 and 4). Although recreational cod fishing is practised for several weeks annually (periods vary by region), landings from this fishery are not known.

The commercial catch data expressed in catches at age, mean weight at age, mean lengths at age and proportion of maturity at age are presented in Tables 5, 6 and 7 and in Figure 4.

3.1.2 Catch per unit effort

Commercial fishery performance indices taken from logbook data for the fixed gear fleets (gillnet and longline, Newfoundland vessels under 10.66 m or 35 ft and Quebec vessels under 13.71 m or 45 ft) show an increase in catches per unit effort (CPUE) after the 2003 moratorium, the

maximum value being observed in 2004 for gillnet and in 2006 for longline (Figure 5). CPUEs then decreased until 2009 and increased again until 2013. In 2014, these indices were slightly lower than the 2013 values but were at average levels for their respective series. The performance index for the commercial longline fishery (Quebec fleets of vessels over 13.71 m or 45 ft) suggests the same trends (Figure 6).

Fish caught in the commercial fishery were mostly between 3 and 13 years of age. In the years when CPUEs in the commercial fishery were highest (2005, 2006, 2013, 2014), the proportion of individuals older than seven years of age in landings ranged between 72% and 83%, whereas in the years where CPUEs were lowest (2008 to 2011), this proportion ranged from 45% to 65%.

3.1.3 Incidental Catch

Since 1999, more than 90% of cod landings have come from the directed cod fishery. Cod bycatch landings are low and mainly occur in the Atlantic Halibut and Greenland Halibut directed fisheries. Bycatches in the directed northern Gulf cod fishery are low and essentially consist of Greenland Halibut and Atlantic Halibut.

Cod is also a bycatch that is not accounted for in shrimp fishery landing statistics. These catches are of 1 kg or less per tow, and the cod caught are small (under 30 cm) (1–2 years). An analysis of the at-sea observer database indicates that cod is caught in slightly more than 20% of shrimp tows. These catches (number and biomass) represent less than 1% of estimates from the DFO survey (Bourdages et al. 2014).

3.1.4 Industry telephone survey

The survey results indicate roughly the same trends as those for commercial fishery CPUEs and the same pattern as that for fixed gear sentinel fisheries. The answers to the question about fishery performance indicate that yields were higher before 2007, decreased until 2009, and increased again until 2014 for the three NAFO Divisions (Figure 7). Respondents also noted that the fish were smaller in 2008 and 2009 and that sizes had increased afterwards. No noticeable change in cod condition or migration profile was noted by the survey respondents.

3.2 SURVEYS

3.2.1 DFO survey

The mean number and mean weight per tow for cod sharply decreased between 1991 and 1993. After the 1994–1996 moratorium, these indicators slightly recovered until 1999. They then remained generally low and stable (Figure 8). The 2002 and 2003 values are considered annual effects that are also present for several species in this survey. In 2014, an increase is observed in these indices, which are above the 1990–2013 series average. This is the second highest value for mean number per tow since 1990. In 2014, the wide range of the size frequency distribution (19 to 57 cm) shows that, in particular, the two modes observed in 2013 at 18 and 26 cm remain so in 2014 at 23 cm (2012 cohort) and 34 cm (2011 cohort) (Figure 9, Tables 8 and 9). The abundance of these two cohorts is above the 1990–2013 series average (Bourdages et al. 2015).

Cod distribution in the northeastern Gulf remained similar from 1994 to 2014, while in the western Gulf, cod concentrations gradually declined from 1995 to 2006. From 2007 onward, the spatial distribution of cod expanded in Division 4S, especially north and west of Anticosti Island. Lastly, recent cod distribution (2011–2014) is now similar to that observed in the early 1990s (1990–1994) (Figure 10) (Bourdages et al. 2015). However, the detailed analysis reveals that cod concentrations are still high in 4R, especially in the northeast (Table 8).

3.2.2 Mobile gear sentinel survey

Like the DFO survey, this survey shows that catch distribution is higher in 4R than in 4S (Table 10 and Figure 11). In 2014, the length frequency distributions in number and percentage (Figure 12) showed a large size distribution with two modes at 25 and 35 cm that correspond to two- and three-year-old fish (2011 and 2012 cohort) (Table 11).

The number and the mean weight caught during these surveys reveal no clear trends (Figure 13). The 2014 values (mean number and weight per tow) are above the 2003–2013 average, which is mainly explained by the arrival of the recent cohorts.

3.2.3 Fixed gear sentinel survey

Since 1999, annual coverage by longline fisheries in NAFO Subdivision 3Pn has been helpful in monitoring cod migration. Cod arrived quickly in the Gulf through the Cabot Strait in May (day 125) and left gradually from mid-September (day 250) to mid-December (Figure 14). The 2014 observations follow this pattern.

The standardized longline abundance index increased between 1995 and 2006 then decreased, reaching its low in 2010 (Figure 15). It then increased until 2013. In 2014, the longline index value was at the series average (1995–2013). This standardized index pattern is similar to the commercial fishery performance indices pattern (Figures 5 and 6).

The standardized gillnet index shows a similar pattern to that for longline and its 2014 value is at the 1995–2013 series average (Figure 15). The gross values of these indices (longline and gillnet) are presented in Appendix 11.

In 2014 for longline, cod catches consisted mainly of five- to nine-year-olds with a mode of seven years, whereas for gillnet, cod were mainly between 5 and 11 years of age with a mode of eight years (Table 12).

In recent years, the saturation percentages for longline have been low enough to avoid biasing catch rates (Appendix 12).

3.3   BIOLOGICAL INDICATORS

3.3.1 Condition

Physical cod condition monitoring conducted mainly as part of the sentinel fisheries program shows an annual cycle. Condition indices are lower in spring before spawning; they then increase from summer until fall, when they peak. In 2014, this seasonal cycle expressed using Fulton's index (somatic K) was similar to the 1998–2013 average. The hepatosomatic index (HSI), which further monitors the recent fish feeding success, showed values not only similar to, but also below the 1998–2013 average for several months (Figure 16).

3.3.2 Maturity and fecundity

The proportion of fish that mature at four years of age was less than 10% before 1994. However, since 1995, it has generally been greater than 15% and even greater than 40% in 1995, 1997, 1999, 2009 and 2011. It ranged from 18 to 25% over the past three years (Table 13).

Fecundity at age decreased between 1984 and 1994. A gradual increase has been observed since 1994 and current levels are similar to those from 1985 to 1989 (Table 14).

3.4 POPULATION ANALYSIS

For the DFO survey, coherence at age analyses indicates that several regressions are influenced by a few high values, particularly in 1990, 1991 and 2003. In the case of the mobile sentinel surveys, both series contain few data whereas coherences are good for longline and gillnet sentinels (Figure 17). It is also possible to observe the consistency between indices for each age by year (Figure 18). The same trends are observed between indices at age two and for ages over six years. At ages 3, 4 and 5, the harmony between the indices is difficult to interpret without interannual variations.

The parameters estimated by SPA are presented in Table 15. The adjustment of the ADAPT model to five abundance indices is represented in Figure 19. Regressions between the observed and predicted values are generally positive for all ages except ages 1 and 2 in the pre-2002 sentinel survey, age 3 in the longline sentinel survey and age 4 in the gillnet sentinel survey.

The distribution of residuals from the ADAPT model for each abundance index is presented in Figure 20. Several annual effects are detected, particularly in 2002 and 2003, in the DFO survey. In addition, the residual patterns in the longline sentinel and gillnet sentinel indices are similar to the abundance indices, which indicates that the ADAPT model gives more consideration to the other abundance indices.

In 2012, when this stock was last assessed, natural mortality (M) had been estimated in five-year blocks by the Gavaris ADAPT program for the 1997–2011 period. The estimated M was 0.186 for 1997–2001, 0.308 for 2002–2006 and 0.404 for 2009–2011. The new estimates made with the ADAPT/NFT program sensitivity analysis are 0.31 for 2002–2005, 0.51 for 2006–2009 and 0.50 for 2010–2014 (Figure 21). Possible causes that may explain the increase in natural mortality from 2006 onward are seal predation and unaccounted fishing mortality.

The northern Gulf of St. Lawrence cod population collapsed in the late 1980s to the early 1990s (Figure 22 and Table 16). Its abundance reached a high of 559 million in 1980 and a low of 31 million in 1994. This abundance remained low and stable until 2005, then exhibited a few fluctuations until 2014. The 2015 estimate (143 million) is essentially based on the abundance of the recent 2011 and 2012 cohorts.

There was also a significant drop in the abundance of mature individuals from 1982 to 1994, and it has remained stable and low to date (Table 17). The abundance of three-year-old individuals estimated by SPA since 1990 was higher in 2007, 2008 and 2009 (2004 to 2006 cohorts) as well as in 2014 and 2015 (2011 and 2012 cohorts) (Figure 22 and Table 16). Table 18 presents the total biomasses at age.

The spawning stock biomass (SSB) has been stable for several years. The estimated value for 2014 is 17 559 t ± 1 401 (Table 19 and Figure 22).

The spawning stock's total egg production decreased starting in the mid-1990s and remained under 10 000 billion until 2014. Fecundity values greater than 7 000 billion correspond to the years of above-average recruitment since the collapse (2004, 2005, 2006, 2011 and 2012), with the exception of 1999 when egg production was more than 8 000 billion and recruitment was low (Table 20 and Figure 22).

The survival rate (number of three-year-old recruits divided by the mature biomass in these recruits' year of birth) declined from 1987 to 1992 then rose again until 2014 (Figure 22).

The exploitation rate for seven- to nine-year-old individuals, estimated using SPA, was high from 1997 to 2002 and in 2008, but it dropped significantly from 2007 to 2014 following TAC reductions (Figure 22 and Table 21).

According to the tagging program, 7 000 mentions of tagged cod were reported by fishers, most of whom were from areas 3Pn, 4R and 4S (Appendix 13). The exploitation rate estimated from this tagging program increased from 2003 to 2007 only to drop to a low level, where it has been since 2011 (Figure 22). The various estimates (ADAPT and tagging) follow essentially the same trends.

3.5   PROJECTION

The NFT AGEPRO model was used to make spawning stock biomass projections for 2016 and 2017 from the SPA results. The projection indicates that, with an annual harvest of 1,500 t (2015–2016 and 2016–2017), the SSB should increase. The estimated values for 2015, 2016 and 2017 are 17,870 t ± 1,657, 24,516 t ± 4,619 and 36,480 t ± 11,944, respectively (Figure 23). These projections are mainly based on the abundance of the recent 2011 and 2012 cohorts. However, the SSB remains very low and well below the limit reference point.

4. SOURCES OF UNCERTAINTY

The optimal conditions for using sequential population analysis with the aid of the ADAPT program include catch rates that cause the stock's biomass to vary. However, for 3Pn and 4RS cod stocks, catches have been low for several years and biomass variations are modest. Therefore, the SPA diagnostic tools show some uncertainties in age estimates. In addition, natural mortality (M) estimates have been high in recent years. New analytical approaches could be considered in order to validate the various parameter estimates.

5. CONCLUSION

This assessment indicates that the cod stock in the northern Gulf of St. Lawrence remains in the critical zone and well below the limit reference point. The limit reference point corresponds to a spawning stock biomass of 116,000 t (Duplisea and Fréchet 2011). The exploitation rate is currently low, while natural mortality is high. An annual harvest of 1,500 t for the next two seasons should allow the spawning stock biomass to increase. However, this increase is largely dependent on the abundance of the 2011 and 2012 cohorts, whose estimates will have to be clarified in the coming years.

6. ACKNOWLEDGEMENTS

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8. TABLES

Table 1. Historical monthly catch statistics (t) for the period 1964-2001 (NK = unknown).

Year	Jan.	Feb.	Mar.	Apr.	May	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.	NK	TOTAL	TAC
1964	1104	24423	15761	6058	3106	10350	12527	5853	2153	1385	863	651		84234	
1965	792	12506	21171	3698	2216	5267	10422	5945	3636	1359	927	990		68929	
1966	1965	22817	8929	2516	1638	8371	7482	4744	2490	1146	1779	1208		65085	
1967	7872	7028	14792	8447	2017	7525	12664	5232	7154	3315	1356	1909	1	79312	
1968	725	7980	22799	9061	3087	10717	17216	9400	4914	1781	1172	819		89671	
1969	875	4654	9675	4220	5192	10958	12103	8639	7866	3557	2035	1366		71140	
1970	1637	25487	18115	27995	4803	6020	8974	3897	2130	3170	1936	1301		105465	
1971	845	44590	7580	5250	2338	5839	8420	3039	2374	1616	1004	915		83810	
1972	1494	14961	5337	7400	7334	4594	6818	3296	2365	1406	994	212	2026	58237	
1973	16472	10556	7586	4826	3235	5860	5125	4145	2365	1459	1016	567	2593	65805	
1974	12995	10753	5959	5665	6231	5021	6235	5396	2214	1331	1009	479	3148	66436	
1975	8232	19486	2702	2616	5316	5122	5042	4488	2767	1267	819	704	1672	60233	
1976	15637	15204	3610	3437	7071	6930	6978	4310	3348	2286	1537	578	6055	76981	
1977	11143	8603	3790	11312	10057	7368	8133	5780	3361	1751	1814	454		73566	55000
1978	20754	6307	5161	3156	6717	9796	13255	7000	2836	1979	1309	236		78506	55000
1979	15543	4273	6475	6647	8517	12890	12085	8660	2971	2449	1816	451		82777	75000
1980	5280	8965	9925	8087	7147	14096	23158	10719	5687	2773	1311	431		97579	75000
1981	9156	15368	3170	3763	12835	17257	16344	10343	5676	2550	1172	277		97911	75000
1982	2289	11671	10122	5544	12723	16826	22492	9136	8412	4463	1229	32		104939	93300
1983	4152	10213	11335	6251	21049	18341	16228	8173	5698	3956	530	154		106080	100000
1984	5002	11079	9494	4260	15205	13349	22300	10962	5238	4644	1113	997		103643	100000
1985	2436	16749	7306	3516	7139	12693	13725	11026	7713	3038	962	1986		88289	100000
1986	2508	18550	10011	4227	11871	7903	12418	5763	4181	2737	803	974	870	82816	92100
1987	8657	7701	4938	3294	6627	8323	9222	7501	5293	2871	1027	1093		66547	80300
1988	1440	2786	4313	2671	9955	5072	7848	6056	3243	1782	1178	1608		47952	73900
1989	6251	7620	2117	2025	6875	6331	6087	4553	1860	2219	745	236		46919	76540
1990	5022	2706	1100	381	6765	7901	4690	3121	1903	1590	1797	487		37463	58000
1991	1533	2000	2803	2270	3527	4512	5309	2890	3230	2017	1805	121		32017	35000
1992	3841	1784	228	1394	4258	1804	3420	3651	2364	1948	1885	1438		28015	35000
1993[c]	8	52	1249	1248	1418	4373	3859	2233	1114	1086	1177	623		18440	18000

Year	Jan.	Feb.	Mar.	Apr.	May	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.	NK	TOTAL	TAC
1994	13	14	28	4	28	9	13	74	145	26	5	28		387	0
1995	0	0	0	0	8	6	18	79	24	14	0	0		148	0
1996	0	0	0	0	5	10	149	55	40	33	23	2		317	0
1997	0	1	0	2	356	255	1189	963	801	1050	148	27		4792	6000
1998	3	0	0	2	16	244	921	1082	432	561	32	3		3296	3000
1999/2000[b]									0	0	0	5	0		
	92	863	1985	1463	989	1058	395	40	1	51	132	50	11	7136	7500
2000/2001	523	907	1251	1533	1087	775	398	82	86	72	49	32	40	6834	7000
2001/2002[d]	405	486	1858	1292	1288	905	313	125	1	167	6	10	43	7150	7000
2002/2003[e]	130	55	2507	1488	854	858	404	7	0	0	0	0	4	6341	7000
2003/2004	1	14	117	131	48	31	39	5	0	0	0	13	7	406	0
2004/2005	21	25	1875	217	537	356	207	1	0	0	0	14	10	3264	3500
2005/2006	34	72	2409	596	848	476	22	3	0	0	0	24	7	4491	5000
2006/2007[f]	12	105	3284	579	656	298	669	17	1	0	0	15	3	5715	6000
2007/2008	19	132	3707	398	1173	577	446	5	0	0	1	7	4	6470	7000
2008/2009[g]	36	118	2952	888	1273	575	301	2	0	0	1	3	8	6224	7000
2009/2010	5	173	1693	661	699	719	687	51	1	0	2	2	1	4695	7000
2010/2011	6	53	1362	836	569	533	186	1	0	0	0	13	8	3567	4000
2011/2012	7	51	998	168	312	16	193	9	0	0	0	12	6	1772	2000
2012/2013	10	41	672	104	293	24	137	3	0	0	0	21	5	1311	1500
2013/2014[a]	6	20	697	93	220	10	148	3	0	0	0	7	3	1206	1500
2014/2015 [a]	5	14	640	85	328	37	100	21						1229	1500

[a] Preliminary statistics.

[b] TAC from 1999/01/01 to 2000/05/14

[c] Established in August 1993, the initial TAC was 35,000 t

[d] Includes 253 t from recreational fishery

[e] Includes 34 t from recreational fishery

[f] Includes 75.3 t from recreational fishery

[g] Includes 67 t from recreational fishery

Table 2. Commercial Fisheries, 2014 Quota Report.

Fleet	Quota		Regions				TOTAL	%	Amount remaining
	Initial	After adjustments	Maritimes	Gulf	Quebec	N&L			
FIXE < 65' NF/ July	374.3	482.2			6.8	453.0	459.8	95.3 %	22.5
FIXE < 65' - NF / Sept.		160.7				263.0	263.0	163.6 %	-102.3
FIXE < 65' NF /Nov.							-		-
FIXE < 65' NF /By-catch		70.0	0.0			26.0	26.0	37.1 %	44.0
FIXE < 65' Quebec	145.6	216.6			235.4		235.4	108.6 %	-18.7
FIXE <65' ITQ Mobile to Quebec FIXE							0.0	-	-
FIXE <65' (GEAC/FFAW, Special)		42.9				40.0			
MOBILE < 45' 4ST Competitive	1.9	1.9					0.0	0.0 %	1.9
MOBILE < 65' 4RS,3Pn Que. buy back							0.0	-	-
MOBILE < 65'4RS,3Pn NF buy back							0.0	-	-
MOBILE <65' 4RS, 3Pn NF/groupe A	265.8	0.0					0.0	-	-
MOBILE < 65' 3Ps,4Vn/Overlap	6.4	0.0	0.0				0.0	-	-
MOBILE <65' 4S/T /Shrimpers	24.2	24.2			0.0		0.0	0.0 %	24.2
MOBILE <65'4T /Groundfish	45.4	45.4					0.0	0.0 %	45.4
MOBILE <65' 4RS, 3Pn Que. Groupe A	21.7	21.7					0.0	0.0 %	21.7
MOBILE <65' /Bought back / 4T	102.5	10.5					0.0	0.0 %	10.5
Shrimpers 65-100'	20.4	20.4					0.0	0.0 %	20.4
MOBILE 65-100' Bought back NB	16.9	1.8					0.0	0.0 %	1.8
Groundfish 65-100'			0.0				0.0	-	-
FIXE 65-100' By-catch			0.2				0.2	-	-
Danish Seiners	17.3	0.0					0.0		-
Vessels >100'	85.6	100.7	0.0		16.3	81.0	97.3	96.6 %	3.4
Aboriginals Québec	53.0	53.0					0.0	0.0 %	53.0
Sentinel	200.0	200.0			105.6	46.5	152.1	76.1 %	47.9
France	39.0	39.0					0.0	0.0 %	39.0
Recreational fishery	80.0	80.0					0.0	0.0 %	80.0
Québec reserve (5%)							0.0	-	-
Total 3Pn, 4RS Cod	1500.0	1571.1	0.2	0.0	364.1	909.5	1273.7	81.1 %	297.4

Table 3a. Nominal landings (*preliminary) for NAFO Subdivision 3Pn by gear category (DV=dory vessels, T=traps, GN=gillnets, HL=handlines, LL=Longline, IN=misc. inshore, DS=Danish seines, PT=pair trawl, OT=otter trawl).

Year	3Pn											
	DV	T	GN	HL	LL	IN	DS	PT	OT	Total Fixe	Total mobile	Total
1964	558				3416	4875		178	6105	8849	6283	15132
1965	113				2702	4815		142	8963	7630	9105	16735
1966	16				2499	2854		559	7696	5369	8255	13624
1967					657	3463	27	33	16248	4120	16308	20428
1968	33				85	5031	12	306	6442	5149	6760	11909
1969			444	270	3630	39	10	24	500	4383	534	4917
1970		46	643	675	3378		5	62	396	4742	463	5205
1971			364	217	5574	134		52	1503	6289	1555	7844
1972	17	10	181	98	5593	20	545	176	3717	5919	4438	10357
1973	1405		175	110	5431	97	174	356	3552	7218	4082	11300
1974	128		297	52	2460	915	58	1507	8596	3852	10161	14013
1975			61	152	2418	12	6		3584	2643	3590	6233
1976		9	163	225	4467	636	163		2802	5500	2965	8465
1977		37	73	163	5679		119		1494	5952	1613	7565
1978		7	34	103	5323		17		1318	5467	1335	6802
1979		25	40	116	7338		181		3216	7519	3397	10916
1980			13	83	6443		18		2242	6539	2260	8799
1981		4	3	72	7560		28		7463	7639	7491	15130
1982		1	8	87	7670		12		7707	7766	7719	15485
1983		1	46	97	6789		20	8	9146	6933	9174	16107
1984		2	129	45	7089		499		8177	7265	8676	15941
1985		4	35	24	5619		186		8581	5682	8767	14449
1986			6	46	5728		16		16415	5780	16431	22211
1987			23	11	6589		25		11709	6623	11734	18357
1988			12	3	3331				5712	3346	5712	9058
1989			155	11	1484				5772	1650	5772	7422
1990			180	14	912		1		4314	1106	4315	5421
1991			276	23	1218		75		5335	1517	5410	6927
1992			213	25	1208		22		6529	1446	6551	7997
1993			153	59	1388				1596	1600	1596	3196
1994									51	0	51	51
1995										0	0	0
1996			14	0	58		0		1	71	1	72

Year	3Pn											
	DV	T	GN	HL	LL	IN	DS	PT	OT	Total Fixe	Total mobile	Total
1997			5	20	1969				12	1994	12	2006
1998			2	16	860					878	0	878
1999			2	49	1110		2		2	1161	4	1165
2000			3	33	1442		0		0	1478	0	1478
2001			2	21	1715				1	1738	1	1739
2002			0	40	1657				15	1698	15	1713
2003			1		85				1	85	1	86
2004			2	10	762				0	774	0	774
2005			1	4	871				0	876	0	876
2006		1	1	5	1197				3	1205	3	1208
2007			3	4	1074				0	1081	0	1081
2008			3	3	1125				0	1131	0	1131
2009			6	6	1345				0	1357	0	1357
2010			2	6	697				0	705	0	705
2011		1	7	6	302				0	316	0	316
2012			10	2	176		0		0	187	0	187
2013			1	2	182		0			185	0	*185
2014			0	2	120				0	122	0	*122

Table 3b. Nominal landings (*preliminary) for NAFO Division 4R by gear category (DV=dory vessels, T=traps, GN=gillnets, HL=handlines, LL=Longline, IN=misc. inshore, DS=Danish seines, PT=pair trawl, OT=otter trawl).

Year	4R											
	DV	T	GN	HL	LL	IN	DS	PT	OT	Total Fixe	Total mobile	Total
1964					123	18789	185		39863	18912	40048	58960
1965					152	16766	145		26776	16918	26921	43839
1966					201	15532	53	38	28384	15733	28475	44208
1967					207	21015	47		28672	21222	28719	49941
1968			289		1138	26130	60	508	41916	27557	42484	70041
1969		3943	10905	1622	4405	2646	198	5	32908	23521	33111	56632
1970	184	2340	4319	1673	5489	1962	239	225	74715	15967	75179	91146
1971		3786	3718	1295	3076	436	247		53804	12311	54051	66362
1972		1606	2835	1107	1115	2851	16	24	28029	9514	28069	37583
1973		2007	3154	1007	2564	3050	120	84	31108	11782	31312	43094
1974		1789	5182	1714	1358	666	223		28514	10709	28737	39446
1975		2032	6462	1413	978	490	221		29973	11375	30194	41569
1976		1572	7671	1445	527	4238	155		40422	15453	40577	56030
1977		2414	7866	1591	1429	147	147		39793	13447	39940	53387
1978		4103	13235	1749	2462		233		35158	21549	35391	56940
1979		3071	11479	3138	5031		311		32738	22719	33049	55768
1980		8354	11607	2380	7768		467		34107	30109	34574	64683
1981		5408	5796	2096	8936	327	384		38231	22563	38615	61178
1982		7473	9465	2126	7208		337		38878	26272	39215	65487
1983		3415	11849	5047	6614		473		38347	26925	38820	65745
1984		2899	6625	2815	7311				43643	19650	43643	63293
1985		3315	4474	2178	7275		321		36881	17242	37202	54444
1986		2938	5540	1000	4645		695		28999	14123	29694	43817
1987		1290	4949	746	4646		950		21180	11631	22130	33761
1988		1323	5110	803	2645		833		18959	9881	19792	29673
1989		736	3689	756	1473		907		21832	6654	22739	29393
1990		391	1797	827	1918		814		18837	4933	19651	24584
1991		2308	2535	1185	2274		606		10632	8302	11238	19540
1992		1679	1656	1287	1767		515		9166	6389	9681	16070
1993		2458	1750	846	562		189		7694	5616	7883	13499
1994			13	148	66		9		44	227	53	280
1995			14	1	15		4		0	30	5	35
1996		4	30	0	33		11		1	67	13	80

Year	4R											
	DV	T	GN	HL	LL	IN	DS	PT	OT	Total Fixe	Total mobile	Total
1997		57	233	246	1712		8		43	2248	51	2299
1998		2	161	283	1287		29		1	1733	30	1763
1999		0	2801	890	1151		32		7	4842	40	4882
2000		26	2230	515	1435		36		24	4205	60	4265
2001		8	1683	716	1814		65		23	4221	88	4308
2002			1939	582	1371		29		17	3892	46	3938
2003		1	80	1	95		25		9	177	34	210
2004		0	956	288	564		44		28	1808	72	1881
2005		1	1674	218	977		50		32	2871	82	2953
2006		0	1976	175	1406		38		76	3558	113	3671
2007			2635	133	1740		31		0	4507	31	4538
2008		0	2285	204	1657		25		1	4147	26	4173
2009		1	1417	166	1129		23		1	2714	24	2738
2010		0	1268	244	648		13		2	2161	15	2176
2011		0	681	74	152		12		5	906	17	923
2012			558	67	101		4		1	727	5	732
2013		1	464	123	171		2		0	759	3	*761
2014			599	124	64		3		2	787	5	*792

*Table 3c. Nominal landings (*preliminary) for NAFO Division 4S by gear category (DV=dory vessels, T=traps, GN=gillnets, HL=handlines, LL=Longline, IN=misc. inshore, DS=Danish seines, PT=pair trawl, OT=otter trawl).*

Year	4S											
	DV	T	GN	HL	LL	IN	DS	PT	OT	Total Fixe	Total mobile	Total
1964					486	6 166			3 490	6 652	3 490	10 142
1965		3 950	24		320		1		4 060	4 294	4 061	8 355
1966		1 656	973		441	798			3 385	3 868	3 385	7 253
1967		2 470	1 618	710	305				3 840	5 103	3 840	8 943
1968		3 070	1 127	623	333				2 568	5 153	2 568	7 721
1969		2 312	1 960	607	262				4 450	5 141	4 450	9 591
1970	21	1 789	846	771	251				5 436	3 678	5 436	9 114
1971		2 410	963	503	565			1	5 162	4 441	5 163	9 604
1972		2 040	1 418	511	511				5 817	4 480	5 817	10 297
1973		885	1 774	470	402	2 248			5 632	5 779	5 632	11 411
1974		200	2 326	402	976	2 064			7 009	5 968	7 009	12 977
1975		579	2 072	2 337	136	1 425			5 882	6 549	5 882	12 431
1976		992	2 900	353	46	1 385			6 810	5 676	6 810	12 486
1977		861	4 089	303	36		2		7 323	5 289	7 325	12 614
1978		2 178	3 626	194	28		2		8 736	6 026	8 738	14 764
1979		1 043	6 578	467	148				7 857	8 236	7 857	16 093
1980			1 376		1 796	11 658			9 267	14 830	9 267	24 097
1981		3	364		2 678	12 554		51	5 953	15 599	6 004	21 603
1982		13	27		3 688	11 629	3	340	8 267	15 357	8 610	23 967
1983			622	2	3 890	11 245	174		8 295	15 759	8 469	24 228
1984	8	675	8 923	961	4 301		1 694		7 847	14 868	9 541	24 409
1985		1 211	6 182	891	4 307		11		6 794	12 591	6 805	19 396
1986		52	4 269	383	2 672		161		9 251	7 376	9 412	16 788
1987		10	3 065	219	2 189		46		8 900	5 483	8 946	14 429
1988			3 782	42	1 232		16		4 149	5 056	4 165	9 221
1989		3	3 206	379	1 395		8		5 113	4 983	5 121	10 104
1990		1	1 825	159	678				4 795	2 663	4 795	7 458
1991		48	1 462	479	679				2 882	2 668	2 882	5 550
1992		19	1 139	78	345				2 367	1 581	2 367	3 948
1993			604	136	169				836	909	836	1 745
1994			6		23	19			8	48	8	56
1995			20		6	88			0	113	0	113
1996			150	0	7	6			1	163	1	165

Year	4S											
	DV	T	GN	HL	LL	IN	DS	PT	OT	Total Fixe	Total mobile	Total
1997			300		176	7			5	483	5	487
1998			497		148	6	0		4	651	4	655
1999			598	29	214		1		2	841	3	844
2000			813	9	234				0	1 056	0	1 057
2001		5	335	128	434				1	902	1	903
2002		5	733	12	127		1		2	876	3	879
2003		0	81		11				1	92	1	93
2004			525	11	71				0	607	0	607
2005		5	613	8	26		0		3	652	3	655
2006			712	9	46				5	767	5	772
2007			789	21	48				0	858	0	858
2008			739	8	106				0	854	0	854
2009		1	429	35	140				0	605	0	605
2010		0	439	13	218				1	670	1	671
2011			316	4	217				0	537	0	537
2012			252	5	126				1	383	1	384
2013		0	206	6	61				2	273	2	*275
2014			211	5	109				0	325	0	*325

*Table 3d. Nominal landings (*preliminary) for NAFO Divisions 3Pn, 4RS by gear category (DV=dory vessels, T=traps, GN=gillnets, HL=handlines, LL=Longline, IN=misc. inshore, DS=Danish seines, PT=pair trawl, OT=otter trawl).*

Year	*3Pn, 4RS*											
	DV	T	GN	HL	LL	IN	DS	PT	OT	Total Fixe	Total mobile	Total
1964	558				4025	29830	185	178	49458	34413	49821	84234
1965	113	3950	24		3174	21581	146	142	39799	28842	40087	68929
1966	16	1656	973		3141	19184	53	597	39465	24970	40115	65085
1967		2470	1618	710	1169	24478	74	33	48760	30445	48867	79312
1968	33	3070	1416	623	1556	31161	72	814	50926	37859	51812	89671
1969		6255	13309	2499	8297	2685	208	29	37858	33045	38095	71140
1970	205	4175	5808	3119	9118	1962	244	287	80547	24387	81078	105465
1971		6196	5045	2015	9215	570	247	53	60469	23041	60769	83810
1972	17	3656	4434	1716	7219	2871	561	200	37563	19913	38324	58237
1973	1405	2892	5103	1587	8397	5395	294	440	40292	24779	41026	65805
1974	128	1989	7805	2168	4794	3645	281	1507	44119	20529	45907	66436
1975		2611	8595	3902	3532	1927	227		39439	20567	39666	60233
1976		2573	10734	2023	5040	6259	318		50034	26629	50352	76981
1977		3312	12028	2057	7144	147	268		48610	24688	48878	73566
1978		6288	16895	2046	7813		252		45212	33042	45464	78506
1979		4139	18097	3721	12517		492		43811	38474	44303	82777
1980		8354	12996	2463	16007	11658	485		45616	51478	46101	97579
1981		5415	6163	2168	19174	12881	412	51	51647	45801	52110	97911
1982		7487	9500	2213	18566	11629	352	340	54852	49395	55544	104939
1983		3416	12517	5146	17293	11245	667	8	55788	49617	56463	106080
1984	8	3576	15677	3821	18701		2193		59667	41783	61860	103643
1985		4530	10691	3093	17201		518		52256	35515	52774	88289
1986		2990	9815	1429	13045		872		54665	27279	55537	82816
1987		1300	8037	976	13424		1021		41789	23737	42810	66547
1988		1323	8904	848	7208		849		28820	18283	29669	47952
1989		739	7050	1146	4352		915		32717	13287	33632	46919
1990		392	3802	1000	3508	0	815		27946	8702	28761	37463
1991		2356	4273	1687	4171		681		18849	12487	19530	32017
1992		1698	3008	1390	3320		537		18062	9416	18599	28015
1993		2458	2507	1041	2119		189		10126	8125	10315	18440
1994		0	19	148	89	19	9		103	275	112	387
1995		0	34	1	21	88	4		0	143	5	148
1996		4	193	0	98	6	11		4	301	15	317
1997		57	538	265	3857	7	8		60	4724	68	4792

| Year | 3Pn, 4RS | | | | | | | | | | |
	DV	T	GN	HL	LL	IN	DS	PT	OT	Total Fixe	Total mobile	Total
1998		2	660	299	2295	6	29		5	3262	34	3296
1999		0	3401	968	2475		35		11	6844	46	6891
2000		26	3046	557	3111		36		24	6740	60	6800
2001		13	2020	864	3963		65		25	6860	90	6950
2002		5	2672	634	3155		30		34	6465	64	6529
2003		1	161	1	191		25		10	354	35	389
2004		0	1483	309	1397		44		29	3189	73	3262
2005		6	2288	230	1874		50		35	4398	85	4483
2006		1	2690	190	2649		38		84	5529	122	5651
2007			3427	158	2862		31		0	6447	31	6478
2008		0	3027	215	2889		25		2	6131	27	6158
2009		2	1852	207	2615		23		2	4676	25	4700
2010		0	1710	263	1563		13		3	3536	16	3552
2011		1	1004	84	671		12		5	1759	17	1776
2012		0	820	74	403		4		2	1297	6	1303
2013		1	670	131	415		2		2	1217	5	*1222
2014		0	811	130	293		3		2	1234	5	*1239

Table 4a. 2014 cod landing (t) statistics (preliminary) in NAFO Subdivision 3Pn.

Region-gear	3Pn												
	Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Total**
Newfoundland													
Otter trawl													0.0
Danish seines													0.0
Gillnets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4
Longlines	0.0	0.0	0.0	5.5	3.5	2.3	7.9	0.9	19.8	0.0	79.9	0.0	119.9
Handlines	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.3	0.0	0.1	0.9	1.7
Traps													0.0
Total	0.0	0.0	0.0	5.5	3.6	2.3	8.4	0.9	20.5	0.0	80.0	0.9	122.1
Maritimes													
Otter trawl													0.0
Danish seines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Longlines:													0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quebec													
Otter trawl													0.0
Longlines													0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	**0.0**	**0.0**	**0.0**	**5.5**	**3.6**	**2.3**	**8.4**	**0.9**	**20.5**	**0.0**	**80.0**	**0.9**	**122.1**

Table 4b. 2014 cod landing (t) statistics (preliminary) in NAFO Division 4R.

Region-gear	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
4R													
Newfoundland													
Otter trawl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4
Danish seines	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.9	0.4	0.0	0.0	0.0	3.3
Gillnets	0.0	0.0	0.0	0.0	0.0	3.0	356.3	1.3	189.6	0.0	2.6	19.7	572.5
Longlines	0.0	0.0	0.0	0.9	0.6	0.7	12.2	4.4	14.5	0.0	17.4	0.0	50.7
Handlines	0.0	0.0	0.0	0.0	0.0	0.0	82.7	0.0	38.5	0.0	0.0	0.0	121.2
Traps													0.0
Total	0.0	0.0	0.0	0.9	0.6	3.7	452.2	7.6	243.1	0.4	19.9	19.7	748.1
Maritimes													
Otter trawl	0.0	0.0	0.0	0.0	0.0	0.4	0.8	0.0	0.0	0.0	0.0	0.0	1.2
Danish seines													0.0
Longlines:													0.0
Total	0.0	0.0	0.0	0.0	0.0	0.4	0.8	0.0	0.0	0.0	0.0	0.0	1.2
Quebec													
Otter trawl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gillnets	0.0	0.0	0.0	0.0	0.0	1.0	9.4	0.0	0.0	16.3	0.0	0.0	26.7
Longlines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.7	3.6	0.0	0.0	0.0	13.3
Handlines	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	2.3
TOTAL	0.0	0.0	0.0	0.0	0.0	1.0	11.7	9.7	3.6	16.3	0.0	0.0	42.2
TOTAL	**0.0**	**0.0**	**0.0**	**0.9**	**0.6**	**5.1**	**464.6**	**17.3**	**246.7**	**16.7**	**19.9**	**19.7**	**791.6**

Table 4c. 2014 cod landing (t) statistics (preliminary) in NAFO Division 4S.

Region-gear	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Newfoundland													
Otter trawl													0.0
Gillnets													0.0
Longlines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Handlines													0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maritimes													
Otter trawl													0.0
Danish seines													0.0
Gillnets													0.0
Longlines	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Total	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Quebec													
Otter trawl	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3
Danish seines													0.0
Gillnets	0.0	0.0	0.0	0.3	3.5	4.7	156.4	44.6	1.6	0.0	0.0	0.0	211.1
Longlines	0.0	0.0	0.0	0.0	0.5	1.7	6.9	20.3	59.0	20.5	0.0	0.0	109.0
Handlines	0.0	0.0	0.0	0.0	0.0	0.0	3.3	1.3	0.0	0.0	0.0	0.0	4.6
Traps													0.0
Total	0.0	0.0	0.0	0.4	3.9	6.4	166.9	66.2	60.6	20.5	0.0	0.0	325.0
TOTAL	**0.0**	**0.0**	**0.0**	**0.4**	**3.9**	**6.6**	**166.9**	**66.3**	**60.6**	**20.5**	**0.0**	**0.0**	**325.2**

Table 4d. 2014 cod landing (t) statistics (preliminary) in NAFO Divisions 3Pn, 4RS.

Region-gear	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
3Pn, 4RS													
Newfoundland													
Otter trawl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4
Danish seines	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.9	0.4	0.0	0.0	0.0	3.3
Gillnets	0.0	0.0	0.0	0.0	0.0	3.0	356.3	1.3	190.0	0.0	2.6	19.7	573.0
Longlines	0.0	0.0	0.0	6.4	4.1	3.0	20.1	5.4	34.4	0.0	97.3	0.0	170.7
Handlines	0.0	0.0	0.0	0.0	0.0	0.0	83.2	0.0	38.8	0.0	0.1	0.9	122.9
Traps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	6.4	4.1	6.0	460.6	8.6	263.6	0.4	100.0	20.6	870.3
Maritimes													
Otter trawl	0.0	0.0	0.0	0.0	0.0	0.4	0.8	0.0	0.0	0.0	0.0	0.0	1.2
Danish seines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gillnets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Longlines	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Total	0.0	0.0	0.0	0.0	0.0	0.6	0.8	0.0	0.0	0.0	0.0	0.0	1.4
Quebec													
Otter trawl	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3
Danish seines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gillnets	0.0	0.0	0.0	0.3	3.5	5.6	165.7	44.7	1.6	16.3	0.0	0.0	237.8
Longlines	0.0	0.0	0.0	0.0	0.5	1.7	6.9	30.0	62.6	20.5	0.0	0.0	122.3
Handlines	0.0	0.0	0.0	0.0	0.0	0.0	5.6	1.3	0.0	0.0	0.0	0.0	6.8
Traps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.4	3.9	7.4	178.5	75.9	64.2	36.8	0.0	0.0	367.2
TOTAL	**0.0**	**0.0**	**0.0**	**6.8**	**8.1**	**14.0**	**639.9**	**84.5**	**327.8**	**37.2**	**100.0**	**20.6**	**1238.9**

Table 5. Commercial Fisheries, catch-at-age ('000).

Âge	3	4	5	6	7	8	9	10	11	12	13
1974	741	4069	9607	13498	5303	6658	2794	1509	413	173	82
1975	35	4313	7707	5091	7185	2930	2757	1719	740	316	135
1976	217	5210	12535	6323	4244	5750	1991	2561	993	395	147
1977	14	2672	10124	12756	7943	2628	3274	1098	894	394	291
1978	61	2678	10794	17616	9292	2163	1064	1261	538	441	235
1979	70	3404	13995	12871	12592	4822	1429	721	543	300	141
1980	605	3390	17515	20196	11624	7064	1531	483	289	324	77
1981	316	6689	8999	20054	13971	4730	2154	939	294	172	163
1982	229	3231	18782	12747	13768	8673	3372	2109	618	145	74
1983	840	4901	15255	18451	10206	6002	3061	1161	817	211	214
1984	47	2947	7733	13493	20246	7394	5688	2095	821	406	145
1985	175	2518	15909	13820	10688	9818	3179	2317	828	200	81
1986	215	2415	8534	15635	11847	6024	6189	2284	1748	461	185
1987	15	1194	8426	12310	11864	7210	3650	1843	1470	575	261
1988	117	1274	6037	11452	6078	5145	1515	656	826	277	142
1989	370	1882	5059	8190	8576	4101	2703	1085	480	380	145
1990	362	3083	7677	5916	5435	3984	1665	913	273	112	61
1991	109	3004	6928	6896	3344	2587	1996	487	433	115	57
1992	309	4276	9148	6080	3414	1661	1132	679	210	104	51
1993	169	1949	3807	5985	2863	888	343	215	130	22	20
1994	1	2	41	65	89	47	7	7	2	2	1
1995	2	10	23	52	40	33	17	5	2	1	1
1996	2	22	60	107	90	57	41	13	2	1	1
1997	18	296	386	764	475	517	220	248	31	10	3
1998	1	30	350	349	460	222	136	123	40	17	4
1999	1	45	200	953	454	776	375	178	136	54	7
2000	1	48	400	675	1269	375	429	159	50	14	11
2001	1	161	298	638	642	1016	333	188	50	30	24
2002	1	63	283	874	748	823	658	168	46	7	26
2003	0	8	21	52	61	43	15	16	11	1	0
2004	0	4	98	272	387	334	233	100	67	7	6
2005	0	12	81	256	641	433	316	146	143	55	11
2006	0	30	218	538	536	823	329	154	116	59	25
2007	2	80	246	450	395	638	506	228	125	40	28
2008	1	171	266	543	627	414	449	187	97	33	17
2009	3	116	593	629	431	302	226	88	50	20	15
2010	0	87	248	519	403	281	193	71	26	21	0
2011	2	32	176	254	298	134	60	33	14	5	5
2012	1	4	30	110	206	185	65	35	15	12	0
2013	0	10	37	119	173	131	95	23	10	1	0
2014	1	18	31	75	95	142	107	59	14	3	2

Table 6. Commercial Fisheries, mean weight at age January 1 (kg).

Âge	3	4	5	6	7	8	9	10	11	12	13
1974	0.46	0.64	0.99	1.31	1.67	1.98	2.51	2.89	4.46	5.59	5.57
1975	0.40	0.72	1.00	1.52	1.89	2.34	2.61	3.08	4.16	4.50	4.30
1976	0.44	0.76	1.13	1.68	2.15	2.60	2.90	3.11	3.91	4.83	6.90
1977	0.46	0.65	1.02	1.48	2.02	2.52	2.77	3.17	3.35	4.23	4.13
1978	0.57	0.75	0.96	1.44	1.98	2.63	3.22	3.32	3.22	3.86	5.12
1979	0.35	0.65	0.93	1.42	1.87	2.58	3.40	3.84	3.96	5.23	5.38
1980	0.51	0.62	0.93	1.43	1.91	2.41	3.41	4.15	4.41	3.87	5.42
1981	0.57	0.79	0.98	1.32	1.85	2.49	3.34	4.55	6.04	7.43	5.93
1982	0.45	0.85	1.11	1.44	1.76	2.12	2.66	3.13	3.88	5.70	6.02
1983	0.38	0.93	1.30	1.60	1.90	2.18	2.45	3.47	4.52	4.37	6.66
1984	0.42	0.79	1.03	1.45	1.77	2.03	2.30	2.70	3.48	3.75	4.70
1985	0.63	0.79	0.98	1.22	1.62	1.93	2.15	2.32	2.60	3.71	4.60
1986	0.64	0.73	0.98	1.19	1.47	1.92	2.22	2.46	2.62	3.07	3.19
1987	0.45	0.60	0.77	1.01	1.31	1.58	2.09	2.65	2.73	3.05	3.28
1988	0.51	0.73	0.88	1.20	1.49	1.81	2.27	2.74	2.92	3.05	3.90
1989	0.40	0.69	0.93	1.12	1.42	1.67	2.02	2.33	2.84	3.11	3.98
1990	0.59	0.75	0.93	1.18	1.39	1.64	1.86	2.16	2.67	3.91	4.13
1991	0.43	0.61	0.83	1.09	1.38	1.59	1.83	2.01	2.29	2.40	3.15
1992	0.46	0.61	0.79	1.01	1.29	1.50	1.75	1.98	2.27	2.23	2.92
1993	0.42	0.59	0.80	1.06	1.30	1.73	2.07	2.50	3.04	4.38	5.27
1994	0.42	0.55	0.88	1.09	1.29	1.66	3.67	2.17	2.61	3.35	5.08
1995	0.42	0.83	0.88	1.36	1.35	1.64	2.01	2.66	1.27	3.58	4.16
1996	0.45	0.74	0.96	1.21	1.50	1.72	2.31	3.00	3.66	3.58	4.16
1997	0.92	0.83	1.08	1.40	1.66	1.98	2.26	2.51	3.92	4.19	4.76
1998	0.90	0.70	1.10	1.31	1.56	1.83	1.92	2.46	2.83	3.09	5.41
1999	0.90	0.99	1.31	1.75	2.04	2.30	2.36	2.86	3.33	3.82	5.22
2000	0.56	0.81	1.27	1.64	2.03	2.26	2.48	2.54	2.83	5.61	3.32
2001	0.57	0.82	1.16	1.59	1.87	2.39	2.63	3.18	3.69	3.57	4.17
2002	0.35	0.71	1.20	1.52	1.81	2.01	2.37	2.61	3.28	4.56	3.03
2003	0.44	0.60	1.04	1.32	1.59	1.87	1.95	2.49	2.49	3.39	5.72
2004	0.58	0.87	1.13	1.62	2.11	2.19	2.58	2.65	3.28	3.80	3.57
2005	0.46	1.04	1.32	1.61	1.85	2.28	2.53	3.21	2.81	3.98	4.33
2006	0.49	0.85	1.17	1.43	1.76	1.95	2.27	2.74	2.83	3.00	3.43
2007	0.59	0.96	1.34	1.80	2.04	2.50	2.66	3.20	3.52	4.09	3.58
2008	0.44	0.85	1.22	1.80	2.17	2.40	2.66	2.85	3.69	4.07	5.66
2009	0.50	0.86	1.16	1.53	2.00	2.59	2.63	3.44	3.83	5.08	5.45
2010	0.47	0.88	1.17	1.55	1.95	2.46	2.61	3.02	3.30	4.20	5.56
2011	0.64	0.81	1.04	1.32	1.89	2.32	2.81	2.96	3.11	3.85	4.32
2012	0.54	0.65	1.12	1.44	1.72	2.18	2.48	2.85	3.55	2.94	4.94
2013	0.59	0.80	1.20	1.59	1.88	2.10	2.71	3.20	3.86	4.50	5.27
2014	0.47	0.75	1.03	1.56	2.00	2.32	2.66	3.13	3.83	5.13	6.42

Table 7. Commercial Fisheries, lengths at age (cm).

Âge	3	4	5	6	7	8	9	10	11	12	13
1974	36.78	41.06	47.59	52.40	56.69	59.95	64.72	67.16	78.00	84.78	83.13
1975	35.17	42.76	47.91	54.96	59.15	63.23	65.57	68.98	76.55	78.01	76.17
1976	36.11	43.64	49.82	56.85	61.83	65.85	68.24	69.83	75.00	80.20	90.65
1977	37.00	41.35	48.08	54.45	60.53	65.14	67.22	70.09	71.23	76.82	76.70
1978	39.24	43.30	47.21	53.91	60.03	66.13	70.50	70.97	69.68	74.89	81.29
1979	33.25	41.14	46.62	53.67	58.85	65.27	71.65	74.13	75.19	81.82	83.78
1980	38.17	40.67	46.49	53.79	59.20	63.91	71.62	76.39	77.99	74.40	84.17
1981	39.26	44.01	47.47	52.49	58.30	63.96	69.95	77.75	86.78	93.17	86.79
1982	36.49	44.94	49.50	53.95	57.79	61.32	65.82	69.06	74.47	85.27	87.26
1983	33.44	46.37	52.06	55.96	59.08	61.48	63.81	70.99	77.97	76.01	88.68
1984	35.88	44.05	48.23	54.20	57.91	60.42	62.75	65.90	71.57	73.09	77.64
1985	40.65	44.06	47.40	51.03	56.04	59.36	61.28	62.88	64.79	72.74	77.76
1986	41.36	42.93	47.33	50.58	54.10	59.02	61.94	64.00	65.17	68.41	69.37
1987	36.65	40.18	43.83	47.80	52.21	55.24	60.53	65.25	65.82	68.30	69.55
1988	37.97	42.83	45.69	50.65	54.35	58.01	62.09	66.01	67.42	68.23	73.75
1989	34.24	42.13	46.65	49.58	53.59	56.46	59.99	62.43	65.91	68.29	73.77
1990	40.08	43.56	46.74	50.23	52.99	55.81	57.78	60.30	63.71	72.10	73.77
1991	36.77	41.33	45.65	50.02	53.93	56.58	59.12	60.78	62.85	63.33	68.29
1992	37.84	41.23	45.08	48.68	52.78	55.24	58.13	60.33	62.94	61.38	67.93
1993	36.31	40.59	44.77	49.12	52.39	57.09	59.95	63.94	67.54	76.80	81.80
1994	36.31	40.00	46.50	49.83	52.79	56.82	73.84	61.42	66.79	72.45	83.77
1995	36.31	44.32	45.69	52.53	52.44	55.69	59.82	65.27	52.00	73.00	76.51
1996	37.00	43.60	47.40	51.01	54.22	56.87	62.26	67.59	72.51	73.00	76.51
1997	44.79	44.99	48.94	53.32	56.36	59.40	61.63	63.89	74.11	75.72	80.40
1998	37.00	44.80	50.60	53.49	56.28	59.01	59.06	61.08	65.90	66.17	75.86
1999	37.00	46.60	51.14	56.23	59.98	62.87	63.86	67.19	71.85	76.52	82.97
2000	40.00	44.57	51.58	56.04	60.48	62.73	64.84	65.34	67.45	83.94	70.26
2001	40.00	44.29	49.71	54.67	58.00	63.02	64.61	69.42	72.39	71.36	74.73
2002	34.00	42.17	50.14	54.08	57.11	59.15	62.17	64.10	68.87	75.89	67.12
2003	36.37	40.15	47.62	51.69	55.08	58.20	58.64	63.67	64.03	70.19	83.36
2004	40.00	45.54	51.24	55.56	60.44	61.18	64.08	64.52	69.08	72.89	71.86
2005	36.79	48.12	51.87	55.37	57.81	61.70	63.61	68.42	65.69	73.07	74.20
2006	37.72	45.75	50.90	54.17	57.79	59.80	62.53	66.39	66.38	68.46	70.70
2007	40.90	47.64	53.09	58.21	60.51	64.61	65.76	69.86	71.94	75.08	72.20
2008	37.00	45.40	50.83	57.54	60.87	62.71	65.09	66.20	71.70	73.72	83.44
2009	38.59	45.66	50.01	54.78	59.42	64.40	64.35	70.35	72.34	79.09	81.94
2010	37.79	46.03	50.24	54.94	59.16	63.52	64.18	67.45	69.83	75.50	82.69
2011	41.77	44.80	48.52	52.19	58.56	62.20	65.70	66.96	68.79	73.93	75.33
2012	40.00	42.27	50.40	54.57	57.63	62.05	64.91	66.93	72.51	67.40	79.01
2013	40.89	44.71	50.60	55.56	58.45	60.23	65.49	69.07	73.80	77.13	82.35
2014	37.97	44.02	48.65	55.33	60.04	63.02	65.83	69.51	73.63	81.89	88.32

Table 8a. DFO Survey, NAFO Division 4R, average weight of cod caught per tow per stratum.

	801	802	809	810	811	812	813	820	821	822	823	824	835	836	837	838	840
									4R / strata								
1990	0.6	0.0	0.0	0.0	1.9	6.0	41.0	83.0	86.9	60.5	116.0	956.1	49.9	43.0	63.6	232.0	3.0
1991	0.1	1.1	0.4	0.0	22.1	31.4	18.2	23.4	128.5	60.7	36.8	162.6	41.8	98.8	83.3	531.9	12.8
1992	0.0	0.0	0.7	0.0	0.1	15.6	60.3	93.4	22.4	23.2	65.5	52.7	72.0	55.7	30.9	127.9	52.4
1993	0.0	0.0	0.0	0.0	0.0	1.7	6.2	3.1	10.3	20.4	3.9	21.8	6.4	2.2	15.5	28.6	0.2
1994	3.0	0.0	0.2	0.0	5.6	6.4	6.8	14.8	5.3	62.7	151.3	62.7	11.8	27.5	64.0	69.0	0.5
1995	0.0	0.0	0.0	0.0	3.3	3.9	60.4	226.5	19.7	58.6	82.0	45.7	21.1	11.3	16.5	9.0	0.5
1996	0.0	0.0	0.0	1.9	3.5	0.0	12.7	49.1	87.6	44.1	15.4	60.7	17.7	7.4	22.6	37.2	0.9
1997	0.0	0.0	0.0	0.0	2.9	9.0	8.9	54.7	56.4	169.9	63.8	50.6	223.2	34.0	69.9	33.2	1.1
1998	0.0	0.0	0.0	0.0	558.2	66.2	9.0	90.5	28.8	48.7	178.1	53.2	170.9	2.4	34.6	9.1	0.6
1999	0.7	0.0	0.8	0.0	9.0	4.0	27.7	113.3	74.5	77.3	49.0	38.2	46.7	162.7	170.9	150.6	1.6
2000	0.0	0.0	0.0	0.0	27.0	1.8	39.6	160.8	85.6	69.7	702.6	22.0	27.0	38.4	52.4	83.5	1.0
2001	1.2	0.0	0.0	0.0	0.0	0.6	12.9	35.6	112.9	45.7	226.0	68.1	25.5	70.1	118.2	168.7	8.4
2002	0.0	0.0	0.0	0.6	0.0	5.3	31.6	0.0	8.0	10.0	62.3	17.4	2.0	2.4	35.1	123.0	0.3
2003	0.0	0.0	0.0	0.4	5.7	91.4	4.9	55.3	61.2	191.5	497.1	168.3	60.0	72.8	65.0	712.6	1.5
2004	0.0	0.4	0.0	0.0	1.6	7.8	27.4	22.8	77.7	29.9	155.3	277.9	86.6	71.8	62.2	120.3	2.0
2005	1.4	0.0	0.0	0.0	98.0	78.2	0.4	80.3	83.9	75.8	102.7	141.6	40.8	44.4	48.9	10.9	12.6
2006	0.0	0.0	0.7	0.0	24.6	25.9	61.1	65.4	46.5	101.9	587.3	225.9	39.3	69.4	51.7	20.5	0.0
2007	0.1	0.0	3.6	0.1	11.9	5.5	8.3	60.9	24.7	31.0	114.6	111.3	61.8	36.0	144.1	15.8	1.7
2008	0.9	0.0	0.0	0.1	25.2	0.0	8.2	10.7	43.1	60.0	73.3	33.2	57.1	66.4	105.0	45.1	10.3
2009	0.2	0.0	0.0	0.0	17.0	10.6	1.1	14.6	35.8	71.0	36.6	95.0	100.5	36.2	115.1	15.6	1.2
2010	0.0	0.0	0.2	0.1	16.2	11.7	8.4	33.0	81.9	48.6	58.4	183.0	109.9	35.6	46.5	35.7	2.6
2011	0.4	0.0	0.7	0.0	1.2	1.1	2.5	4.1	56.4	46.3	28.9	35.9	68.2	44.9	75.5	55.1	1.8
2012	0.0	0.0	0.5	0.0	4.5	3.4	23.9	25.3	16.6	33.9	30.9	20.0	19.9	30.7	384.1	9.2	6.3
2013	0.7	0.0	0.0	0.2	9.4	3.8	2.3	25.5	10.9	65.3	39.2	31.5	38.0	27.3	24.2	22.6	2.1
2014	4.7	0.0	2.2	0.0	0.6	5.1	13.2	22.2	112.4	30.5	68.1	28.5	51.7	67.6	330.9	344.5	14.5

Table 8b. DFO Survey, NAFO Division 4S, average weight of cod caught per tow per stratum.

	803	804	805	806	807	808	814	815	816	817	818	819	827	828	829	830	831	832	833	839	841
																	4S / strata				
1990	1.0	0.0	0.0	0.0	0.0	0.0	11.5	0.5	12.2	80.3	3.1	7.2	1.9	42.1	129.4	45.0	114.5	97.5	94.6	4.0	0.2
1991	1.8	0.0	0.0	0.5	1.0	0.4	63.4	5.4	14.2	273.5	160.6	96.6	17.6	39.1	46.9	15.9	538.5	306.8	28.9	31.1	0.6
1992	0.0	0.0	0.0	0.0	0.0	0.0	11.2	8.7	2.3	0.9	3.5	24.5	0.4	9.4	6.3	51.2	122.5	41.6	0.4	0.1	0.0
1993	0.0	0.0	0.0	1.2	0.3	0.0	0.4	0.0	11.9	7.5	0.3	0.0	2.0	1.4	1.3	1.3	35.6	12.5	3.3	2.7	0.3
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	7.8	3.8	27.2	1.9	29.3	14.8	5.4	0.5	20.5	24.7	1.0	3.7	5.2
1995	0.0	1.2	0.0	0.0	0.0	0.0	0.2	0.7	4.0	0.5	2.5	2.3	8.6	0.0	0.4	17.6	5.9	6.1	0.5	0.0	0.0
1996	0.0	0.0	0.0	0.0	1.4	0.0	3.2	1.0	22.0	74.5	15.3	10.1	14.0	6.2	4.6	15.9	3.3	19.7	0.0	0.7	0.0
1997	0.0	0.0	0.0	0.0	0.8	0.0	33.6	1.7	7.5	3.3	9.4	2.2	8.3	0.3	2.7	0.5	2.2	3.1	8.3	2.8	0.1
1998	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	8.2	1.0	3.0	26.3	27.8	0.0	7.6	2.0	5.4	2.3	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	2.6	0.7	6.1	0.1	0.9	4.0	23.9	18.5	20.6	0.1	24.0	8.0	3.5	4.1	14.1	3.0	0.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	28.5	8.5	0.2	1.0	205.0	2.4	17.9	0.0	0.0	29.2	12.4	1.6	8.2	0.0	2.9
2001	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.5	0.7	13.7	0.5	7.9	0.0	0.5	0.7	4.5	1.5	0.4	0.0	0.0
2002	0.0	0.0	0.0	0.0	0.0	0.0	7.1	0.0	1.2	1.5	18.2	0.0	14.6	0.0	4.2	3.0	0.2	1.3	1.7	0.0	2.9
2003	0.0	0.0	0.0	0.7	0.0	0.0	5.5	8.8	20.8	7.4	83.9	15.5	1.2	0.0	0.1	5.5	1.2	2.2	62.7	11.1	10.2
2004	0.0	0.0	0.6	0.0	0.0	0.0	47.3	2.0	0.9	1.5	44.2	0.3	36.2	5.7	0.5	4.7	12.4	4.3	12.8	11.6	2.2
2005	0.0	0.0	0.0	0.0	0.1	0.0	0.0	5.6	0.0	1.3	0.2	19.8	16.1	2.1	13.9	8.6	7.6	5.7	5.5	4.7	3.5
2006	0.0	0.0	0.0	3.4	0.0	0.0	0.6	0.3	5.0	0.0	16.5	1.7	44.7	7.9	8.4	94.6	4.4	8.4	18.3	6.6	5.0
2007	0.0	0.0	0.0	0.0	0.0	0.0	33.1	2.8	0.1	1.5	21.8	19.1	25.5	2.9	18.6	11.1	7.9	9.3	6.9	3.6	6.9
2008	0.2	0.0	0.0	0.4	0.0	0.0	46.4	1.8	35.0	0.0	6.6	0.9	88.9	9.3	69.2	55.8	49.0	74.7	6.8	54.6	13.1
2009	0.0	0.0	0.0	0.0	0.0	0.0	7.8	0.3	0.0	4.9	76.6	1.7	6.9	19.3	4.9	7.5	19.8	6.3	20.7	6.5	3.5
2010	0.0	0.2	0.0	0.0	0.9	0.0	54.5	16.3	6.7	3.5	11.1	5.4	27.0	80.5	12.2	9.2	2.4	13.4	14.7	16.1	2.9
2011	0.0	0.0	0.0	0.0	0.4	0.1	0.4	20.5	49.4	46.3	14.0	2.5	38.4	12.5	12.0	17.4	15.7	39.7	23.1	14.7	3.8
2012	0.1	0.0	0.0	0.0	0.0	0.0	3.8	0.1	21.9	15.1	9.0	1.2	21.4	79.0	26.2	24.7	16.0	15.0	19.7	9.7	9.8
2013	0.0	0.0	0.0	2.1	0.7	0.1	5.1	0.0	0.4	14.3	33.4	1.2	110.1	9.5	11.2	24.1	71.1	9.2	17.8	20.4	11.0
2014	0.0	0.4	0.0	1.1	3.7	9.4	13.5	8.6	19.6	15.1	21.6	2.1	4.3	2.7	88.8	54.5	67.4	50.3	20.2	10.9	12.0

Table 8c. DFO Survey, NAFO Division s4RS, average weight per tow and average number per set.

Year	Mean weight/Set with multiplicative model	Mean weight/set without multiplicative model	Mean number /set with multiplicative model
1990	43.8	39.5	87.2
1991	76.0	73.5	145.3
1992	21.8	22.7	39.8
1993	5.3	5.3	11.3
1994	14.5	14.6	38.2
1995	12.1	12.3	16.3
1996	13.8	13.0	23.2
1997	21.2	22.6	28.8
1998	25.4	25.3	32.0
1999	27.1	28.6	42.4
2000	26.6	25.4	47.6
2001	19.1	23.6	30.4
2002	9.4	10.7	12.9
2003	53.5	32.1	86.4
2004	22.3	27.3	29.4
2005	18.7	19.1	24.1
2006	25.4	25.4	45.6
2007	16.0	16.1	30.0
2008	27.6	27.6	65.1
2009	17.0	17.2	34.6
2010	20.1	17.2	34.1
2011	21.0	21.2	37.6
2012	23.2	23.2	46.5
2013	15.8	15.4	50.0
2014	39.8	39.8	87.4

Table 9. DFO Survey, average numbers at age.

Age	1	2	3	4	5	6	7	8	9	10	11	12	13
1990	4.37	7.80	33.73	20.85	9.10	3.12	3.01	2.79	0.58	0.18	0.06	0.02	0.04
1991	19.71	10.46	35.39	58.40	26.56	11.36	3.04	1.73	1.82	0.42	0.28	0.06	0.07
1992	7.29	7.40	10.51	15.01	12.89	4.60	1.43	0.67	0.51	0.21	0.09	0.07	0.03
1993	0.00	2.65	2.53	1.88	1.98	1.65	0.29	0.15	0.04	0.02	0.00	0.02	0.00
1994	5.67	6.55	12.38	4.76	2.23	2.35	1.69	0.63	0.12	0.02	0.02	0.02	0.00
1995	0.00	1.83	1.50	5.13	3.51	1.96	0.87	0.86	0.14	0.10	0.03	0.00	0.00
1996	0.14	3.07	9.20	3.42	3.98	1.98	0.90	0.29	0.23	0.04	0.00	0.01	0.00
1997	0.64	4.14	4.32	9.15	2.91	4.09	1.92	0.92	0.41	0.28	0.02	0.00	0.00
1998	0.52	2.29	7.55	7.51	7.27	3.12	2.34	0.70	0.46	0.15	0.00	0.00	0.00
1999	0.99	8.41	12.34	9.46	3.88	4.33	1.02	0.87	0.28	0.08	0.14	0.03	0.02
2000	8.01	5.57	13.93	9.30	4.94	2.05	2.46	0.61	0.48	0.13	0.06	0.07	0.01
2001	1.71	4.86	9.38	4.42	3.41	2.63	1.31	1.70	0.23	0.45	0.06	0.07	0.02
2002	0.00	2.08	2.46	4.26	1.52	1.12	0.62	0.49	0.17	0.10	0.01	0.00	0.00
2003	0.76	19.61	23.23	17.86	11.33	6.09	3.89	1.62	0.80	0.88	0.16	0.08	0.00
2004	0.77	5.77	5.28	5.69	3.56	3.75	1.99	1.17	0.84	0.31	0.19	0.02	0.01
2005	3.09	2.89	3.64	4.16	3.56	2.50	2.33	0.78	0.56	0.29	0.19	0.07	0.00
2006	5.32	14.28	7.82	6.58	4.18	3.21	1.80	1.23	0.61	0.23	0.23	0.05	0.00
2007	4.53	4.98	7.91	6.01	2.78	1.56	0.93	0.60	0.42	0.14	0.08	0.04	0.01
2008	1.84	24.73	12.68	15.62	5.63	2.69	1.04	0.51	0.19	0.11	0.01	0.02	0.02
2009	0.44	10.92	6.66	6.60	5.53	2.37	1.39	0.43	0.06	0.11	0.00	0.01	0.01
2010	3.54	1.80	8.88	8.96	6.40	3.08	0.89	0.32	0.19	0.03	0.01	0.00	0.01
2011	1.54	10.16	6.67	6.71	5.67	3.54	2.16	0.67	0.26	0.06	0.03	0.00	0.01
2012	6.82	8.94	10.78	6.42	5.42	5.00	1.61	0.81	0.34	0.17	0.02	0.08	0.00
2013	7.22	18.09	12.70	6.44	1.98	1.39	1.07	0.49	0.19	0.07	0.00	0.02	0.00
2014	2.94	29.28	25.29	16.03	6.34	3.61	2.18	0.86	0.61	0.27	0.03	0.00	0.00

Table 10. Mobile gear sentinel surveys, average weight of cod per tow per unit area and per stratum.

	3Pn / strata				4R / strata												
	302	303	304	305	101	102	103	801	802	809	810	811	812	813	820	821	822
1995	37.8	9.1	0.0	0.1				0.6	0.0	0.0	0.0	9.8	1.7	67.3	38.7	74.8	28.7
1996	31.6	8.7	0.3	0.0				1.6	0.0	0.0	0.0	5.0	8.3	19.1	30.8	175.1	71.5
1997	69.6	3.9	0.4	0.0				0.4	0.0	0.0	0.0	5.6	1.3	34.6	80.9	79.5	177.5
1998	45.4	3.7	0.3	0.0				0.4	0.0	0.2	0.8	8.5	6.2	26.8	46.3	69.0	56.6
1999	10.3	2.1	0.5	0.0				0.0	0.0	0.8	0.0	4.7	3.1	12.7	137.7	129.7	37.1
2000	17.3	0.8	0.4	0.0				0.4	0.0	0.0	0.3	0.1	1.5	16.6	23.8	56.4	77.2
2001	121.2	5.1	0.0	0.1				0.0	0.0	0.2	0.0	9.2	3.7	82.5	21.8	76.2	53.4
2002	191.3	10.2	0.0	0.0				2.2	0.0	0.1	0.0	9.9	18.1	14.2	33.0	27.3	29.5
2003	28.0	5.1	0.0	0.0	38.3	580.7	11.0	0.7	0.0	2.1	0.5	7.8	1.8	28.8	32.7	36.5	96.8
2004	26.4	9.4	0.8	0.1	37.3	240.4	174.6	0.0	0.1	0.0	1.1	6.8	3.7	35.4	54.1	28.6	114.8
2005	26.5	14.9	0.0	0.0	37.2	117.0	144.9	0.0	0.4	0.0	0.6	34.6	8.1	5.9	87.1	194.3	86.4
2006	20.9	3.7	0.0	0.0	61.2	126.9	1.5	0.9	0.0	0.5	0.0	46.0	13.0	7.8	34.3	83.3	64.5
2007	11.6	16.1	0.1	0.0	54.6	336.1	15.6	1.2	0.0	0.1	0.0	7.7	9.4	31.7	55.2	34.6	51.3
2008	1.6	0.0	0.0	0.0	23.4	612.6	839.4	2.0	0.0	0.4	0.0	2.0	3.6	17.2	4.2	27.5	24.0
2009	1.5	1.6	0.2	0.0	23.9	62.7	1.5	2.9	0.0	0.0	0.0	2.3	3.4	87.4	18.9	10.5	55.9
2010	1.2	0.1	0.0	0.0	53.5	12.6	359.1	0.3	0.0	0.0	0.0	4.6	3.6	37.5	25.1	9.8	30.5
2011	0.2	0.0	0.0	0.0	0.0	11.7	462.8	0.0	0.0	0.0	0.0	6.9	2.6	1.5	22.1	38.1	28.0
2012	2.4	0.1	0.0	0.0	35.3	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.8	9.2	9.6	12.3
2013	2.5	1.8	0.0	0.0	0.6	21.7	24.9	0.3	0.0	0.9	0.0	1.1	0.3	7.2	2.1	0.6	1.3
2014	1.3	0.1	0.0	0.0	18.2	26.0	9.6	4.2	0.1	0.5	0.0	1.9	26.4	22.0	4.5	15.9	19.5

Table 10 (continued). Mobile gear sentinel surveys, average weight of cod per tow per unit area and per stratum.

4R / strata							4S / strata									
823	824	835	836	837	838	840	803	804	805	806	807	808	814	815	816	817
164.6	41.1	48.8	32.8	18.2	30.6	0.4	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.5	5.4	13.6
128.9	126.4	69.9	39.4	18.5	9.0	2.6	0.1	0.0	0.0		0.2	0.4	8.5	39.1	10.6	5.9
259.4	169.5	81.9	124.4	93.7	61.2	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.7	0.9	0.3
288.1	592.5	64.4	107.7	219.6	43.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.6	1.1	0.0
39.8	77.2	77.8	147.0	27.2	11.0	15.2	0.0	0.0	0.0	0.0	1.2	0.0	4.3	2.1	4.2	0.0
74.8	44.0	114.5	195.8	295.7	179.5	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	6.7	0.0
149.6	241.4	105.4	66.1	516.8	58.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.2	0.4
55.5	66.3	79.2	147.3	192.2	98.6	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.0	0.0	0.0	0.3
1240.9	108.8	190.2	57.1	107.9	18.1	4.8	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.5	5.8	0.6
316.0	281.5	89.1	121.3	543.5	9.7	7.3	0.0	0.2		0.3	0.0	0.0	0.5	0.7	1.1	0.7
63.3	107.9	59.3	72.1	187.6	213.7	4.9	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
83.6	8.5	139.1	176.2	278.7	328.1	12.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.1	0.1
31.0	53.1	56.7	38.9	129.3	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.5	33.8	0.2
69.3	36.3	11.1	71.9	196.7	12.8	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.3	4.2	0.4	0.0
46.5	45.8	21.8	65.4	460.7	77.6	0.0	0.0	0.0	0.0	0.2	0.4	0.0	1.6	0.3	1.2	0.3
18.0	4.1	12.6	22.3	141.0	74.2	7.4	0.0	0.0	0.1	0.3	0.0	0.5	9.5	0.5	7.7	0.3
153.3	99.6	13.2	73.0	1079.2	22.8	7.3	0.0	0.0	0.1	0.0	0.0	0.0	53.2	0.2	0.1	3.2
4.6	18.3	6.8	18.1	88.4	26.5	0.5	0.0	0.0	0.0	0.5	0.0	0.0	1.0	0.9	0.1	0.9
16.9	3.4	0.7	137.3	135.8	198.0	200.6	0.0	0.2	0.1	0.0	0.8	0.0	4.8	6.3	2.2	0.5
34.9	49.0	19.4	51.7	633.7	61.8	3.1	0.2	0.4	0.1	1.2	1.3	0.5	5.8	6.7	7.1	0.3

Table 10 (continued). Mobile gear sentinel surveys, average weight of cod per tow per unit area and per stratum.

	4S / strata											Mean weight / set
	818	819	827	828	829	830	831	832	833	839	841	
1995	0.3	1.0	1.3	3.0	1.8	8.0	6.9	12.1	0.0			**13.0**
1996	3.0	0.9	0.0	0.0	28.8		13.1	15.6	0.0	0.0	5.6	**16.9**
1997	0.0	0.7	11.7		7.3	22.2		4.2	3.2	0.8	1.7	**25.4**
1998	0.2	12.0	0.3	3.3	23.2	30.0	3.8	8.9	0.7	1.0	0.6	**26.3**
1999	0.5	0.0	5.4	2.4	44.0	32.2	8.0	5.6	5.0	2.3	0.0	**16.9**
2000	0.5	0.0	0.6	34.5	12.1	4.3	0.0	5.8	0.0	0.0	1.7	**29.7**
2001	1.5	0.0	0.0	0.0	6.3	0.0	8.4	3.9	0.3	0.0	2.4	**33.1**
2002	3.0	3.0		0.5	25.0	4.1	0.0	1.8	0.0	0.5	1.2	**22.7**
2003	3.3	30.5	2.4	0.0	0.0	6.1	0.0	1.8	0.0	0.3	2.8	**30.6**
2004	3.1	0.3	0.0	0.5	9.8	1.8	5.9	4.8	0.0	0.0	0.0	**37.5**
2005	2.4		2.0	3.7	24.5	11.4	12.0	3.8	0.0	2.2	4.3	**28.7**
2006	0.7	0.7	0.5	3.9	13.9	3.1	13.6	3.3	5.4	1.6	6.4	**35.3**
2007	0.2	0.7	7.4		0.7	3.8	119.8	14.0	2.7	2.7	11.7	**20.3**
2008	0.7	0.3	1.0		3.6	12.2	18.3	19.0	1.1	0.8	1.0	**25.1**
2009	8.6	0.0	5.0	3.3		22.5	6.0	23.3	0.0	1.7	1.7	**26.6**
2010	1.8	0.0	4.1		22.2	8.9		30.9	4.3	10.4	2.2	**17.0**
2011	5.1		0.0	3.9	0.0	51.1	27.7	6.2	0.0	13.7	1.0	**40.9**
2012	5.0	0.6	6.7	0.0	0.2	8.4		10.7	4.2	3.7		**6.5**
2013	4.3	3.7	17.6	3.0	4.3	11.4	26.4	23.6	5.3	1.5	4.2	**19.2**
2014	3.3	5.7	27.1		2.4	38.6	9.8	37.5	2.9	8.1		**29.5**

Table 11. Mobile gear sentinel surveys, average numbers at age.

Age	1	2	3	4	5	6	7	8	9	10	11	12	13
1995	1.078	2.010	2.273	4.677	3.101	1.861	1.303	1.143	0.230	0.055	0.024	0.008	0.000
1996	0.118	1.692	7.259	6.180	4.951	2.392	1.216	0.819	0.644	0.145	0.025	0.011	0.000
1997	0.000	2.924	6.145	13.872	4.956	4.423	1.715	0.687	0.512	0.164	0.044	0.003	0.000
1998	0.038	2.059	8.547	6.780	7.260	3.062	2.971	0.970	0.663	0.253	0.157	0.039	0.000
1999	0.093	2.043	5.091	5.832	3.415	2.943	1.089	0.935	0.190	0.085	0.047	0.013	0.000
2000	0.359	1.220	7.433	10.218	5.743	3.892	3.485	0.800	0.792	0.281	0.047	0.012	0.007
2001	1.207	5.632	11.254	9.884	5.021	3.111	1.809	1.373	0.480	0.320	0.099	0.044	0.010
2002	0.023	0.600	3.035	8.159	4.663	3.783	2.055	1.655	0.880	0.264	0.074	0.005	0.007
2003	0.051	1.104	4.227	7.383	6.368	3.220	2.400	1.171	0.944	0.728	0.268	0.054	0.023
2004	0.016	0.709	3.620	6.718	5.831	5.489	3.401	2.218	1.352	0.664	0.488	0.127	0.025
2005	0.025	1.865	4.837	6.209	4.895	3.321	2.650	1.066	0.707	0.388	0.159	0.163	0.013
2006	0.962	3.672	4.644	7.686	5.155	3.851	2.423	2.382	1.075	0.531	0.149	0.116	0.094
2007	9.826	2.724	7.722	6.301	2.871	1.667	1.080	0.664	0.560	0.345	0.224	0.093	0.043
2008	0.023	4.637	5.882	10.553	4.089	3.034	1.707	1.168	0.813	0.359	0.107	0.065	0.031
2009	0.056	4.158	6.508	10.432	10.428	2.237	1.694	0.940	0.291	0.163	0.018	0.009	0.006
2010	0.037	0.395	6.087	6.337	5.382	2.512	0.858	0.562	0.166	0.065	0.021	0.000	0.000
2011	0.073	1.317	3.315	12.867	8.555	9.565	3.745	2.031	1.032	0.303	0.176	0.035	0.003
2012	0.908	0.619	1.134	1.145	1.560	1.321	0.926	0.328	0.183	0.036	0.016	0.002	0.000
2013	2.368	6.081	5.508	6.050	3.065	2.190	1.848	0.995	0.497	0.165	0.104	0.097	0.000
2014	0.325	7.063	11.675	10.518	6.560	4.384	1.721	1.237	0.642	0.134	0.130	0.065	0.012

Table 12a. Longline sentinel surveys, numbers at age.

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1994	3	62	408	794	352	298	73	53	8	2	5	1				
1995	41	712	4822	5532	8102	10707	10346	3076	710	206	158	108	20	26	3	5
1996	42	1458	5126	8606	9975	11882	7101	6178	1501	207	57	49	36			
1997	105	902	3991	4662	8831	5850	4144	3042	2058	324	104	32		14		
1998	35	2540	7087	13038	12387	9393	4552	3369	1539	664	193	72	19			
1999	25	1804	10052	7727	13937	6264	7572	2084	1357	762	353	74	30			
2000	167	2124	13016	19204	18587	19666	6187	3439	610	202	233	77	13			
2001	328	1122	12498	19947	19561	16901	17335	5517	2240	813	311	112	34			
2002	5	1071	8214	13357	17461	13936	8969	8876	1843	982	150	94				
2003		253	3460	10274	12596	11737	6128	4062	4286	820	338	80	45			
2004		316	2188	10263	19406	16276	11338	6298	2811	3330	397	189	117	14		
2005		294	2932	6668	7949	17481	9143	7766	3437	1945	1168	263	58	23		3
2006		561	4582	10228	15548	14816	13372	8719	4969	2696	1099	396	163	35		
2007		372	4719	7941	10922	9574	8147	5366	3481	1145	870	395	159	35	5	
2008		203	6056	9046	10308	9054	4369	3425	1823	547	516	129	51	8		
2009		678	3829	10221	8803	6967	3960	2273	606	262	57	36	13	24		
2010		142	5307	9389	10739	5860	1839	1257	440	121	13					
2011		562	2989	11871	9963	10124	3472	1511	559	88		28				
2012		747	2098	6458	9832	8305	5987	1795	708	181	37	10				
2013		106	3041	6130	7253	7645	6001	3086	1003	369	174	32				
2014		168	1220	4954	6009	6025	5304	3541	984	423	53		58	14		

Table 12b. Longline sentinel surveys, numbers at age (%).

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1994	0.00	0.03	0.20	0.39	0.17	0.14	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1995	0.00	0.02	0.11	0.12	0.18	0.24	0.23	0.07	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996	0.00	0.03	0.10	0.16	0.19	0.23	0.14	0.12	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997	0.00	0.03	0.12	0.14	0.26	0.17	0.12	0.09	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1998	0.00	0.05	0.13	0.24	0.23	0.17	0.08	0.06	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1999	0.00	0.03	0.19	0.15	0.27	0.12	0.15	0.04	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2000	0.00	0.03	0.16	0.23	0.22	0.24	0.07	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001	0.00	0.01	0.13	0.21	0.20	0.17	0.18	0.06	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2002	0.00	0.01	0.11	0.18	0.23	0.19	0.12	0.12	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2003	0.00	0.00	0.06	0.19	0.23	0.22	0.11	0.08	0.08	0.02	0.01	0.00	0.00	0.00	0.00	0.00
2004	0.00	0.00	0.03	0.14	0.27	0.22	0.16	0.09	0.04	0.05	0.01	0.00	0.00	0.00	0.00	0.00
2005	0.00	0.00	0.05	0.11	0.13	0.30	0.15	0.13	0.06	0.03	0.02	0.00	0.00	0.00	0.00	0.00
2006	0.00	0.01	0.06	0.13	0.20	0.19	0.17	0.11	0.06	0.03	0.01	0.01	0.00	0.00	0.00	0.00
2007	0.00	0.01	0.09	0.15	0.21	0.18	0.15	0.10	0.07	0.02	0.02	0.01	0.00	0.00	0.00	0.00
2008	0.00	0.00	0.13	0.20	0.23	0.20	0.10	0.08	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2009	0.00	0.02	0.10	0.27	0.23	0.18	0.10	0.06	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2010	0.00	0.00	0.15	0.27	0.31	0.17	0.05	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2011	0.00	0.01	0.07	0.29	0.24	0.25	0.08	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2012	0.00	0.02	0.05	0.16	0.24	0.20	0.15	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2013	0.00	0.00	0.07	0.15	0.18	0.19	0.15	0.07	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2014	0.00	0.00	0.03	0.12	0.15	0.15	0.13	0.09	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00

Table 12c. Longline sentinel surveys, Catch rates at age

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1994																
1995	1	17	113	130	190	251	243	72	17	5	4	3	0	1	0	0
1996	1	30	107	179	208	248	148	129	31	4	1	1	1	0	0	0
1997	3	24	106	124	234	155	110	81	55	9	3	1	0	0	0	0
1998	1	90	250	460	437	332	161	119	54	23	7	3	1	0	0	0
1999	1	82	456	351	633	284	344	95	62	35	16	3	1	0	0	0
2000	5	68	419	618	598	633	199	111	20	7	8	2	0	0	0	0
2001	11	36	402	641	629	543	557	177	72	26	10	4	1	0	0	0
2002	0	30	232	377	493	394	253	251	52	28	4	3	0	0	0	0
2003	0	10	131	390	478	445	232	154	163	31	13	3	2	0	0	0
2004	0	16	108	507	959	804	560	311	139	165	20	9	6	1	0	0
2005	0	14	143	324	386	850	445	378	167	95	57	13	3	1	0	0
2006	0	28	229	512	779	742	670	437	249	135	55	20	8	2	0	0
2007	0	21	273	459	631	553	471	310	201	66	50	23	9	2	0	0
2008	0	11	314	470	535	470	227	178	95	28	27	7	3	0	0	0
2009	0	41	230	613	528	418	238	136	36	16	3	2	1	1	0	0
2010	0	9	329	581	665	363	114	78	27	7	1	0	0	0	0	0
2011	0	39	208	827	694	705	242	105	39	6	0	2	0	0	0	0
2012	0	71	199	614	934	789	569	171	67	17	3	1	0	0	0	0
2013	0	11	318	642	759	800	628	323	105	39	18	3	0	0	0	0
2014	0	16	116	470	570	571	503	336	93	40	5	0	6	1	0	0

Table 12d. Longline sentinel surveys, lengths at age (cm).

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1994	29.4	37.9	44.0	50.8	54.7	56.7	59.2	60.5	68.9	64.0	74.4	85.0				
1995	26.9	34.7	42.6	48.1	53.2	56.3	59.3	64.5	69.2	77.0	74.1	77.7	91.1	86.8	88.0	89.0
1996	28.8	38.8	45.2	51.6	55.2	60.6	63.7	66.2	70.6	84.0	76.8	86.2	80.1			
1997	30.9	37.7	45.0	49.8	55.0	57.5	63.1	63.9	66.8	67.5	62.0	80.9		88.8		
1998	25.0	36.3	43.2	50.0	54.0	58.0	60.2	63.6	65.8	73.3	75.9	78.3	79.0			
1999	31.0	38.6	45.1	49.7	54.5	57.8	59.4	63.2	63.5	66.3	75.2	80.3	90.1			
2000	30.3	37.3	44.8	50.5	54.2	58.5	61.7	63.1	68.3	72.4	77.7	68.4	70.0			
2001	30.2	36.5	43.4	49.9	54.5	57.2	61.6	63.9	65.8	65.4	69.2	87.4	74.4			
2002	28.0	36.4	42.4	48.5	53.5	56.4	60.0	64.2	68.7	72.4	75.1	76.8				
2003		36.5	43.5	49.4	54.1	57.5	61.5	63.1	65.8	73.5	72.5	83.2	77.7			
2004		37.1	43.7	49.7	53.3	58.3	61.9	64.4	66.4	69.2	76.1	69.8	74.4	88.0		
2005		38.3	44.9	50.6	54.8	56.5	60.8	65.0	67.5	67.9	74.0	72.9	80.4	85.9		94.0
2006		38.0	43.6	50.3	54.1	57.9	60.6	63.3	66.9	68.9	73.3	76.7	76.6	82.3		
2007		36.0	43.3	50.6	55.0	57.5	60.5	63.5	68.2	74.7	75.2	73.8	79.6	79.9	100.2	
2008		36.8	43.7	49.4	53.6	57.5	61.5	63.1	66.3	71.2	70.3	71.5	83.7	87.3		
2009		36.3	42.9	47.8	52.7	57.6	60.1	62.5	67.6	72.6	74.3	78.4	76.0	95.5		
2010		38.2	43.6	47.3	51.4	54.6	59.1	62.5	63.5	68.2	73.0					
2011		37.8	43.7	48.6	51.3	54.3	59.5	59.6	70.1	65.8		73.0				
2012		38.5	43.8	47.7	52.3	55.4	57.9	61.3	66.7	71.4	74.6	76.0				
2013		36.9	44.7	49.5	53.5	56.3	56.0	63.3	67.0	69.8	71.4	70.0				
2014		37.1	43.0	47.4	51.9	55.6	59.5	61.0	67.0	71.4	71.9		81.6	82.0		

Table 12e. Longline sentinel surveys, weights at age (kg).

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1994	0.23	0.52	0.78	1.22	1.54	1.71	1.94	2.12	3.13	2.39	4.67	5.59				
1995	0.18	0.38	0.71	1.03	1.41	1.69	1.97	2.62	3.28	4.44	4.01	4.74	7.18	6.14	6.32	6.60
1996	0.21	0.53	0.84	1.25	1.54	2.08	2.43	2.74	3.39	5.53	4.13	6.00	4.64			
1997	0.28	0.51	0.85	1.14	1.54	1.77	2.38	2.50	2.84	3.02	2.40	4.78		6.31		
1998	0.14	0.43	0.73	1.13	1.43	1.78	2.03	2.40	2.67	3.62	4.10	4.39	4.32			
1999	0.26	0.51	0.81	1.08	1.43	1.72	1.88	2.30	2.33	2.69	3.76	4.55	6.37			
2000	0.24	0.45	0.80	1.15	1.43	1.83	2.16	2.36	2.96	3.66	4.41	2.98	3.06			
2001	0.25	0.44	0.73	1.09	1.42	1.64	2.04	2.31	2.50	2.40	2.88	5.43	3.55			
2002	0.19	0.44	0.72	1.08	1.48	1.76	2.13	2.65	3.28	3.81	4.35	4.82				
2003		0.45	0.76	1.13	1.51	1.82	2.26	2.48	2.82	3.95	3.77	5.69	4.52			
2004		0.46	0.77	1.16	1.44	1.91	2.30	2.62	2.91	3.27	4.38	3.31	4.05	6.51		
2005		0.50	0.84	1.21	1.58	1.74	2.21	2.73	3.14	3.15	4.07	3.93	5.13	6.31		8.30
2006		0.47	0.74	1.14	1.43	1.77	2.06	2.40	2.84	3.16	3.80	4.31	4.21	5.13		
2007		0.40	0.72	1.17	1.51	1.76	2.06	2.42	3.03	4.03	4.07	3.88	4.80	4.74	9.54	
2008		0.43	0.75	1.10	1.43	1.78	2.23	2.39	2.86	3.54	3.47	3.52	5.67	6.37		
2009		0.42	0.71	0.99	1.35	1.80	2.06	2.35	2.98	3.73	3.94	4.59	4.10	8.40		
2010		0.48	0.75	0.95	1.25	1.51	1.95	2.33	2.41	2.94	3.57					
2011		0.48	0.74	1.04	1.23	1.48	1.99	1.98	3.31	2.60		3.57				
2012		0.49	0.73	0.96	1.29	1.54	1.77	2.10	2.86	3.33	3.71	3.92				
2013		0.44	0.81	1.11	1.43	1.69	1.65	2.43	2.84	3.33	3.40	3.15				
2014		0.44	0.71	0.96	1.28	1.60	1.98	2.16	2.86	3.41	3.36		5.39	5.03		

Table 12f. Longline sentinel surveys, total numbers at age, effort, catch and catch per unit effort (CPUE).

Year	Total	Effort	Catch	CPUE
1994	2059			
1995	44574	4262	71066	16.68
1996	52218	4798	96426	20.10
1997	34059	3767	65578	17.41
1998	54888	2832	88842	31.37
1999	52041	2203	85046	38.61
2000	83525	3106	136546	43.96
2001	96719	3112	160687	51.64
2002	74958	3540	130858	36.96
2003	54079	2636	105677	40.09
2004	72943	2024	136703	67.55
2005	59130	2057	122924	59.76
2006	77184	1997	142227	71.22
2007	53131	1731	100440	58.03
2008	45535	1927	75463	39.17
2009	37729	1667	55377	33.23
2010	35107	1615	45497	28.18
2011	41167	1435	53710	37.42
2012	36158	1052	50742	48.22
2013	34841	956	51569	53.97
2014	28754	1055	42915	40.68

Table 12g. Gillnet sentinel surveys, numbers at age.

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1995	7	82	585	1765	5407	8729	10614	2653	716	104	122	98	17	5	4	6
1996	3	156	1298	19590	38993	35306	22594	16257	4911	195	42	48	39			
1997	3	138	1901	6299	23046	17150	12442	8878	5145	737	216	29		11		
1998		1504	6450	32715	21488	25843	12707	7773	6904	1820	700	54	116			98
1999		123	1052	6520	22375	14816	19043	5775	2971	1634	669	102	21			
2000	18	105	1541	15221	35346	49826	18546	13028	3723	1349	821	734	130			
2001	0	14	765	4582	10723	13862	20905	7715	3129	665	616	56	20			
2002		29	469	4907	19084	17590	15598	14302	2901	1694	171	260				
2003		44	401	5354	15105	20342	11406	7123	8487	1265	616	44	47			
2004		50	201	2660	18655	27204	22857	8457	3673	3526	261	296	364			
2005		6	520	3976	8701	30211	24737	16737	7043	3082	1712	629	55	4		2
2006		25	475	5912	17674	25550	25152	16236	9631	4922	1863	582	215	38		
2007		10	238	4915	14824	16591	17022	12313	8708	2307	1870	908	320	56	14	
2008		17	403	5490	17821	20599	11586	10219	5222	1615	1332	448	109	35		
2009		11	316	4410	11288	15298	9642	6005	1624	684	117	73	21	33		
2010			509	2170	18577	12664	7622	2848	2063	332	145	74				
2011		8	461	5256	17157	37445	16081	8268	3903	112						
2012			148	4394	19903	25881	22907	10197	2894	368	417					
2013			510	2526	13400	14232	12275	10206	1200	1108	41	35				
2014		101	152	2395	9854	11940	16132	12592	4259	1304	330	67	52			

Table 12h. Gillnet sentinel surveys, numbers at age (%).

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1995	0.00	0.00	0.02	0.06	0.17	0.28	0.34	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996	0.00	0.00	0.01	0.14	0.28	0.25	0.16	0.12	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997	0.00	0.00	0.03	0.08	0.30	0.23	0.16	0.12	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1998	0.00	0.01	0.05	0.28	0.18	0.22	0.11	0.07	0.06	0.02	0.01	0.00	0.00	0.00	0.00	0.00
1999	0.00	0.00	0.01	0.09	0.30	0.20	0.25	0.08	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00
2000	0.00	0.00	0.01	0.11	0.25	0.35	0.13	0.09	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00
2001	0.00	0.00	0.01	0.07	0.17	0.22	0.33	0.12	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00
2002	0.00	0.00	0.01	0.06	0.25	0.23	0.20	0.19	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00
2003	0.00	0.00	0.01	0.08	0.22	0.29	0.16	0.10	0.12	0.02	0.01	0.00	0.00	0.00	0.00	0.00
2004	0.00	0.00	0.00	0.03	0.21	0.31	0.26	0.10	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
2005	0.00	0.00	0.01	0.04	0.09	0.31	0.25	0.17	0.07	0.03	0.02	0.01	0.00	0.00	0.00	0.00
2006	0.00	0.00	0.00	0.05	0.16	0.24	0.23	0.15	0.09	0.05	0.02	0.01	0.00	0.00	0.00	0.00
2007	0.00	0.00	0.00	0.06	0.19	0.21	0.21	0.15	0.11	0.03	0.02	0.01	0.00	0.00	0.00	0.00
2008	0.00	0.00	0.01	0.07	0.24	0.28	0.15	0.14	0.07	0.02	0.02	0.01	0.00	0.00	0.00	0.00
2009	0.00	0.00	0.01	0.09	0.23	0.31	0.19	0.12	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2010	0.00	0.00	0.01	0.05	0.40	0.27	0.16	0.06	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2011	0.00	0.00	0.01	0.06	0.19	0.42	0.18	0.09	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2012	0.00	0.00	0.00	0.05	0.22	0.29	0.26	0.11	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2013	0.00	0.00	0.01	0.03	0.15	0.16	0.14	0.12	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2014	0.00	0.00	0.00	0.03	0.11	0.13	0.18	0.14	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00

Table 12i. Gillnet sentinel surveys, catch rates at age.

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1995	0	3	19	58	178	288	350	88	24	3	4	3	1	0	0	0
1996	0	2	15	223	444	402	258	185	56	2	0	1	0	0	0	0
1997	0	2	24	80	294	219	159	113	66	9	3	0	0	0	0	0
1998	0	14	59	301	198	238	117	72	64	17	6	0	1	0	0	1
1999	0	1	12	75	258	171	220	67	34	19	8	1	0	0	0	0
2000	0	1	12	117	272	383	143	100	29	10	6	6	1	0	0	0
2001	0	0	7	41	96	125	188	69	28	6	6	1	0	0	0	0
2002	0	0	5	48	188	174	154	141	29	17	2	3	0	0	0	0
2003	0	1	11	142	401	540	303	189	225	34	16	1	1	0	0	0
2004	0	1	5	60	419	611	513	190	82	79	6	7	8	0	0	0
2005	0	0	9	73	159	552	452	306	129	56	31	11	1	0	0	0
2006	0	1	11	137	408	590	581	375	222	114	43	13	5	1	0	0
2007	0	0	6	116	350	392	402	291	206	54	44	21	8	1	0	0
2008	0	0	10	132	428	494	278	245	125	39	32	11	3	1	0	0
2009	0	0	8	108	277	376	237	148	40	17	3	2	1	1	0	0
2010	0	0	14	58	499	340	205	76	55	9	4	2	0	0	0	0
2011	0	0	14	162	530	1157	497	255	121	3	0	0	0	0	0	0
2012	0	0	5	139	629	817	723	322	91	12	13	0	0	0	0	0
2013	0	0	17	85	449	476	411	342	40	37	1	1	0	0	0	0
2014	0	3	4	66	271	328	444	346	117	36	9	2	1	0	0	0

Table 12j. Gillnet sentinel surveys, lengths at age (cm).

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1995	27.51	34.28	43.16	51.18	55.16	57.63	59.41	64.21	67.19	80.77	72.77	74.85	88.26	90.24	88.00	86.22
1996	25.60	36.59	43.93	53.05	56.59	58.34	60.83	62.23	62.03	81.50	78.92	85.99	80.67			
1997	32.53	40.49	47.97	53.52	57.24	58.74	61.36	61.68	63.61	63.56	60.91	81.29		88.08		
1998		35.94	41.41	50.58	54.63	58.67	60.81	64.33	65.18	74.42	71.12	78.35	79.00			85.00
1999		36.56	45.02	54.27	57.19	60.55	62.28	63.71	63.62	70.91	74.47	72.86	88.98			
2000	29.71	36.78	46.83	53.79	56.76	60.22	62.19	62.46	66.12	64.86	71.19	64.69	70.00			
2001		35.89	45.19	53.40	58.16	60.40	63.07	65.00	64.44	67.06	67.27	88.23	70.00			
2002		37.76	46.69	52.69	57.08	58.97	60.99	63.52	66.71	68.74	77.04	66.35				
2003		35.35	45.48	54.35	57.88	59.53	62.52	62.40	63.77	68.80	69.02	89.00	77.30			
2004		37.05	42.88	52.19	56.27	59.79	61.98	64.35	66.99	66.77	83.88	69.09	71.96			
2005		34.80	45.29	51.92	56.38	58.71	61.10	63.23	63.55	66.11	71.49	68.38	80.33	85.12		94.00
2006		38.46	46.50	54.47	57.75	60.22	61.81	63.52	65.17	66.40	70.34	72.82	75.49	82.86		
2007		36.17	45.78	56.35	59.41	61.16	62.96	64.46	67.08	73.58	72.97	71.05	78.51	80.01	97.33	
2008		37.15	46.29	54.05	57.63	59.83	63.62	63.15	65.97	69.62	69.34	68.30	85.78	89.69		
2009		36.80	47.22	53.31	56.26	60.18	60.89	62.86	66.67	70.19	73.58	79.40	76.00	96.33		
2010			47.56	54.33	56.72	57.96	62.97	63.69	63.62	69.35	74.46	77.40				
2011		40.00	47.28	53.76	56.09	57.48	59.96	62.05	63.81	77.06						
2012			40.95	56.40	57.05	58.95	60.76	61.84	67.47	78.53	70.67					
2013			49.57	56.62	58.76	59.13	60.80	63.76	67.77	65.78	79.42	79.00				
2014		39.47	46.48	55.57	59.25	60.50	61.51	64.05	67.07	68.74	80.07	76.84	76.45			

Table 12k. Gillnet sentinel surveys, Weights at age (kg).

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1995	0.19	0.37	0.74	1.24	1.56	1.78	1.96	2.54	3.00	5.12	3.82	4.20	6.48	6.92	6.32	6.66
1996	0.15	0.44	0.77	1.35	1.64	1.81	2.06	2.22	2.27	5.04	4.54	5.91	4.75			
1997	0.32	0.62	1.02	1.41	1.72	1.86	2.14	2.18	2.41	2.43	2.17	4.86		6.16		
1998		0.42	0.65	1.16	1.47	1.82	2.07	2.51	2.59	3.78	3.38	4.33	4.32			5.38
1999		0.44	0.81	1.41	1.64	1.96	2.13	2.33	2.29	3.16	3.68	3.39	6.14			
2000	0.22	0.43	0.91	1.39	1.63	1.97	2.19	2.23	2.66	2.58	3.39	2.49	3.06			
2001		0.42	0.82	1.33	1.70	1.90	2.15	2.37	2.31	2.55	2.66	5.58	2.85			
2002		0.49	0.97	1.39	1.78	1.99	2.20	2.54	2.97	3.26	4.65	2.91				
2003		0.41	0.89	1.50	1.83	1.99	2.33	2.35	2.50	3.23	3.21	6.75	4.45			
2004		0.46	0.74	1.33	1.68	2.02	2.28	2.58	2.95	2.91	5.79	3.16	3.65			
2005		0.38	0.86	1.31	1.69	1.93	2.20	2.49	2.57	2.87	3.68	3.19	5.13	6.13		8.30
2006		0.49	0.89	1.44	1.73	1.97	2.15	2.36	2.58	2.77	3.32	3.69	4.03	5.25		
2007		0.41	0.85	1.62	1.90	2.09	2.29	2.48	2.84	3.83	3.73	3.44	4.63	4.76	8.63	
2008		0.45	0.91	1.44	1.76	2.00	2.42	2.37	2.79	3.26	3.34	3.02	6.15	6.99		
2009		0.43	0.94	1.38	1.64	2.02	2.13	2.38	2.84	3.37	3.81	4.77	4.10	8.62		
2010			0.97	1.46	1.66	1.78	2.32	2.45	2.42	3.15	3.86	4.53				
2011		0.55	0.97	1.42	1.61	1.74	1.99	2.25	2.43	4.41						
2012			0.59	1.60	1.65	1.83	2.03	2.14	2.82	4.42	3.19					
2013			1.12	1.67	1.87	1.93	2.09	2.44	3.03	2.83	4.90	4.59				
2014		0.54	0.88	1.55	1.88	2.03	2.14	2.41	2.88	3.03	4.84	4.19	4.28			

Table 12I. Gillnet sentinel surveys, total numbers at age, effort, catch and catch per unit effort (CPUE).

	Total	Effort	Catch	CPUE
1995	30914	3032	57210	18.87
1996	139432	8774	251247	28.64
1997	75995	7844	144425	18.41
1998	118172	10866	255026	23.47
1999	75101	8668	185249	21.37
2000	140388	13012	310878	23.89
2001	63052	11119	153284	13.79
2002	77005	10128	182517	18.02
2003	70234	3767	165454	43.93
2004	88204	4456	207039	46.47
2005	97415	5475	236486	43.19
2006	108275	4331	255338	58.96
2007	80096	4237	192087	45.33
2008	74896	4167	169919	40.78
2009	49522	4069	108880	26.76
2010	47004	3723	96322	25.87
2011	88691	3237	177301	54.78
2012	87110	3166	186909	59.03
2013	55534	2987	120241	40.25
2014	59176	3636	136699	37.60

Table 13. Proportion mature at age.

Age	3	4	5	6	7	8	9	10	11	12	13
1974	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1975	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1976	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1977	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1978	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1979	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1980	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1981	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1982	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1983	0.01	0.06	0.49	0.81	0.93	0.95	0.98	1.00	1.00	1.00	1.00
1984	0.00	0.02	0.29	0.88	0.97	0.99	1.00	1.00	1.00	1.00	1.00
1985	0.00	0.02	0.22	0.80	0.97	0.98	1.00	1.00	1.00	1.00	1.00
1986	0.00	0.06	0.38	0.70	0.90	0.96	1.00	1.00	1.00	1.00	1.00
1987	0.00	0.05	0.24	0.74	0.93	0.98	1.00	1.00	1.00	1.00	1.00
1988	0.00	0.02	0.13	0.58	0.83	0.95	1.00	1.00	1.00	1.00	1.00
1989	0.00	0.04	0.31	0.72	0.92	0.96	1.00	1.00	1.00	1.00	1.00
1990	0.00	0.04	0.18	0.47	0.69	0.85	1.00	1.00	1.00	1.00	1.00
1991	0.00	0.03	0.25	0.73	0.94	0.97	1.00	1.00	1.00	1.00	1.00
1992	0.01	0.10	0.34	0.59	0.86	0.93	1.00	1.00	1.00	1.00	1.00
1993	0.00	0.04	0.54	0.91	0.99	1.00	1.00	1.00	1.00	1.00	1.00
1994	0.02	0.10	0.32	0.70	0.89	0.95	1.00	1.00	1.00	1.00	1.00
1995	0.07	0.49	0.88	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1996	0.13	0.39	0.77	0.92	0.98	0.99	1.00	1.00	1.00	1.00	1.00
1997	0.24	0.56	0.82	0.92	0.96	0.98	0.98	0.99	1.00	1.00	1.00
1998	0.04	0.26	0.75	0.93	0.99	1.00	1.00	1.00	1.00	1.00	1.00
1999	0.03	0.41	0.77	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2000	0.02	0.20	0.67	0.89	0.99	1.00	1.00	1.00	1.00	1.00	1.00
2001	0.03	0.23	0.70	0.94	0.98	1.00	1.00	1.00	1.00	1.00	1.00
2002	0.04	0.20	0.60	0.83	0.96	0.98	1.00	1.00	1.00	1.00	0.99
2003	0.07	0.30	0.66	0.89	0.96	0.99	0.99	1.00	1.00	1.00	1.00
2004	0.05	0.27	0.75	0.92	0.98	1.00	1.00	1.00	1.00	1.00	1.00
2005	0.03	0.20	0.63	0.96	0.99	1.00	1.00	1.00	1.00	1.00	1.00
2006	0.04	0.21	0.64	0.87	0.98	0.99	1.00	1.00	1.00	1.00	1.00
2007	0.03	0.17	0.64	0.89	0.97	0.98	1.00	1.00	1.00	1.00	1.00
2008	0.02	0.14	0.49	0.88	0.97	0.99	1.00	1.00	1.00	1.00	1.00
2009	0.10	0.40	0.78	0.95	0.99	1.00	1.00	1.00	1.00	1.00	1.00
2010	0.02	0.15	0.41	0.86	0.95	0.99	1.00	1.00	1.00	1.00	1.00
2011	0.19	0.43	0.72	0.86	0.94	0.98	0.99	0.99	1.00	1.00	1.00
2012	0.05	0.18	0.60	0.89	0.96	0.99	1.00	1.00	1.00	1.00	1.00
2013	0.03	0.19	0.46	0.88	0.93	0.98	1.00	1.00	1.00	1.00	1.00
2014	0.04	0.25	0.77	0.94	0.99	1.00	1.00	1.00	1.00	1.00	1.00

Table 14. Fecundity at age ('000).

Age	3	4	5	6	7	8	9	10	11	12	13
1974	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1975	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1976	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1977	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1978	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1979	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1980	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1981	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1982	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1983	54	172	349	582	783	954	1 178	1 411	1 965	2 751	2 943
1984	75	184	380	673	816	1 007	1 211	1 523	2 360	3 775	2 908
1985	51	178	331	573	826	917	1 146	1 198	1 952	2 260	2 754
1986	36	153	337	500	706	937	1 176	1 512	1 584	2 219	3 166
1987	57	155	271	485	692	968	1 588	1 671	1 866	2 523	1 947
1988	50	102	225	460	651	933	1 192	1 386	1 790	2 180	1 800
1989	49	129	298	489	707	857	1 122	1 665	1 992	2 643	2 234
1990	47	141	270	421	551	719	996	1 204	1 738	2 454	4 152
1991	42	131	239	393	573	657	765	1 164	1 260	6 716	1 380
1992	40	126	227	322	500	614	815	1 036	1 424	1 510	1 970
1993	43	111	226	338	479	615	853	723	1 137	1 053	1 598
1994	53	114	191	316	449	547	959	927	1 068	1 886	1 828
1995	68	159	286	475	685	884	1 294	1 905	1 596	3 461	2 683
1996	74	151	293	452	705	874	1 103	1 493	1 415	1 519	2 683
1997	82	191	359	523	668	848	952	1 180	1 420	1 564	2 683
1998	93	202	368	541	852	1 085	1 197	1 610	2 447	2 652	2 683
1999	71	236	382	806	1 313	1 363	1 888	1 261	1 774	4 917	2 683
2000	99	218	388	539	862	1 151	1 143	1 159	1 879	1 334	2 440
2001	77	188	367	615	821	1 111	1 470	1 399	1 520	1 283	5 554
2002	74	176	347	501	829	927	1 443	1 887	1 555	1 380	1 097
2003	81	191	345	552	757	1 188	1 031	1 791	2 655	2 212	1 644
2004	92	192	379	550	825	1 176	1 457	2 055	3 087	3 212	2 885
2005	107	224	399	754	1 011	1 388	1 429	1 862	2 153	2 664	1 467
2006	93	188	340	494	793	1 019	1 233	2 319	2 174	2 642	2 472
2007	90	191	378	565	779	907	1 266	1 386	2 090	2 380	2 348
2008	103	207	360	615	830	987	1 396	1 391	2 206	2 197	2 206
2009	105	208	357	550	914	1 278	1 233	1 217	1 572	1 793	4 083
2010	99	234	350	620	791	1 093	1 408	1 376	1 662	2 633	2 683
2011	87	183	348	500	760	1 013	1 385	1 532	2 202	1 638	5 403
2012	169	272	450	582	740	957	1 214	1 660	2 518	6 000	2 683
2013	105	264	373	561	625	786	1 385	2 034	2 614	4 237	2 683
2014	101	181	341	473	639	769	965	1 704	2 033	2 683	4 366

Table 15. Parameter estimates based on NFT ADAPT sequential population analysis.

	age	Parameter	Estimation	Standard error	Bias	Corrected
Effectifs	2	N[2015 2]	50444.13	29546.00	35520	14924.00
	3	N[2015 3]	99955.83	41495.70	17325	82631.00
	4	N[2015 4]	28621.50	8991.83	1133	27488.00
	5	N[2015 5]	5399.23	1357.16	140	5259.00
	6	N[2015 6]	4266.12	922.04	39	4227.00
	7	N[2015 7]	1619.55	321.65	56	1564.00
	8	N[2015 8]	1460.06	273.30	25	1435.00
	9	N[2015 9]	1392.65	254.70	11	1382.00
	10	N[2015 10]	565.08	112.38	8	557.00
	11	N[2015 11]	357.90	60.90	5	353.00
	12	N[2015 12]	94.14	17.99	2	92.00
	13	N[2015 13]	21.00	n/a	n/a	n/a
Mature biomass (t)		[2014]	18044	1313	285	17759
Natural mortality	[3-13]	M[2003-06]	0.31	n/a	n/a	n/a
		M[2007-10]	0.51	n/a	n/a	n/a
		M[2011-14]	0.50	n/a	n/a	n/a
DFO survey	1	q ID#[1]	0.0000702	0.0000158	1.62E-06	0.0000686
	2	q ID#[2]	0.0003121	0.0000410	3.60E-06	0.0003085
	3	q ID#[3]	0.0006308	0.0000827	5.08E-06	0.0006257
	4	q ID#[4]	0.0008227	0.0000858	4.50E-06	0.0008182
	5	q ID#[5]	0.0007070	0.0000554	1.64E-06	0.0007053
	6	q ID#[6]	0.0007057	0.0000705	4.46E-06	0.0007013
	7	q ID#[7]	0.0006131	0.0000597	1.27E-06	0.0006118
	8	q ID#[8]	0.0005937	0.0000542	1.35E-06	0.0005924
	9	q ID#[9]	0.0005706	0.0000643	4.43E-06	0.0005661
	10	q ID#[10]	0.0005922	0.0000875	7.02E-06	0.0005851
	11	q ID#[11]	0.0006223	0.0001088	1.06E-05	0.0006117
Sentinel mobile over 20 fathoms (1995-2002)	1	q ID#[12]	0.0000103	0.0000062	2.00E-06	0.000008
	2	q ID#[13]	0.0001483	0.0000392	5.18E-06	0.000143
	3	q ID#[14]	0.0005967	0.0001077	9.17E-06	0.000588
	4	q ID#[15]	0.0010572	0.0001271	7.35E-06	0.001050
	5	q ID#[16]	0.0009465	0.0000820	4.88E-06	0.000942
	6	q ID#[17]	0.0009043	0.0000899	6.35E-06	0.000898
	7	q ID#[18]	0.0008762	0.0000767	6.99E-06	0.000869
	8	q ID#[19]	0.0008635	0.0000639	3.35E-07	0.000863
	9	q ID#[20]	0.0009824	0.0001344	3.43E-06	0.000979
	10	q ID#[21]	0.0009256	0.0002149	1.59E-05	0.000910
	11	q ID#[22]	0.0007799	0.0001811	1.36E-05	0.000766

	age	Parameter	Estimation	Standard error	Bias	Corrected
Sentinel mobile over 10 fathoms (2003+)	1	q ID#[23]	0.0000032	0.0000016	4.00E-07	0.000003
	2	q ID#[24]	0.0000651	0.0000099	4.29E-07	0.000065
	3	q ID#[25]	0.0002901	0.0000399	3.11E-06	0.000287
	4	q ID#[26]	0.0006996	0.0001101	4.75E-06	0.000695
	5	q ID#[27]	0.0007487	0.0000834	4.51E-06	0.000744
	6	q ID#[28]	0.0007835	0.0001417	6.95E-06	0.000777
	7	q ID#[29]	0.0007728	0.0000932	3.69E-06	0.000769
	8	q ID#[30]	0.0008503	0.0001513	1.66E-05	0.000834
	9	q ID#[31]	0.0010043	0.0001946	1.48E-05	0.000990
	10	q ID#[32]	0.0009886	0.0002025	1.65E-05	0.000972
	11	q ID#[33]	0.0013611	0.0004140	6.88E-05	0.001292
Sentinel longlines	3	q ID#[34]	0.0019496	0.0004250	3.61E-05	0.0019
	4	q ID#[35]	0.0242874	0.0028652	1.81E-04	0.0241
	5	q ID#[36]	0.0721522	0.0068180	4.37E-04	0.0717
	6	q ID#[37]	0.1408750	0.0115382	4.02E-05	0.1408
	7	q ID#[38]	0.2101820	0.0137826	2.45E-04	0.2099
	8	q ID#[39]	0.2456490	0.0181249	5.01E-04	0.2451
	9	q ID#[40]	0.3159150	0.0270923	-9.66E-04	0.3169
	10	q ID#[41]	0.3161110	0.0331056	5.49E-04	0.3156
	11	q ID#[42]	0.3225360	0.0592850	3.71E-03	0.3188
	12	q ID#[43]	0.3159790	0.1034880	1.84E-02	0.2976
	13	q ID#[44]	0.3460670	0.1568760	3.74E-02	0.3087
Sentinel gillnets	4	q ID#[45]	0.0012164	0.0002061	2.12E-05	0.0012
	5	q ID#[46]	0.0167622	0.0018675	6.59E-05	0.0167
	6	q ID#[47]	0.0828613	0.0087854	-3.28E-04	0.0832
	7	q ID#[48]	0.1684870	0.0188018	4.02E-04	0.1681
	8	q ID#[49]	0.2418840	0.0252072	-3.02E-05	0.2419
	9	q ID#[50]	0.3111610	0.0398841	2.61E-03	0.3086
	10	q ID#[51]	0.3284160	0.0485548	3.64E-03	0.3248
	11	q ID#[52]	0.2452270	0.0489801	4.76E-03	0.2405
	12	q ID#[53]	0.2515880	0.0852792	1.38E-02	0.2378
	13	q ID#[54]	0.2436960	0.1424790	4.70E-02	0.1967

Table 16. Population numbers at age ('000).

Age	1	2	3	4	5	6	7	8	9	10	11	12	13	3+
1974	173134	166963	106305	57417	37143	48645	18187	19159	9023	4658	1477	705	305	303024
1975	238268	141736	136684	86366	43338	21779	27707	10130	9719	4881	2460	838	422	344324
1976	261251	195058	116032	111876	66818	28546	13255	16230	5664	5482	2456	1350	403	368112
1977	196609	213873	159684	94803	86894	43426	17686	7046	8136	2853	2202	1122	751	424603
1978	307339	160953	175087	130725	75206	62018	24106	7384	3415	3732	1353	1003	566	484595
1979	199297	251602	131764	143294	104610	51851	34961	11418	4104	1842	1925	626	427	486822
1980	198815	163154	205974	107816	114246	73039	30886	17343	5036	2079	863	1088	245	558615
1981	250665	162760	133566	168091	85212	77763	41665	14879	7880	2750	1268	447	600	534121
1982	187909	205206	133243	109069	131583	61653	45651	21587	7939	4517	1410	774	212	517638
1983	246613	153832	167992	108883	86381	90813	39012	25022	9914	3485	1815	602	503	534422
1984	186955	201889	125934	136781	84723	56992	57754	22772	15092	5371	1812	757	304	508292
1985	142487	153050	165277	103064	109326	62392	34533	29142	12014	7263	2522	751	258	526542
1986	177659	116647	125295	135159	82108	75179	38656	18685	15058	6981	3868	1322	435	502746
1987	149983	119076	78183	83813	88637	48129	37799	16420	7703	5169	2852	1206	518	370429
1988	139571	100527	79811	52395	55211	52590	22370	15837	5282	2273	1993	752	353	288867
1989	60724	93548	67378	53404	34087	32122	26031	10116	6498	2326	998	679	283	233922
1990	32833	40701	62701	44864	34269	18761	14951	10588	3517	2206	699	289	157	193002
1991	22318	22007	27280	41735	27573	16792	7839	5683	3920	1039	752	251	104	132968
1992	31566	14959	14750	18198	25540	12915	5769	2597	1758	1052	311	165	77	83132
1993	19333	21157	10026	9636	8758	9815	3841	1194	447	297	177	45	29	44265
1994	34834	12958	14181	6583	4889	2847	1901	380	119	38	34	19	13	31004
1995	19769	23348	8685	9505	4412	3243	1855	1202	217	74	20	21	11	29245
1996	14297	13251	15649	5820	6363	2938	2132	1211	779	132	45	12	14	35095
1997	13839	9583	8881	10488	3883	4216	1883	1356	766	489	77	29	8	32076
1998	13095	11443	7924	7328	8405	2861	2795	1128	656	435	182	36	15	31765
1999	22516	10828	9462	6552	6032	6633	2050	1895	732	420	248	114	14	34152
2000	19428	18618	8953	7824	5377	4807	4622	1285	869	269	187	83	46	34322
2001	19815	16064	15395	7403	6426	4084	3364	2677	725	334	81	110	56	40655
2002	26340	16384	13283	12730	5976	5044	2800	2201	1299	300	108	22	64	43827
2003	25472	19317	12016	9742	9283	4142	2958	1421	922	403	80	41	10	41018
2004	35849	18680	14167	8812	7138	6791	2994	2118	1006	664	282	50	29	44051
2005	68440	26291	13700	10390	6460	5152	4749	1867	1270	541	402	150	31	44712
2006	65302	50192	19281	10047	7610	4669	3560	2939	1003	664	273	174	64	50284
2007	93969	47890	36810	14140	7343	5396	2967	2156	1460	458	357	103	78	71268
2008	54708	56422	28755	22102	8430	4221	2897	1481	815	498	107	121	32	69459
2009	34759	32849	33878	17266	13141	4859	2122	1265	578	161	160	0	48	73478
2010	52866	20871	19723	20341	10279	7438	2439	948	532	179	32	58	0	61969
2011	40012	31742	12532	11843	12148	5983	4070	1158	358	175	54	1	19	48341
2012	128311	24266	19251	7599	7158	7232	3433	2240	600	171	81	22	0	47787
2013	271762	77817	14717	11675	4606	4319	4302	1925	1217	314	77	38	5	43195
2014	83177	164816	47194	8925	7073	2766	2528	2476	1067	665	172	39	22	72927
2015	103791	50444	99956	28621	5399	4266	1620	1460	1393	565	358	94	21	143753

Table 17. Mature population at age ('000).

Age	2	3	4	5	6	7	8	9	10	11	12	13	3+
1974	0	1063	3445	18200	39402	16914	18201	8843	4658	1477	705	305	113213
1975	0	1367	5182	21236	17641	25768	9624	9525	4881	2460	838	422	98942
1976	0	1160	6713	32741	23122	12327	15419	5551	5482	2456	1350	403	106723
1977	0	1597	5688	42578	35175	16448	6694	7973	2853	2202	1122	751	123081
1978	0	1751	7844	36851	50235	22419	7015	3347	3732	1353	1003	566	136114
1979	0	1318	8598	51259	41999	32514	10847	4022	1842	1925	626	427	155376
1980	0	2060	6469	55981	59162	28724	16476	4935	2079	863	1088	245	178081
1981	0	1336	10085	41754	62988	38748	14135	7722	2750	1268	447	600	181834
1982	0	1332	6544	64476	49939	42455	20508	7780	4517	1410	774	212	199947
1983	0	1680	6533	42327	73559	36281	23771	9716	3485	1815	602	503	200271
1984	0	0	2736	28806	51863	56021	22544	15092	5371	1812	757	304	185306
1985	0	0	2061	24052	49914	33497	28559	11894	7263	2522	751	258	160771
1986	0	0	8110	31201	52625	34790	17938	14907	6981	3868	1322	435	172177
1987	0	0	4191	21273	35615	35153	16092	7703	5169	2852	1206	518	129772
1988	0	0	1048	7177	30502	18567	15045	5176	2250	1993	752	353	82864
1989	0	0	2136	10567	23128	23949	9711	6433	2326	998	679	283	80210
1990	0	0	1795	6168	8818	10316	9000	3376	2162	699	289	157	42780
1991	0	0	1252	6893	12258	7369	5513	3881	1039	752	251	104	39311
1992	0	148	1820	8684	7620	4961	2415	1705	1041	311	165	77	28947
1993	0	0	385	4729	8932	3803	1194	447	297	177	45	29	20038
1994	0	284	658	1564	1993	1692	361	118	38	34	19	13	6774
1995	467	608	4657	3883	3178	1855	1202	217	74	20	21	11	15726
1996	530	2034	2270	4900	2703	2089	1199	779	132	45	12	14	16177
1997	1246	2131	5873	3184	3879	1808	1329	751	484	77	29	8	19553
1998	0	317	1905	6304	2661	2767	1128	656	435	182	36	15	16406
1999	108	284	2686	4645	6500	2050	1895	732	420	248	114	14	19588
2000	0	179	1565	3603	4278	4576	1285	869	269	187	83	46	16939
2001	161	462	1703	4498	3839	3297	2677	725	334	81	110	56	17781
2002	164	531	2546	3586	4187	2688	2157	1299	300	108	22	63	17487
2003	386	841	2923	6127	3686	2840	1407	913	403	80	41	10	19270
2004	187	708	2379	5354	6248	2934	2118	1006	664	282	50	29	21772
2005	0	411	2078	4070	4946	4702	1867	1270	541	402	150	31	20467
2006	0	771	2110	4870	4062	3489	2910	1003	664	273	174	64	20390
2007	0	1104	2404	4700	4802	2878	2113	1460	458	357	103	78	20457
2008	0	575	3094	4131	3714	2810	1466	815	498	107	121	32	17364
2009	985	3388	6906	10250	4616	2101	1265	578	161	160	0	48	29473
2010	0	394	3051	4214	6397	2317	939	532	179	32	58	0	18113
2011	2857	2381	5092	8747	5145	3826	1135	354	173	54	1	19	26928
2012	0	963	1368	4295	6436	3296	2218	600	171	81	22	0	19449
2013	0	442	2218	2119	3801	4001	1887	1217	314	77	38	5	16118
2014	0	1888	2231	5446	2600	2503	2476	1067	665	172	39	22	19109
2015	0	3998	5915	3293	3854	1555	1445	1393	565	358	94	21	22492

Table 18. Biomass (t) at age.

Age	1	2	3	4	5	6	7	8	9	10	11	12	13	3+
1974	4675	8849	17540	21876	27820	59200	30791	43606	30055	21501	8810	3147	1837	266183
1975	6433	7512	22553	32906	32460	26506	46908	23057	32374	22529	14681	3741	2538	260253
1976	7054	10338	19145	42625	50047	34740	22441	36939	18867	25305	14652	6028	2427	273216
1977	5308	11335	26348	36120	65084	52850	29942	16037	27100	13170	13139	5009	4520	289319
1978	8298	8531	28889	49806	56329	75476	40811	16806	11377	17226	8074	4477	3404	312675
1979	10363	11071	16998	51586	80864	64191	60378	26569	13798	6536	6052	3025	2021	332018
1980	5368	8810	33780	36550	83514	84214	52383	40756	15472	10416	4130	5752	1179	368146
1981	2005	9603	26847	74800	63227	97981	68997	31989	28045	14543	12644	1465	5111	425649
1982	5074	16211	24250	45264	100530	73121	73773	39332	17125	12160	4834	3753	1223	395365
1983	17510	11384	36454	50413	81457	119238	64214	44538	21335	12257	7387	4230	4039	445562
1984	5048	17766	19268	37341	45496	54712	87382	40239	32039	12256	5153	2999	1493	338378
1985	3847	11479	29089	52356	88773	80236	58292	55894	26382	16537	8506	2666	1125	419856
1986	4797	3849	12529	48252	63551	84126	59723	39238	39391	23944	14911	6770	3057	395492
1987	1200	5835	11024	30759	58678	52893	57076	34138	22000	16609	10691	5731	2192	301791
1988	3350	6333	11732	15142	29151	56219	32236	29124	12265	6129	6562	3099	1667	203326
1989	425	6642	13071	21308	28087	38868	41546	18027	14303	6563	3298	2605	1002	188678
1990	887	2646	9844	16645	23612	18799	18689	15904	6914	4770	2098	1271	937	119483
1991	335	1232	4119	15233	17481	16104	10136	8104	6146	2426	1659	1035	242	82685
1992	852	883	2109	6806	16167	10874	6802	3599	3019	2067	835	445	281	53004
1993	522	1185	1404	3257	5255	8215	4291	1565	746	462	386	95	99	25775
1994	941	505	2326	1903	2337	2184	1989	468	207	73	81	103	48	11719
1995	435	2265	1668	4781	3004	3279	1852	1735	302	207	19	75	39	16961
1996	558	1060	3255	2346	4632	2741	2631	1771	1379	280	133	29	48	19245
1997	291	862	2025	4709	2928	4297	2299	2007	1268	1017	192	95	29	20866
1998	484	858	1767	3327	6808	3130	3488	1708	1104	705	470	104	54	22665
1999	1126	1104	2063	3184	4578	7595	2940	2895	1367	828	558	373	50	26431
2000	758	1787	2229	3474	4194	4975	6503	2297	1495	607	515	220	172	26681
2001	238	1414	2709	3472	4659	4272	4380	4384	1487	645	281	404	161	26854
2002	606	885	2524	4583	4512	5347	3698	3678	2506	812	353	91	237	28341
2003	1095	1449	2151	4033	6739	4532	4290	2301	1775	869	242	167	36	27135
2004	860	1513	2947	3578	5575	7130	4137	3696	1918	1424	681	172	99	31357
2005	821	1709	2589	4561	4819	5538	6326	3103	2403	1228	1004	424	133	32128
2006	2286	2861	3586	4461	5571	4987	4774	4937	1861	1195	697	441	210	32720
2007	3101	3879	6920	5670	5456	5606	4027	3558	3162	992	922	368	289	36970
2008	1094	4570	5406	8642	5387	4226	3876	2391	1645	1144	225	526	160	33628
2009	1286	2365	6674	6544	8673	4387	2493	2023	1071	364	414	1	173	32817
2010	1533	1711	4024	8320	6630	6917	2800	1411	1038	471	74	195	0	31880
2011	880	2571	2155	4796	8212	5690	4538	1581	687	384	186	3	59	28291
2012	2310	1650	3946	2538	4574	6400	4062	3100	1100	396	195	77	0	26388
2013	6794	5525	2649	4775	2727	3839	4530	2527	1961	955	212	121	16	24312
2014	1996	11702	9911	3517	5093	2652	2998	3657	1915	1341	519	127	79	31809
2015	2283	3531	19791	10848	3509	3886	1848	2031	2433	1388	975	310	75	47094

Table 19. Mature biomass (t) at age.

Age	1	2	3	4	5	6	7	8	9	10	11	12	13	3+
1974	0	0	175	1313	13632	47952	28635	41425	29454	21501	8810	3147	1837	197881
1975	0	0	226	1974	15906	21470	43624	21904	31727	22529	14681	3741	2538	180320
1976	0	0	191	2557	24523	28139	20870	35092	18490	25305	14652	6028	2427	178274
1977	0	0	263	2167	31891	42808	27846	15235	26558	13170	13139	5009	4520	182606
1978	0	0	289	2988	27601	61136	37954	15965	11149	17226	8074	4477	3404	190263
1979	0	0	170	3095	39623	51995	56152	25241	13522	6536	6052	3025	2021	207432
1980	0	0	338	2193	40922	68213	48716	38718	15163	10416	4130	5752	1179	235740
1981	0	0	268	4488	30981	79365	64167	30390	27484	14543	12644	1465	5111	270906
1982	0	0	243	2716	49260	59228	68608	37365	16782	12160	4834	3753	1223	256172
1983	0	0	365	3025	39914	96582	59719	42311	20908	12257	7387	4230	4039	290737
1984	0	0	0	747	15469	49788	84760	39837	32039	12256	5153	2999	1493	244541
1985	0	0	0	1047	19530	64189	56543	54776	26118	16537	8506	2666	1125	251037
1986	0	0	0	2895	24150	58888	53751	37668	38997	23944	14911	6770	3057	265031
1987	0	0	0	1538	14083	39141	53081	33455	22000	16609	10691	5731	2192	198521
1988	0	0	0	303	3790	32607	26756	27667	12020	6068	6562	3099	1667	120539
1989	0	0	0	852	8707	27985	38222	17306	14160	6563	3298	2605	1002	120700
1990	0	0	0	666	4250	8835	12895	13518	6637	4674	2098	1271	937	55781
1991	0	0	0	457	4370	11756	9528	7861	6085	2426	1659	1035	242	45419
1992	0	0	21	681	5497	6416	5850	3347	2928	2046	835	445	281	28347
1993	0	0	0	130	2838	7476	4248	1565	746	462	386	95	99	18045
1994	0	0	47	190	748	1529	1770	445	205	72	81	103	48	5238
1995	0	45	117	2343	2644	3213	1852	1735	302	207	19	75	39	12591
1996	0	42	423	915	3567	2522	2578	1753	1379	280	133	29	48	13669
1997	0	112	486	2637	2401	3953	2207	1967	1243	1007	192	95	29	16329
1998	0	0	71	865	5106	2911	3454	1708	1104	705	470	104	54	16552
1999	0	11	62	1306	3525	7443	2940	2895	1367	828	558	373	50	21358
2000	0	0	45	695	2810	4428	6438	2297	1495	607	515	220	172	19722
2001	0	14	81	799	3261	4015	4293	4384	1487	645	281	404	161	19825
2002	0	9	101	917	2707	4438	3550	3604	2506	812	353	91	235	19323
2003	0	29	151	1210	4448	4033	4118	2278	1758	869	242	167	36	19339
2004	0	15	147	966	4181	6560	4055	3696	1918	1424	681	172	99	23914
2005	0	0	78	912	3036	5316	6262	3103	2403	1228	1004	424	133	23899
2006	0	0	143	937	3565	4338	4679	4888	1861	1195	697	441	210	22954
2007	0	0	208	964	3492	4989	3906	3487	3162	992	922	368	289	22779
2008	0	0	108	1210	2639	3719	3760	2367	1645	1144	225	526	160	17503
2009	0	71	667	2617	6765	4168	2468	2023	1071	364	414	1	173	20802
2010	0	0	80	1248	2718	5949	2660	1397	1038	471	74	195	0	15830
2011	0	231	410	2062	5913	4893	4266	1550	680	380	186	3	59	20633
2012	0	0	197	457	2744	5696	3899	3069	1100	396	195	77	0	17830
2013	0	0	79	907	1254	3379	4213	2476	1961	955	212	121	16	15573
2014	0	0	396	879	3921	2493	2968	3657	1915	1341	519	127	79	18295
2015	0	0	792	2242	2141	3511	1774	2011	2434	1388	976	310	75	17652

Table 20. Population's egg production (billions) at age.

Age	3	4	5	6	7	8	9	10	11	12	13	3+
1974	28	315	3041	11573	6434	7849	5951	2212	1272	1777	406	40857
1975	35	473	3548	5181	9802	4150	6410	2317	2119	2112	562	36711
1976	30	613	5471	6791	4689	6649	3736	2603	2115	3402	537	36636
1977	41	519	7114	10331	6257	2887	5366	1355	1896	2828	1000	39595
1978	45	716	6158	14755	8528	3025	2252	1772	1165	2528	754	41698
1979	34	785	8565	12336	12368	4678	2707	875	1658	1578	569	46151
1980	53	591	9354	17377	10926	7105	3322	987	743	2742	326	53526
1981	35	921	6977	18500	14739	6096	5198	1306	1092	1127	799	56789
1982	35	598	10773	14668	16149	8844	5236	2145	1214	1951	282	61895
1983	44	597	7072	21605	13801	10251	6539	1655	1563	1517	670	65314
1984	5	262	4044	12719	20992	11247	12806	3678	1993	2225	584	70553
1985	2	197	3776	13275	12244	13059	8617	3992	1953	1403	242	58760
1986	11	469	3097	12527	11885	7862	10699	3189	3063	2402	436	55641
1987	6	252	3414	9163	12855	8480	6599	3411	3349	2496	938	50964
1988	10	116	964	4758	5379	5994	3522	1180	1598	1355	473	25350
1989	8	140	960	3829	9074	3995	4301	1649	1065	632	362	26014
1990	8	67	428	1068	2485	3995	1493	1639	288	275	304	12051
1991	1	69	823	1884	1876	2088	1882	523	635	237	34	10051
1992	4	73	737	1399	1178	673	633	611	200	120	47	5675
1993	0	28	460	1464	920	235	70	146	110	23	24	3480
1994	3	23	144	306	424	149	48	20	19	22	10	1167
1995	33	376	540	909	528	665	74	50	23	31	20	3248
1996	84	257	928	844	848	538	383	84	33	10	13	4021
1997	121	596	558	1156	553	462	340	212	53	22	7	4079
1998	13	200	998	917	1110	890	498	160	198	47	23	5052
1999	24	281	1283	2307	1234	1266	628	636	320	176	25	8179
2000	19	296	1012	1205	1309	706	336	165	201	74	40	5361
2001	37	288	933	1004	1265	1157	341	78	70	88	48	5310
2002	42	343	812	1419	744	745	1341	309	87	20	62	5925
2003	43	295	1037	1119	1265	918	616	108	127	51	15	5593
2004	31	202	807	1729	1156	1220	888	581	355	44	68	7081
2005	19	300	1100	1659	1784	1233	810	503	448	181	49	8088
2006	27	208	705	1207	1303	2083	704	379	165	127	55	6964
2007	64	243	540	1225	789	1209	1045	253	267	91	80	5806
2008	35	382	852	1083	1128	652	575	405	130	171	52	5464
2009	269	1121	1997	1447	731	454	185	99	112	0	41	6457
2010	29	308	1328	1949	1236	295	353	141	29	59	0	5727
2011	141	637	1783	1476	1709	718	195	116	42	1	19	6837
2012	97	310	1052	2432	1885	1223	438	123	67	21	0	7648
2013	19	151	439	964	1427	736	976	230	67	39	6	5053
2014	70	188	537	525	614	1814	808	402	126	34	22	5138

Table 21. Fishing mortality at age, natural mortality (M), fishing mortality at ages 7 to 9 (F 7-9) and exploitation rate (Expl. %).

Age	1	2	3	4	5	6	7	8	9	10	11	12	13	M	F 7-9	Expl.
1974	0,00	0,00	0,01	0,08	0,33	0,36	0,39	0,48	0,41	0,44	0,37	0,31	0,35	0,20	0,43	0,32
1975	0,00	0,00	0,00	0,06	0,22	0,30	0,33	0,38	0,37	0,49	0,40	0,53	0,43	0,20	0,36	0,28
1976	0,00	0,00	0,00	0,05	0,23	0,28	0,43	0,49	0,49	0,71	0,58	0,39	0,51	0,20	0,47	0,34
1977	0,00	0,00	0,00	0,03	0,14	0,39	0,67	0,52	0,58	0,55	0,59	0,49	0,55	0,20	0,59	0,41
1978	0,00	0,00	0,00	0,02	0,17	0,37	0,55	0,39	0,42	0,46	0,57	0,65	0,60	0,20	0,45	0,33
1979	0,00	0,00	0,00	0,03	0,16	0,32	0,50	0,62	0,48	0,56	0,37	0,74	0,45	0,20	0,53	0,38
1980	0,00	0,00	0,00	0,04	0,18	0,36	0,53	0,59	0,41	0,29	0,46	0,40	0,42	0,20	0,51	0,36
1981	0,00	0,00	0,00	0,04	0,12	0,33	0,46	0,43	0,36	0,47	0,29	0,55	0,35	0,20	0,41	0,31
1982	0,00	0,00	0,00	0,03	0,17	0,26	0,40	0,58	0,62	0,71	0,65	0,23	0,48	0,20	0,53	0,38
1983	0,00	0,00	0,01	0,05	0,22	0,25	0,34	0,31	0,41	0,45	0,68	0,48	0,62	0,20	0,35	0,27
1984	0,00	0,00	0,00	0,02	0,11	0,30	0,48	0,44	0,53	0,56	0,68	0,88	0,74	0,20	0,48	0,35
1985	0,00	0,00	0,00	0,03	0,17	0,28	0,41	0,46	0,34	0,43	0,45	0,35	0,42	0,20	0,41	0,30
1986	0,00	0,00	0,00	0,02	0,13	0,29	0,46	0,49	0,67	0,50	0,77	0,54	0,70	0,40	0,54	0,35
1987	0,00	0,00	0,00	0,02	0,12	0,37	0,47	0,73	0,82	0,55	0,93	0,83	0,90	0,40	0,67	0,41
1988	0,00	0,00	0,00	0,03	0,14	0,30	0,39	0,49	0,42	0,42	0,68	0,58	0,65	0,40	0,43	0,29
1989	0,00	0,00	0,01	0,04	0,20	0,36	0,50	0,66	0,68	0,80	0,84	1,07	0,93	0,40	0,61	0,38
1990	0,00	0,00	0,01	0,09	0,31	0,47	0,57	0,59	0,82	0,68	0,62	0,62	0,62	0,40	0,66	0,41
1991	0,00	0,00	0,00	0,09	0,36	0,67	0,70	0,77	0,92	0,81	1,12	0,78	1,02	0,40	0,80	0,47
1992	0,00	0,00	0,03	0,33	0,56	0,81	1,18	1,36	1,38	1,38	1,52	1,33	1,45	0,40	1,30	0,63
1993	0,00	0,00	0,02	0,28	0,72	1,24	1,91	1,90	2,07	1,77	1,85	0,85	1,55	0,40	1,96	0,75
1994	0,00	0,00	0,00	0,00	0,01	0,03	0,06	0,16	0,08	0,24	0,07	0,12	0,09	0,40	0,10	0,08
1995	0,00	0,00	0,00	0,00	0,01	0,02	0,03	0,03	0,10	0,09	0,11	0,04	0,07	0,40	0,05	0,04
1996	0,00	0,00	0,00	0,00	0,01	0,04	0,05	0,06	0,07	0,13	0,05	0,06	0,05	0,40	0,06	0,05
1997	0,00	0,00	0,00	0,03	0,12	0,22	0,32	0,54	0,38	0,80	0,58	0,45	0,54	0,19	0,41	0,31
1998	0,00	0,00	0,00	0,00	0,05	0,14	0,20	0,24	0,26	0,37	0,28	0,75	0,34	0,19	0,23	0,19
1999	0,00	0,00	0,00	0,01	0,04	0,17	0,28	0,59	0,81	0,62	0,90	0,72	0,84	0,19	0,56	0,39
2000	0,00	0,00	0,00	0,01	0,09	0,17	0,36	0,38	0,77	1,01	0,34	0,21	0,30	0,19	0,50	0,36
2001	0,00	0,00	0,00	0,02	0,05	0,19	0,23	0,53	0,69	0,94	1,12	0,36	0,61	0,19	0,49	0,35
2002	0,00	0,00	0,00	0,01	0,06	0,22	0,37	0,56	0,86	1,01	0,67	0,46	0,63	0,31	0,60	0,39
2003	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,04	0,02	0,05	0,17	0,03	0,12	0,31	0,03	0,02
2004	0,00	0,00	0,00	0,00	0,02	0,05	0,16	0,20	0,31	0,19	0,32	0,17	0,30	0,31	0,22	0,17
2005	0,00	0,00	0,00	0,00	0,01	0,06	0,17	0,31	0,34	0,37	0,53	0,54	0,53	0,31	0,27	0,21

Age	1	2	3	4	5	6	7	8	9	10	11	12	13	M	F 7-9	Expl.
2006	0,00	0,00	0,00	0,00	0,03	0,14	0,19	0,39	0,47	0,31	0,66	0,49	0,59	0,31	0,35	0,26
2007	0,00	0,00	0,00	0,01	0,04	0,11	0,18	0,46	0,57	0,94	0,57	0,66	0,59	0,51	0,40	0,26
2008	0,00	0,00	0,00	0,01	0,04	0,18	0,32	0,43	1,11	0,63	4,90	0,41	1,04	0,51	0,62	0,37
2009	0,00	0,00	0,00	0,01	0,06	0,18	0,30	0,36	0,66	1,11	0,50	5,00	0,51	0,51	0,44	0,28
2010	0,00	0,00	0,00	0,01	0,03	0,09	0,23	0,46	0,60	0,68	2,99	0,61	0,99	0,51	0,43	0,28
2011	0,00	0,00	0,00	0,00	0,02	0,06	0,10	0,16	0,24	0,27	0,39	5,00	0,41	0,50	0,16	0,12
2012	0,00	0,00	0,00	0,00	0,01	0,02	0,08	0,11	0,15	0,30	0,26	1,06	0,38	0,50	0,11	0,08
2013	0,00	0,00	0,00	0,00	0,01	0,04	0,05	0,09	0,10	0,10	0,18	0,05	0,13	0,50	0,08	0,06
2014	0,00	0,00	0,00	0,00	0,01	0,04	0,05	0,08	0,14	0,12	0,11	0,11	0,11	0,50	0,09	0,07

9. FIGURES
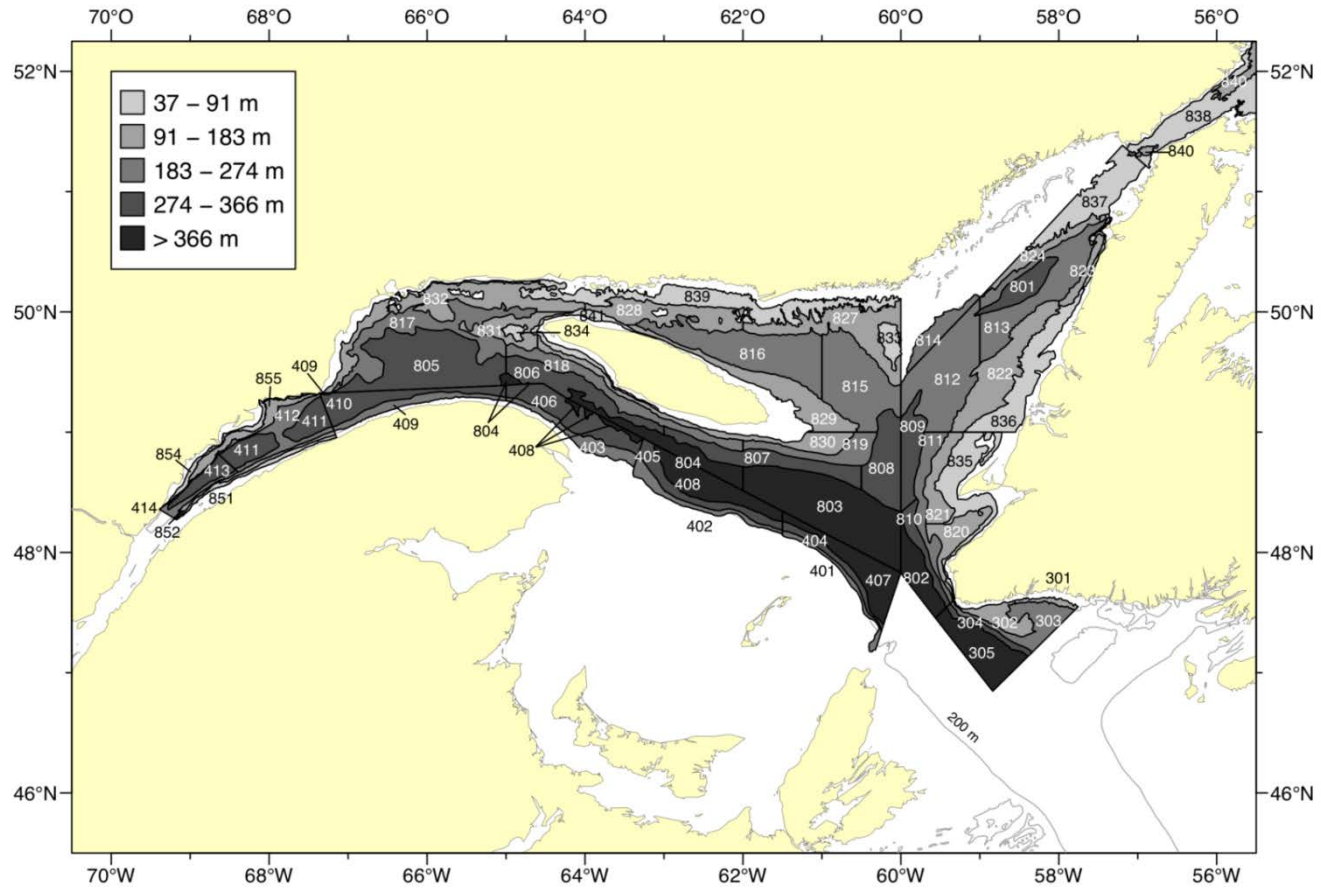
Figure 1. Stratification scheme used for multispecies research surveys (non-illustrated 10-20 fathom strata) and mobile gear sentinel surveys.
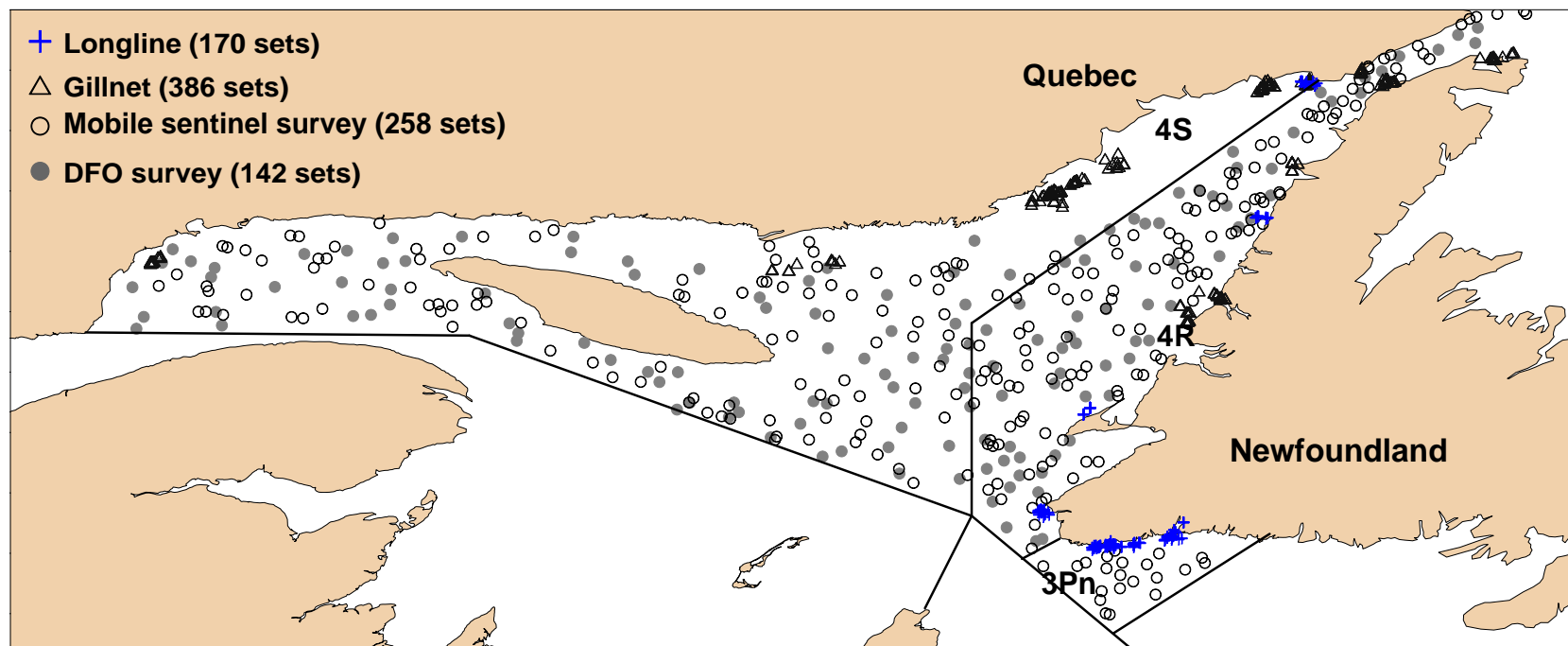
Figure 2a. Spatial distribution of sampling effort for cod abundance indices (3Pn, 4RS) in 2014.
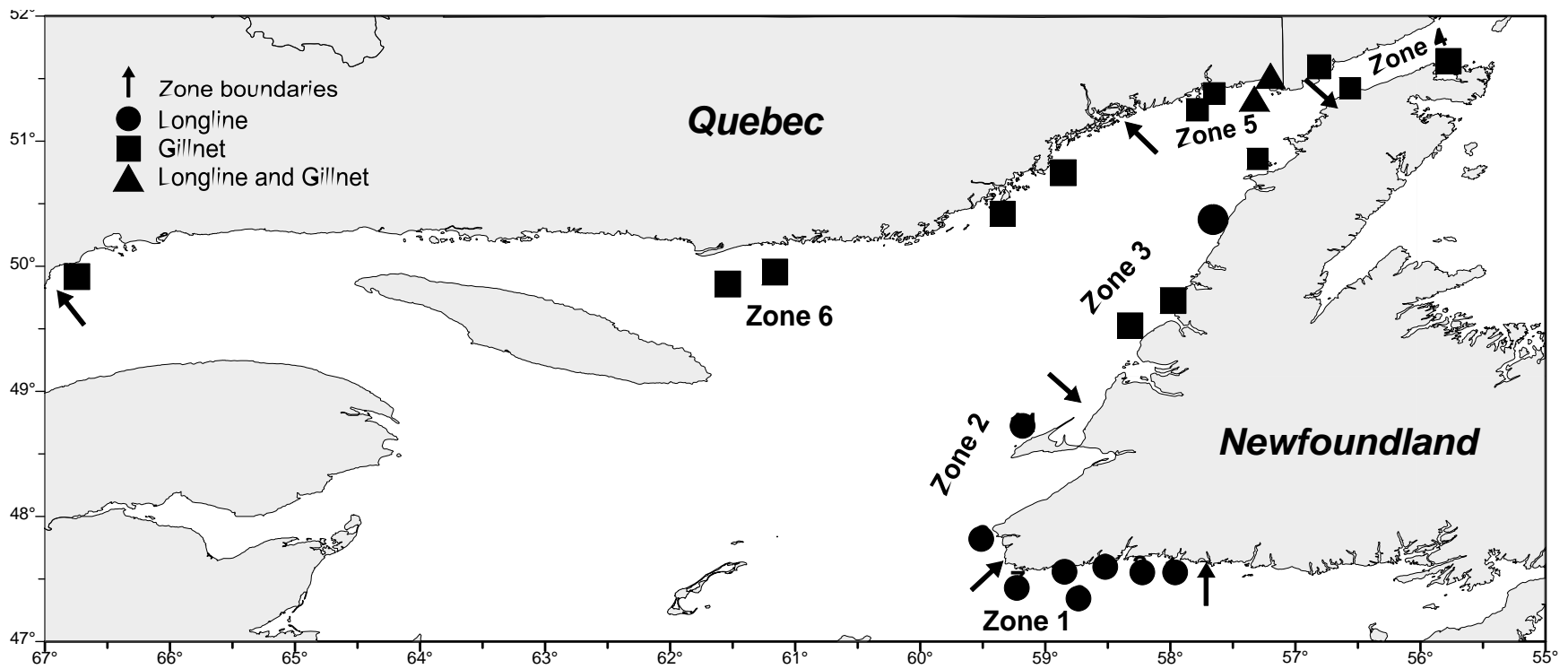
Figure 2b. Spatial distribution of sampling effort for fixed gear sentinel survey indices in 2014.
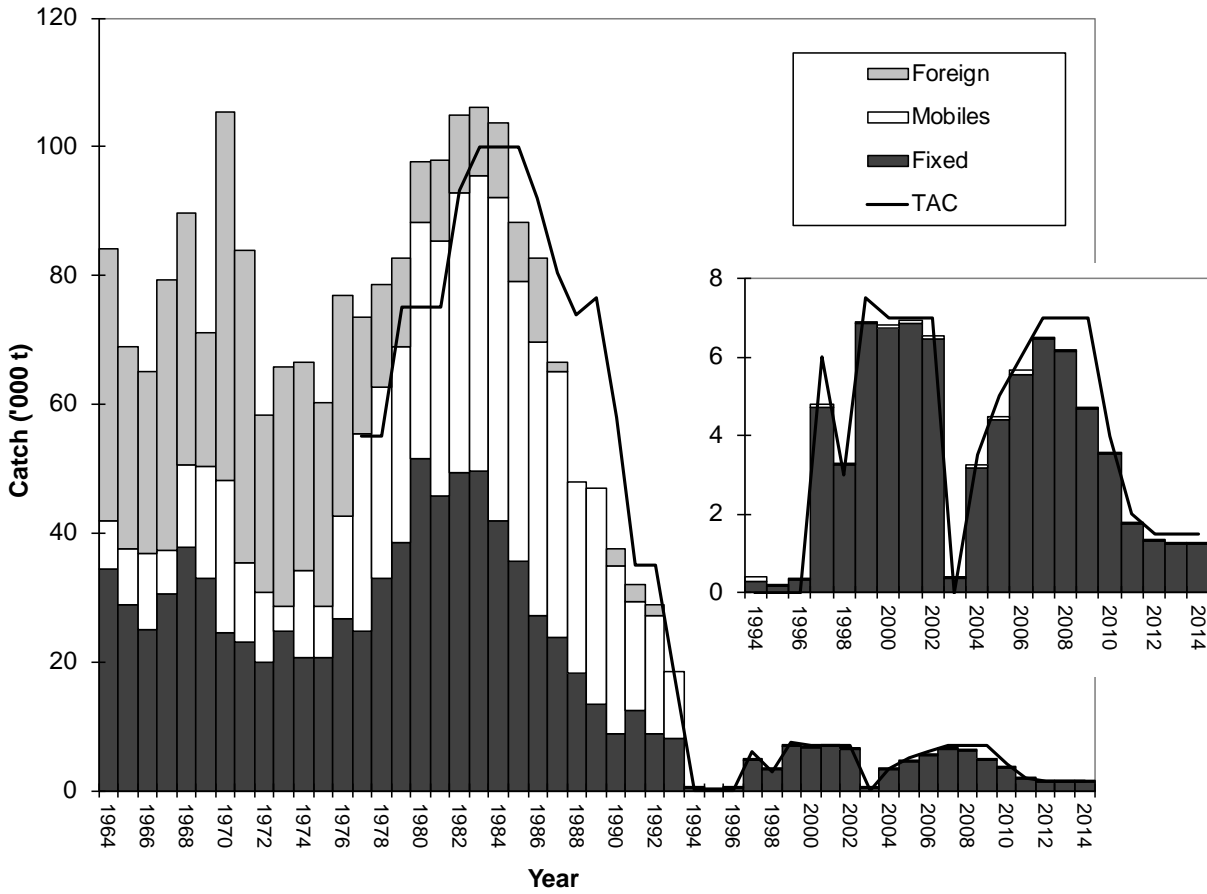
Figure 3. Annual landings and total allowable catch (TAC) by management year. (1999: TAC from 1999/01/01 to 2000/05/14; 2000 and+: TAC from May 15 to May 14 of the following year)
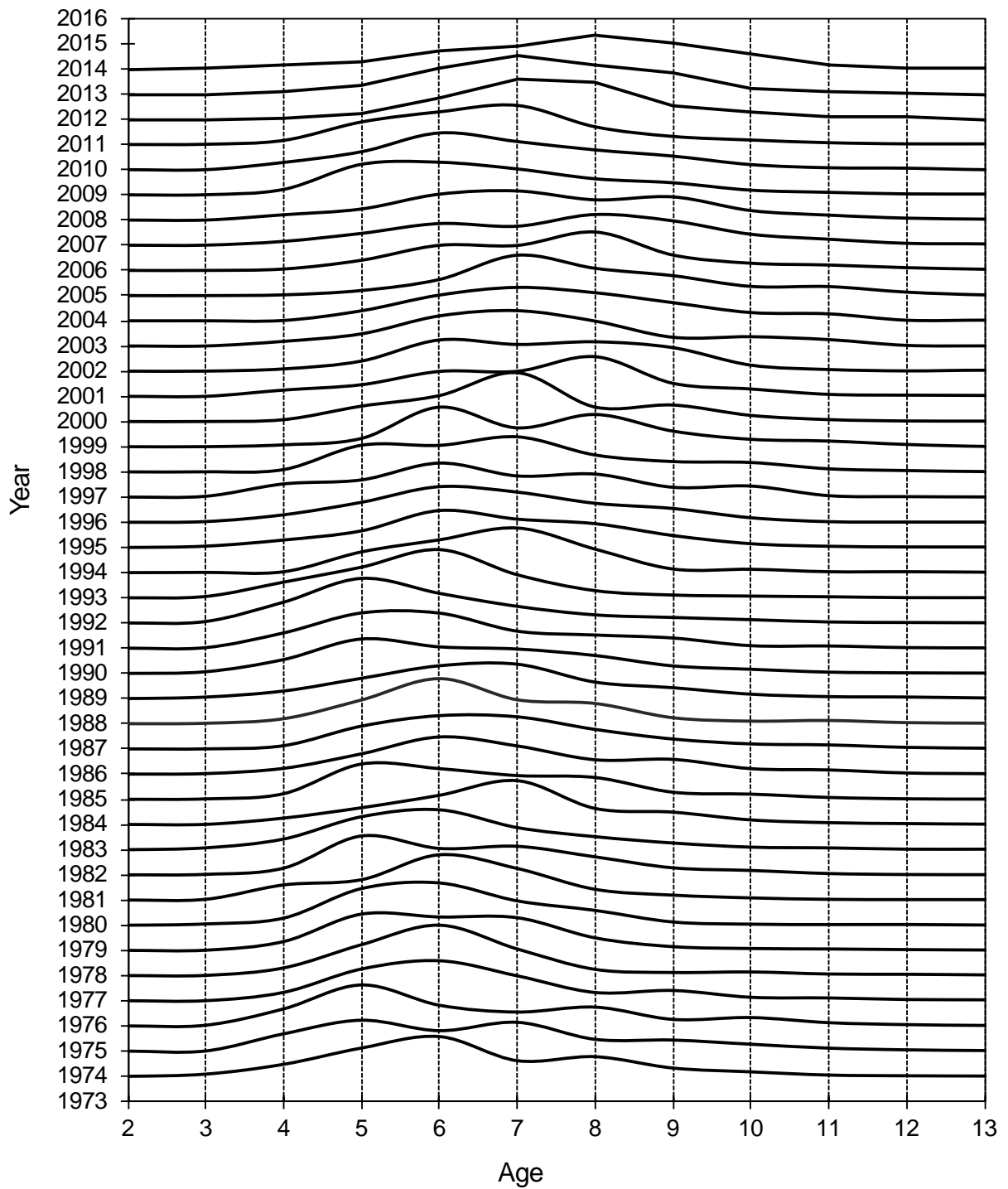
Figure 4. Catch-at-age (%) of cod in the commercial fishery.
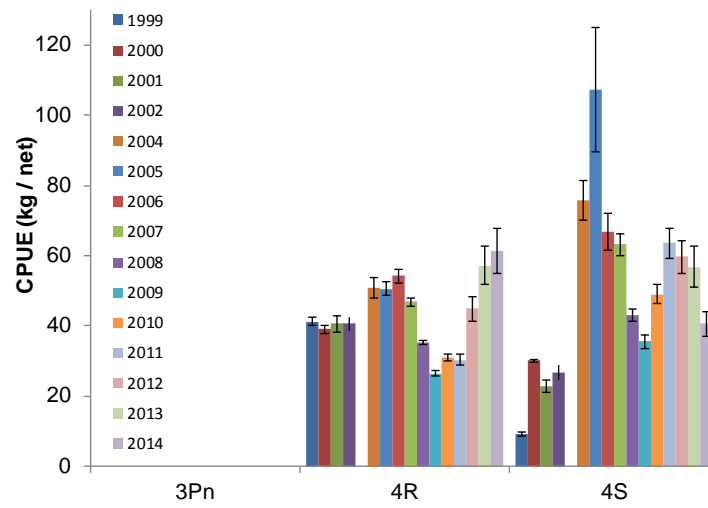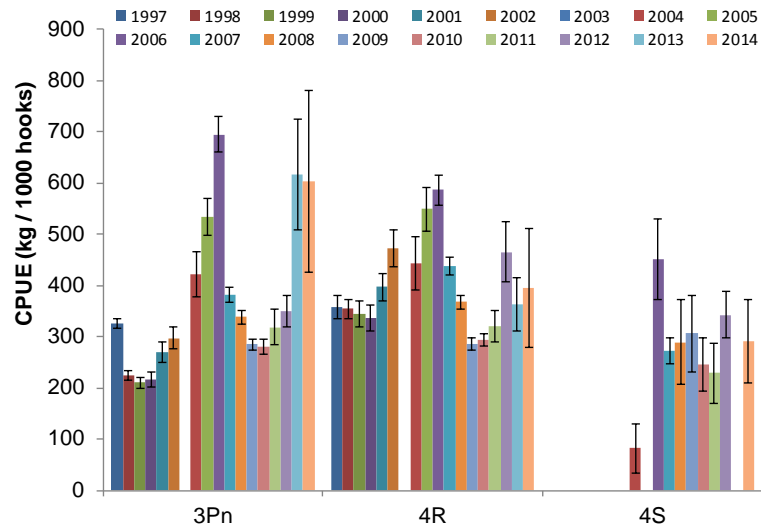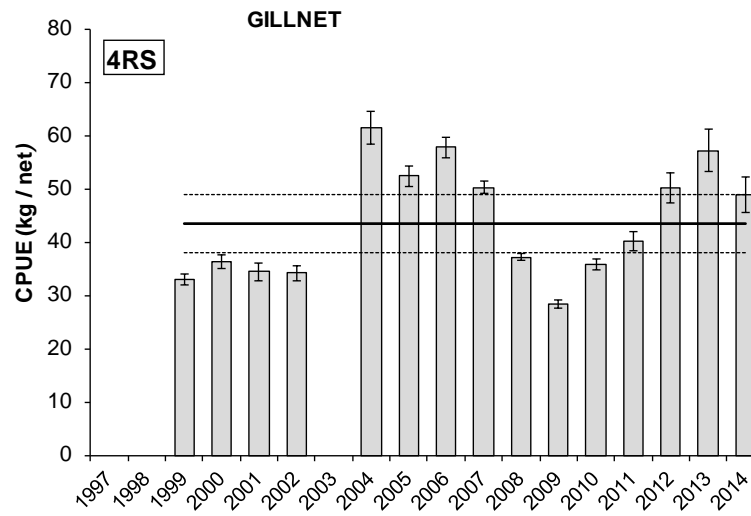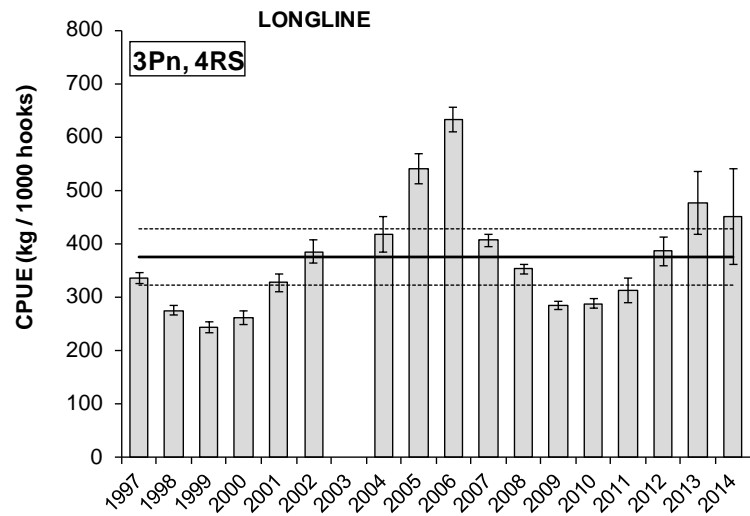
Figure 5. Commercial fishery logbooks for Quebec vessels (< 45 feet) and Newfoundland vessels (< 35 feet) from 1997 to 2014. Catch per unit effort ± 95% CI. The solid line represents the series average (1997-2013), and the dotted lines ± ½ standard deviation around the average.
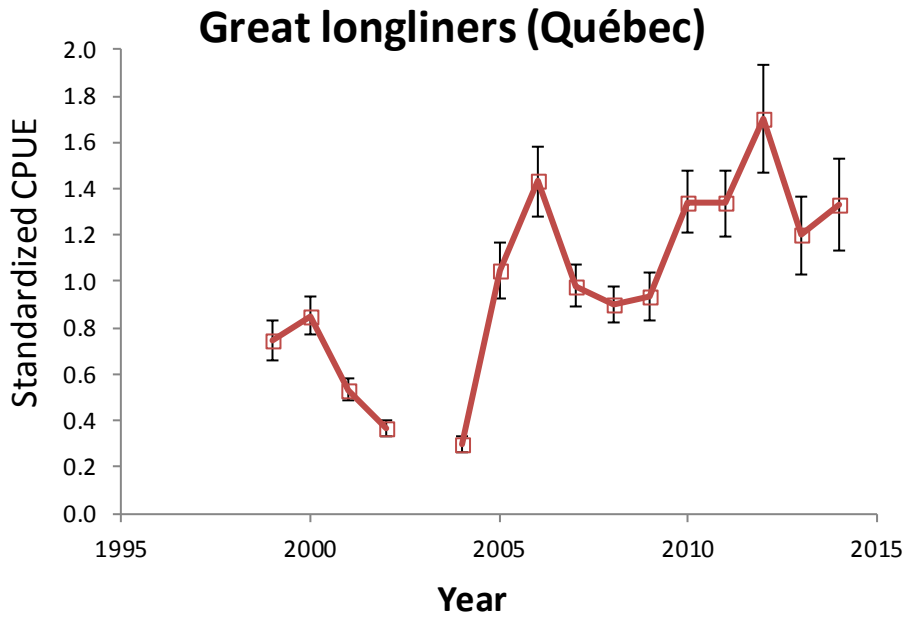
Figure 6. Quebec commercial longline fishery logbook data. Standardized catch per unit effort (CPUE) (average ± 95% CI).
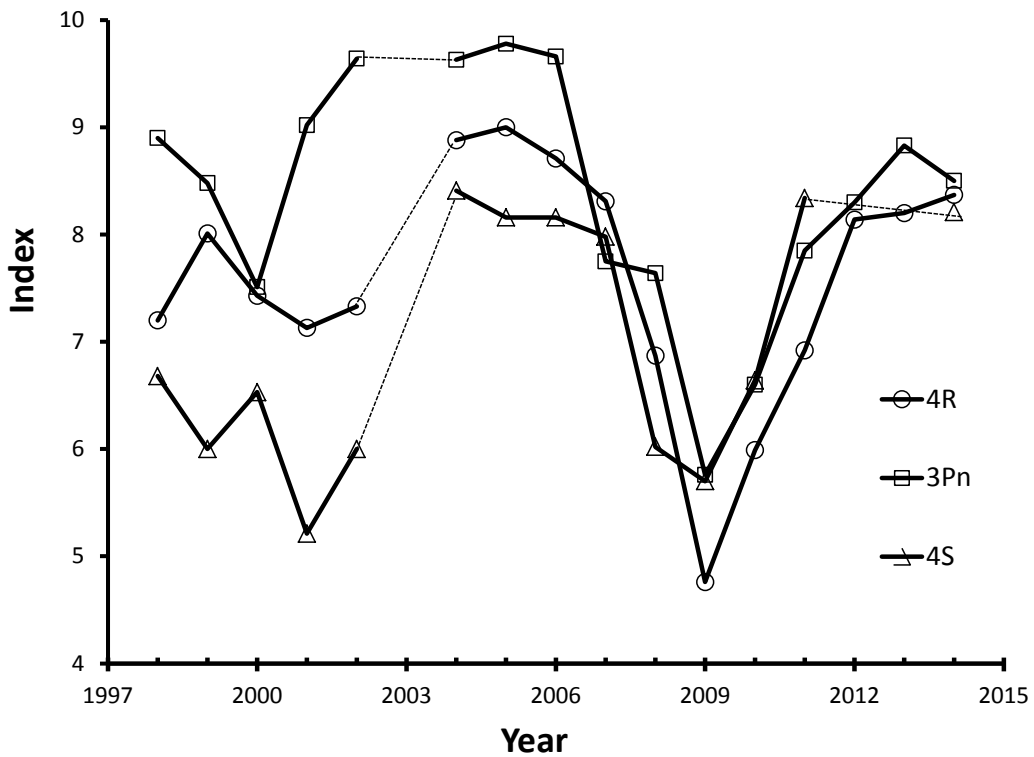
Figure 7. Fishery performance index by NAFO Division from the industry telephone survey of fixed gear fishers (dotted lines = years with no survey).

A)
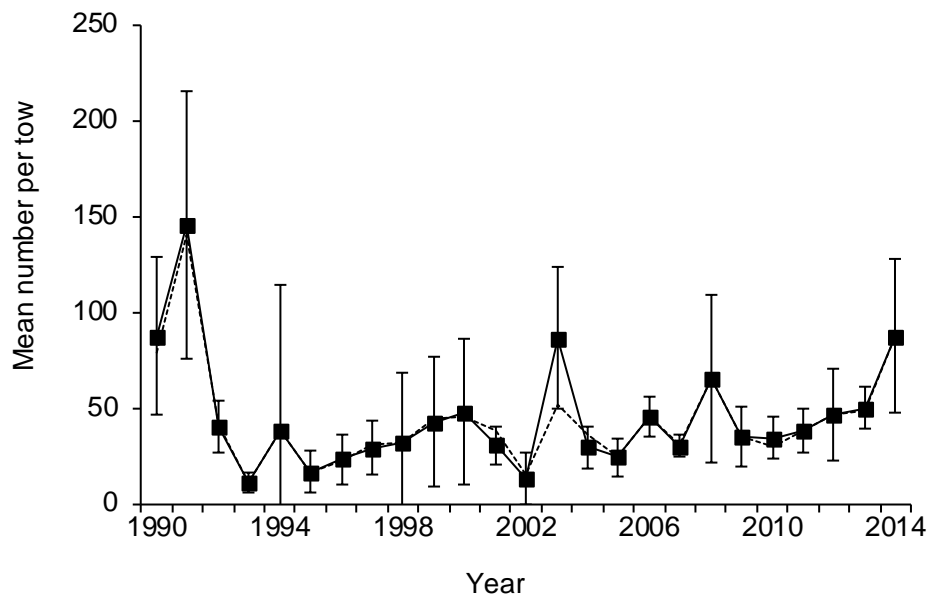
B)
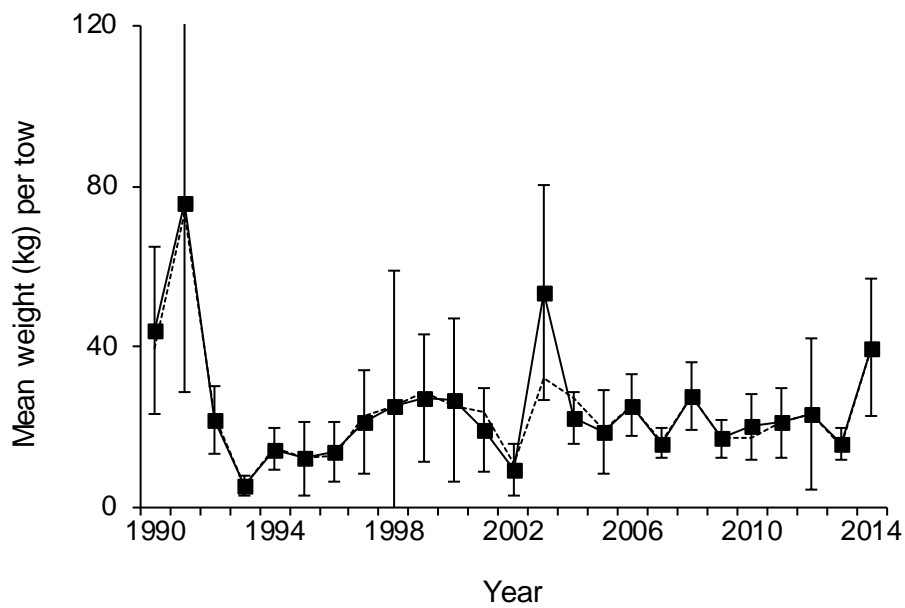
Figure 8. Mean numbers (A) and mean weights (B) per tow observed during the DFO survey. Data corrected by a multiplicative model to consider strata not sampled (solid line) and data without correction (dotted line). Error bars indicate 95% confidence intervals.
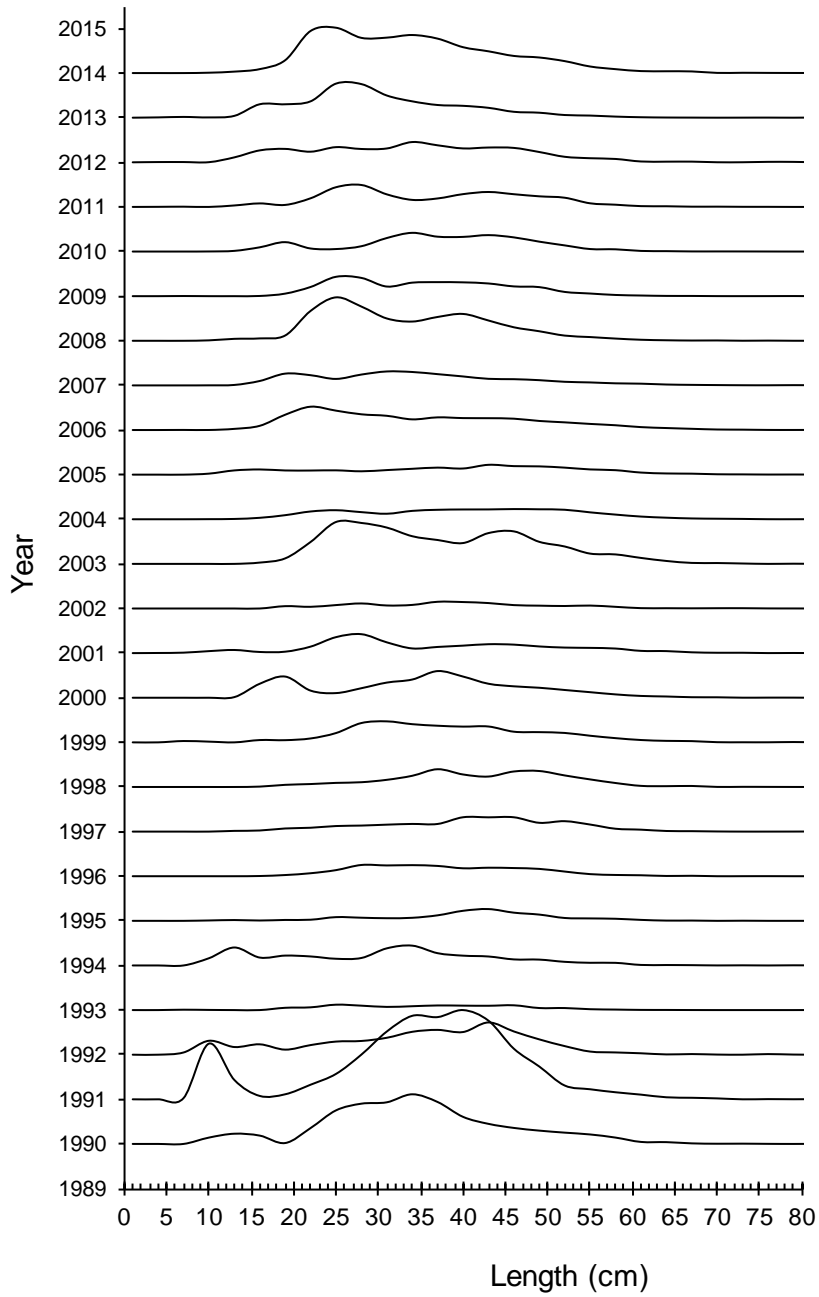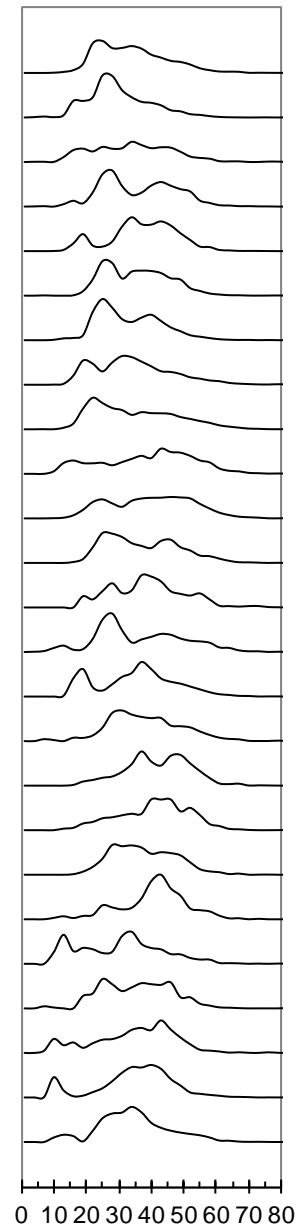
Figure 9. Length frequency distributions during DFO research surveys. (Numbers (A), percentage (B)).
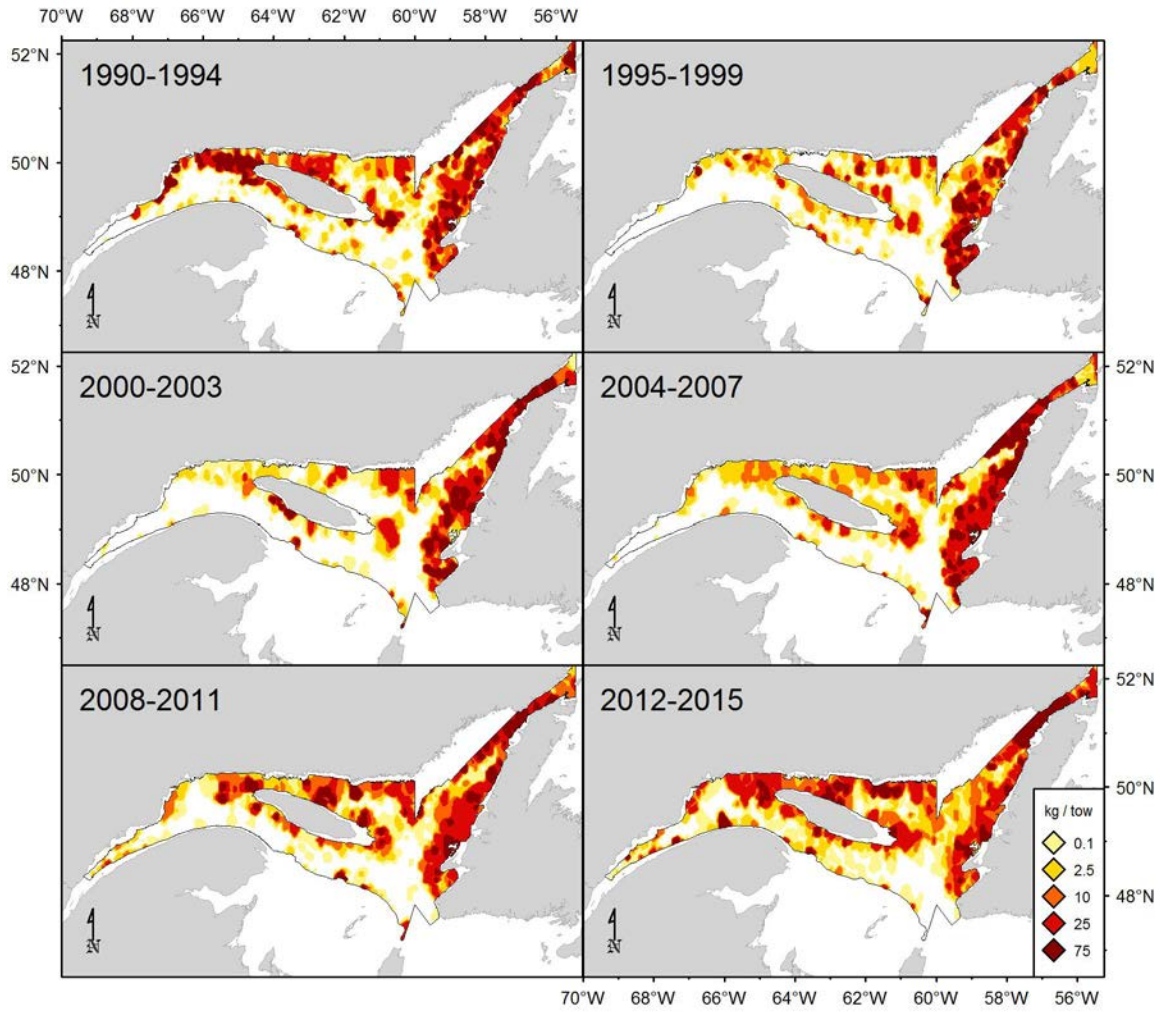
Figure 10. Distribution of cod catch rates (kg/15-minute tow) in the (August) DFO survey in NAFO Divisions 4RS.
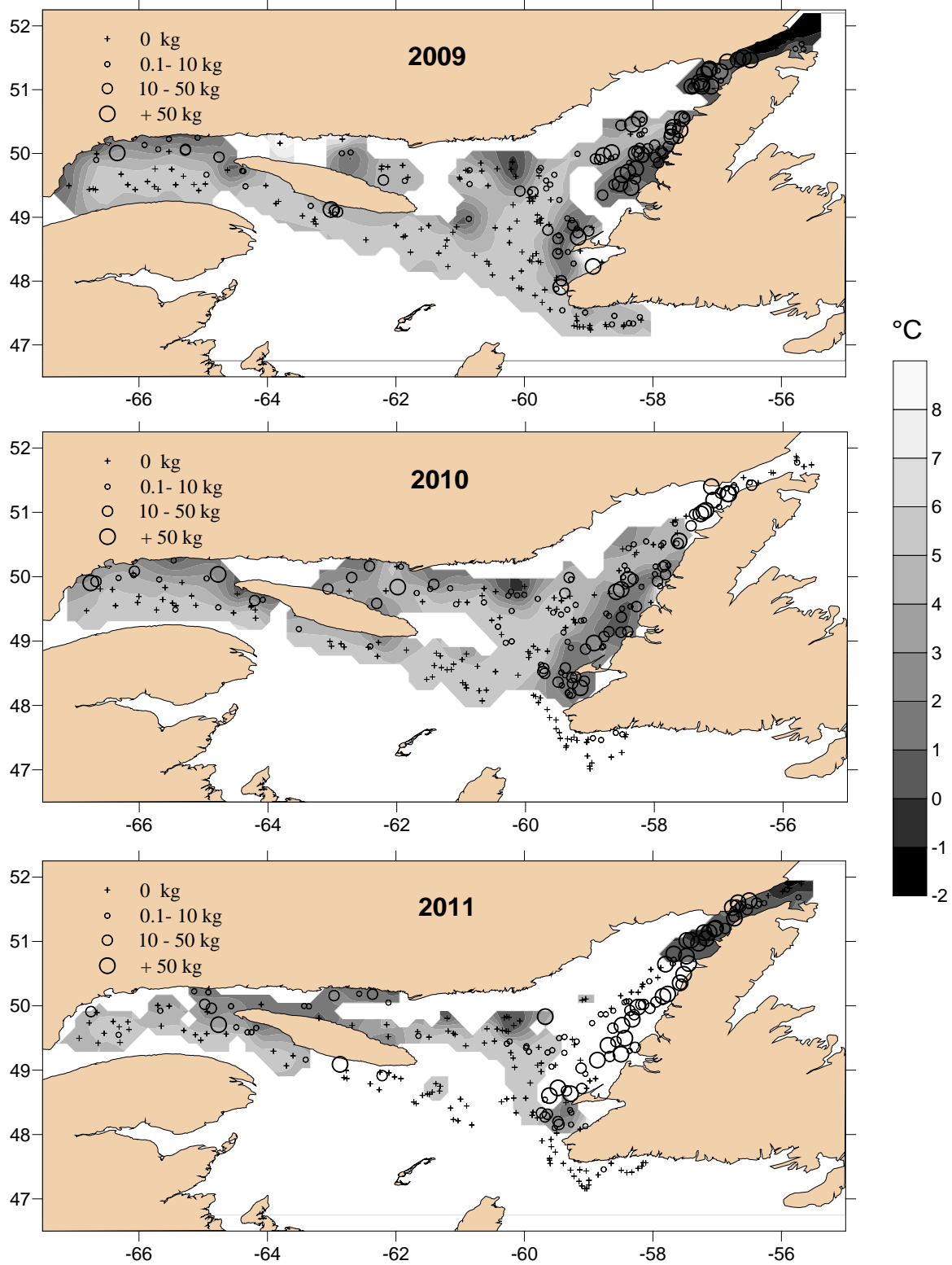
Figure 11. Bottom temperature and distribution of catch rates (kg/30 min. tow) from July mobile gear sentinel surveys.
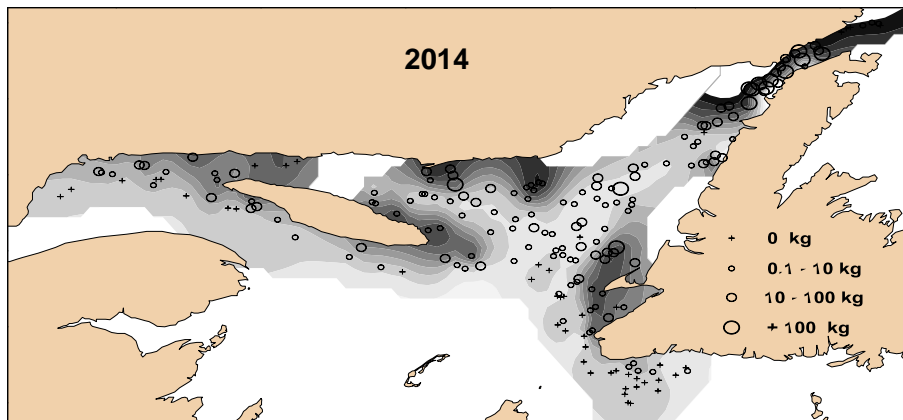
Figure 11. (continued)
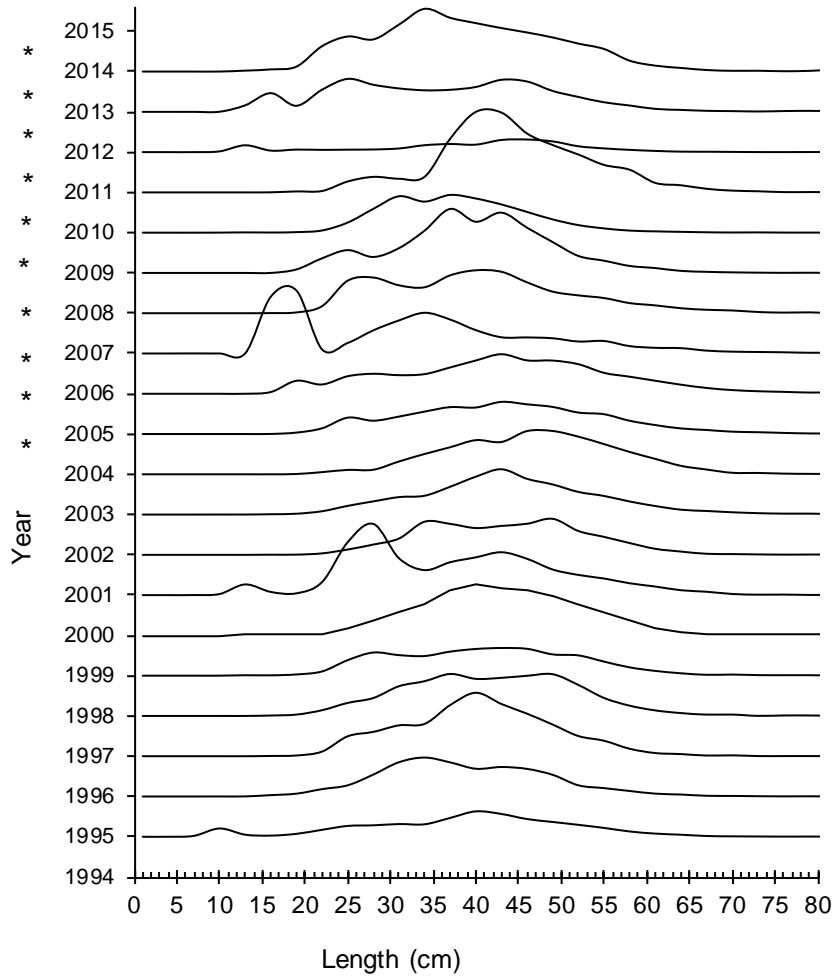
A)   B)
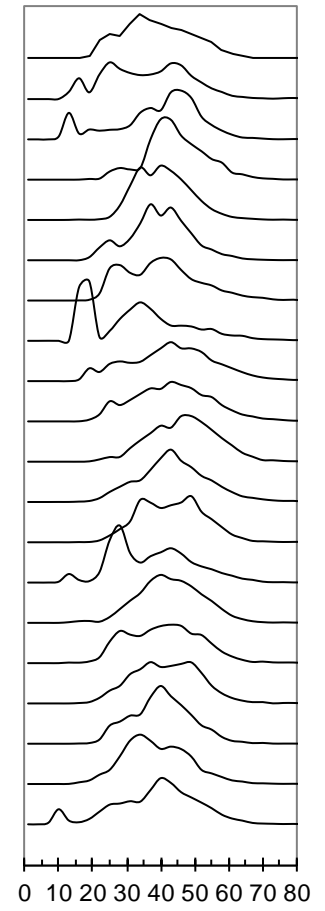
Figure 12. Length frequencies distribution in number (A) and in percentage (B) during the July mobile gear sentinel survey. (Includes 10-20 fathom strata).*

A)
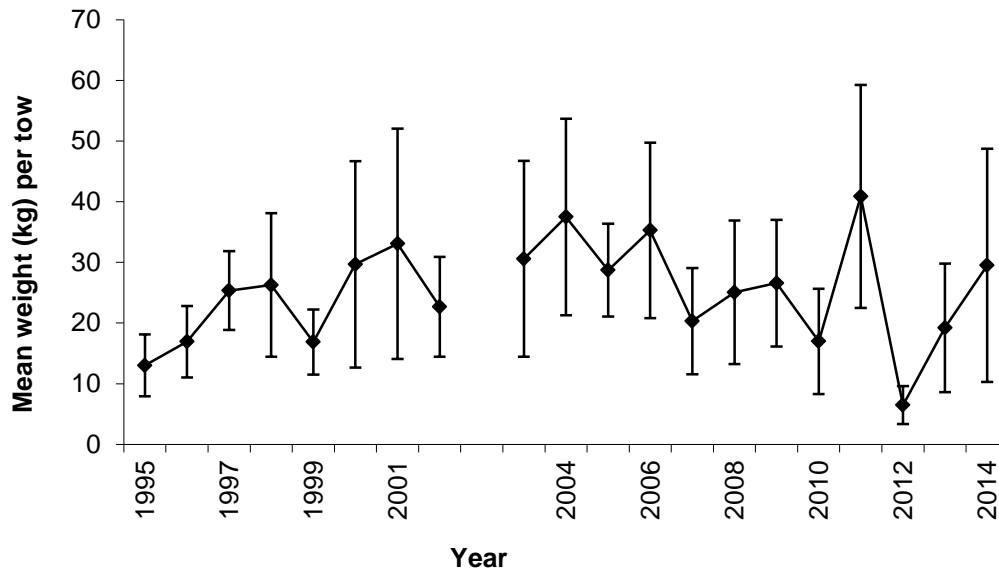
B)
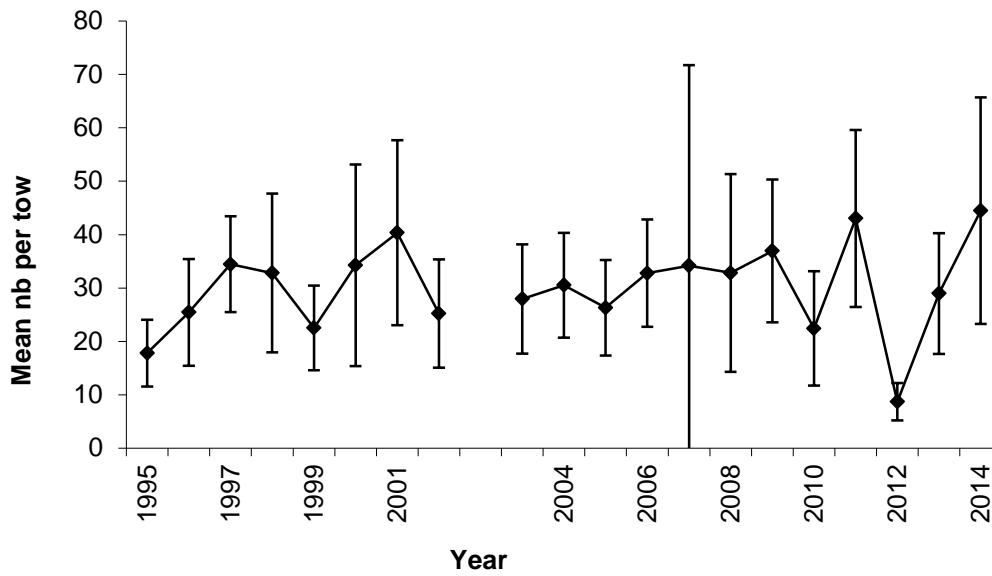
Figure 13. Mean weights (A) and mean numbers (B) per tow during the July mobile gear sentinel survey. (2003-2011 includes 10-20 fathom strata).
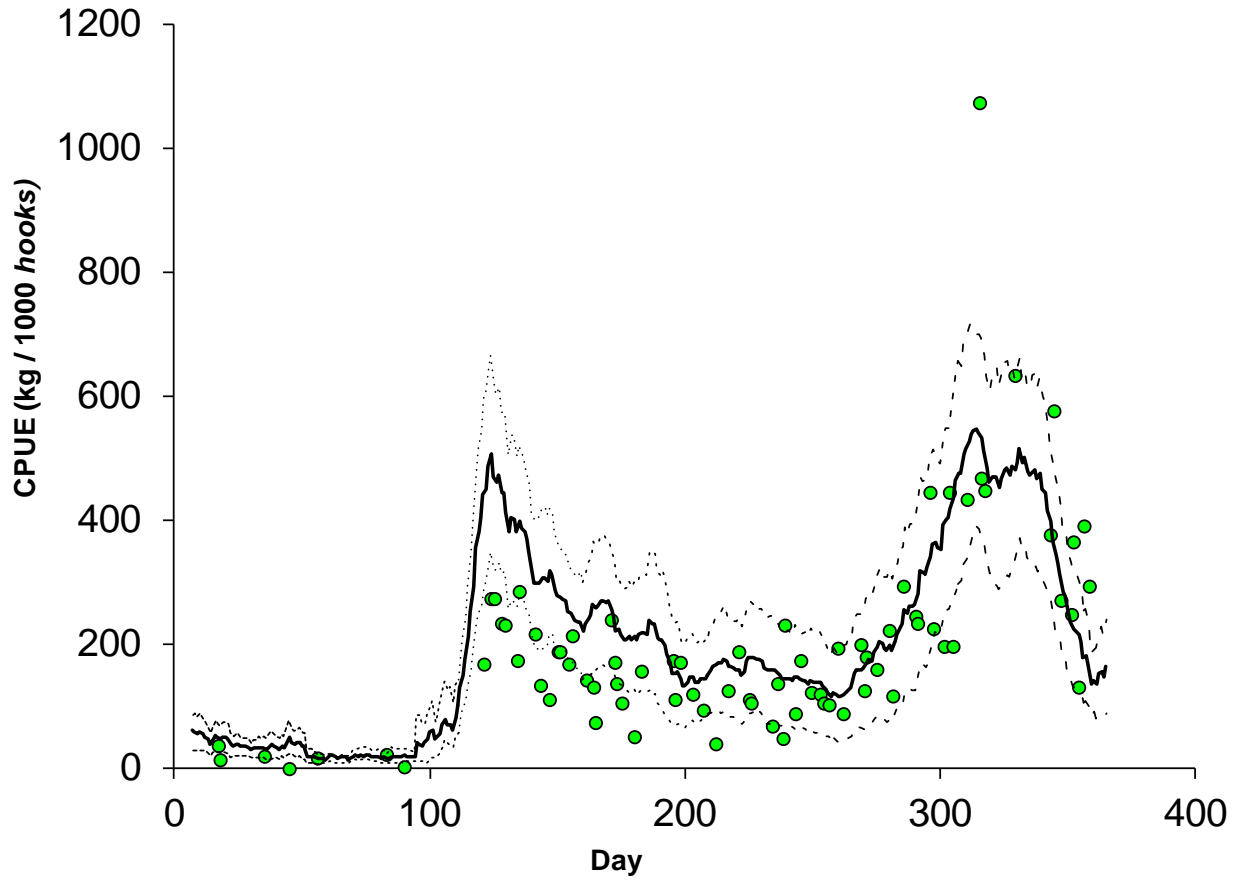
Figure 14. Average daily longline CPUE (kg / 1000 hooks) for the sentinel survey program in zone 1 (3Pn). The dots represent the 2014 data; the solid line is a 7-day running average of the daily averages for the 1995-2013 series; and the dotted lines ± ½ standard deviation around this average.

A)
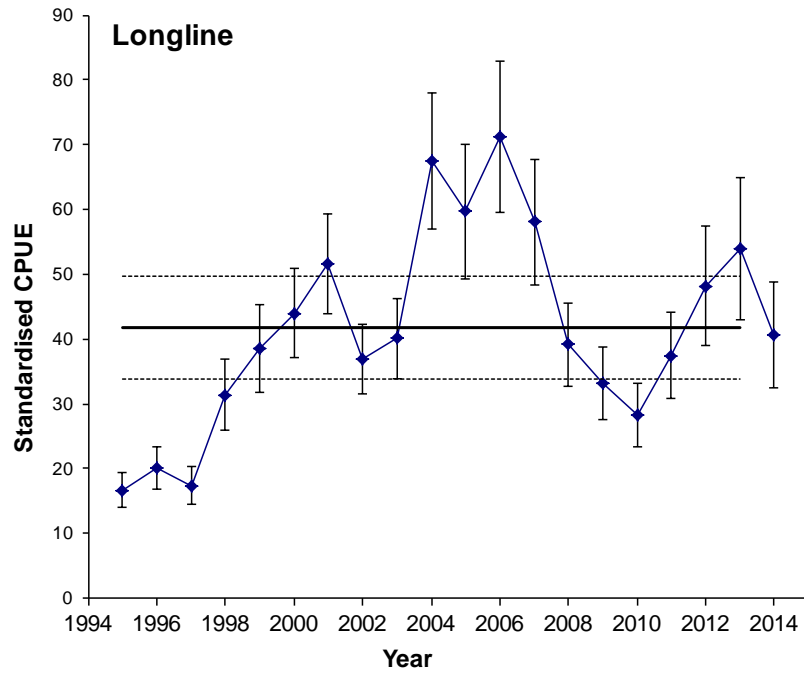
B)
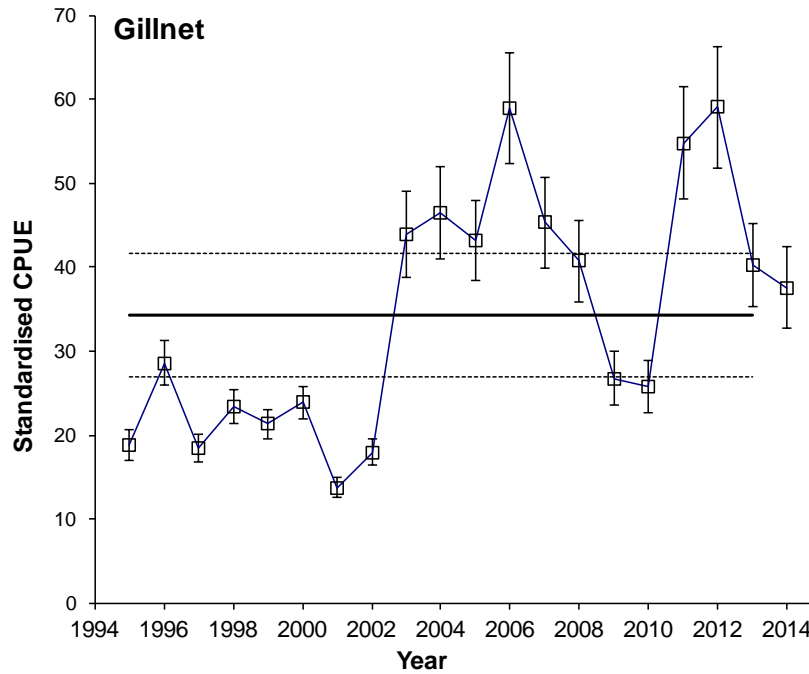
Figure 15. Standardized catch per unit effort (CPUE) (average ± 95% CI) in the sentinel survey program A) Longline B) Gillnet. The solid line represents the 1995-2013 series average, and the dotted lines ± ½ standard deviation around the average.
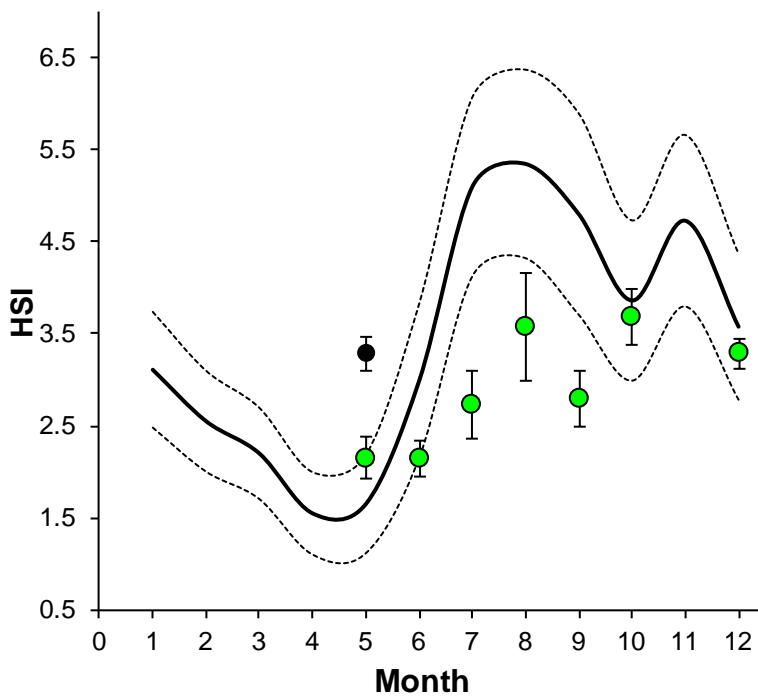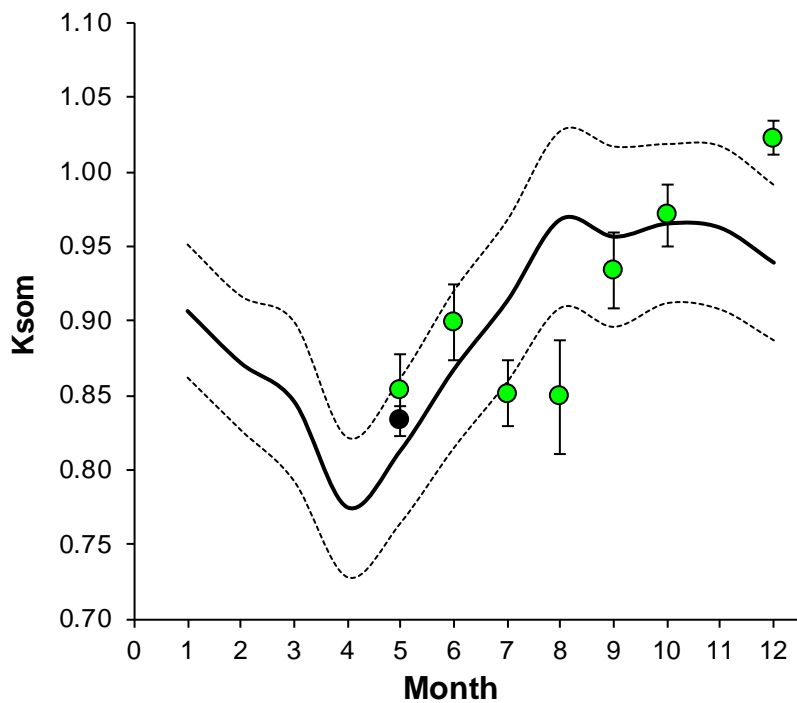
Figure 16. Seasonal changes in condition of cod sampled in the 2014 fixed gear sentinel survey program. Monthly average ± 95% CI of Fulton's somatic index (K som) and the hepato-somatic index (HSI). The solid line represents the 1998–2013 series monthly average, and the dotted lines ±½ the standard deviation around the average.
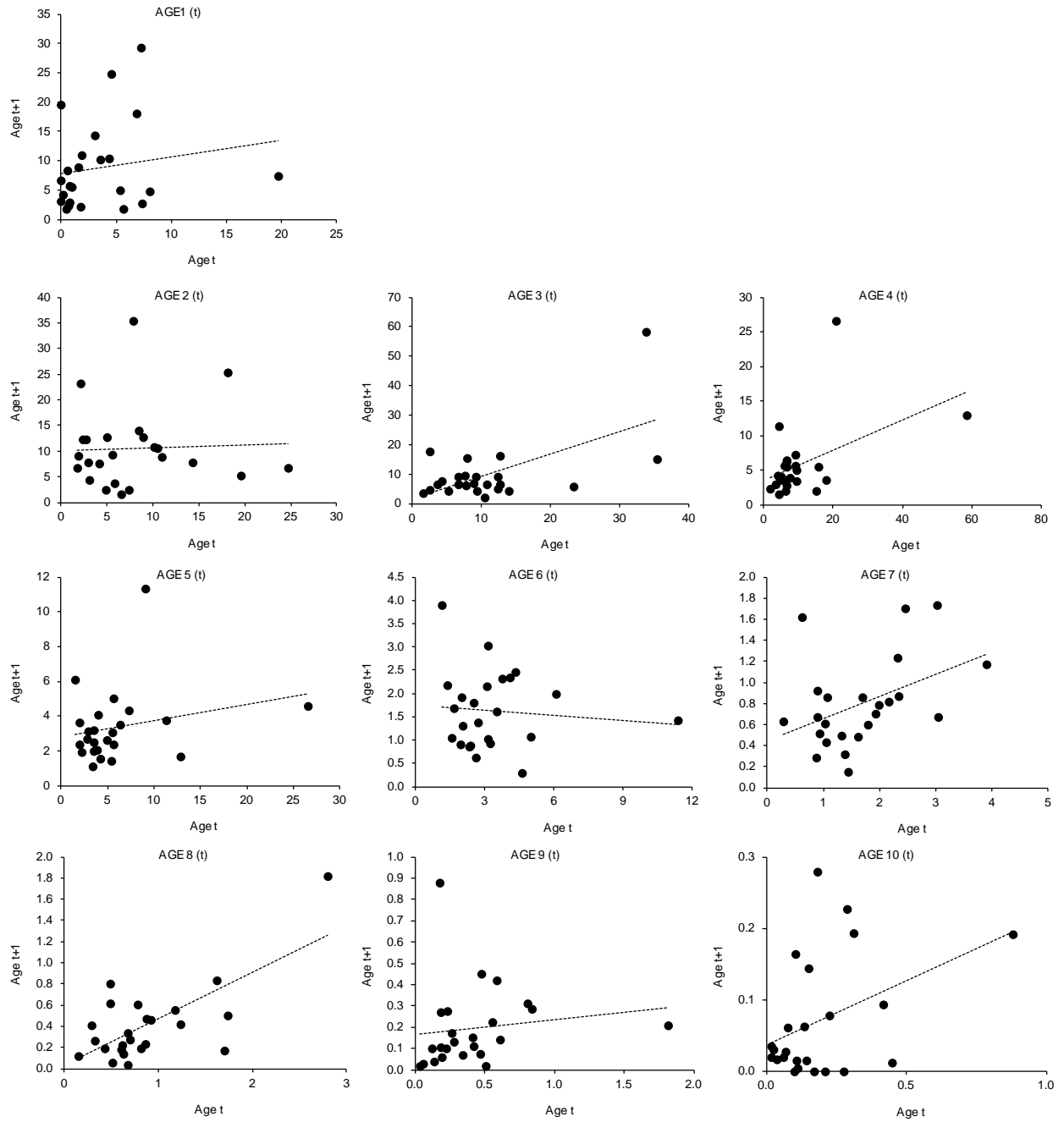
Figure 17a. Coherence at age for the DFO survey.
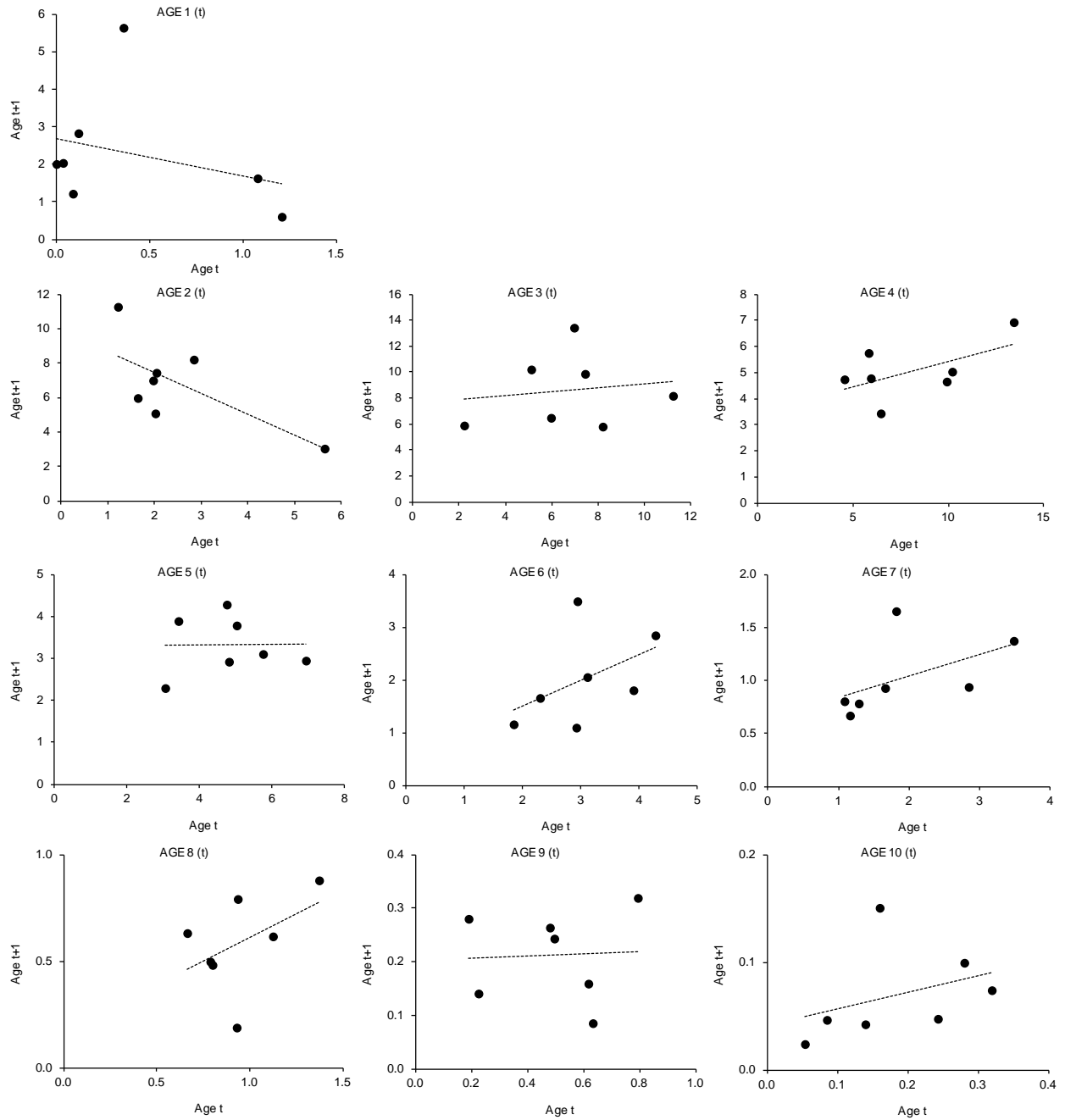
Figure 17b. Coherence at age for the mobile gear sentinel survey > 20 fathoms (1995 to 2002).
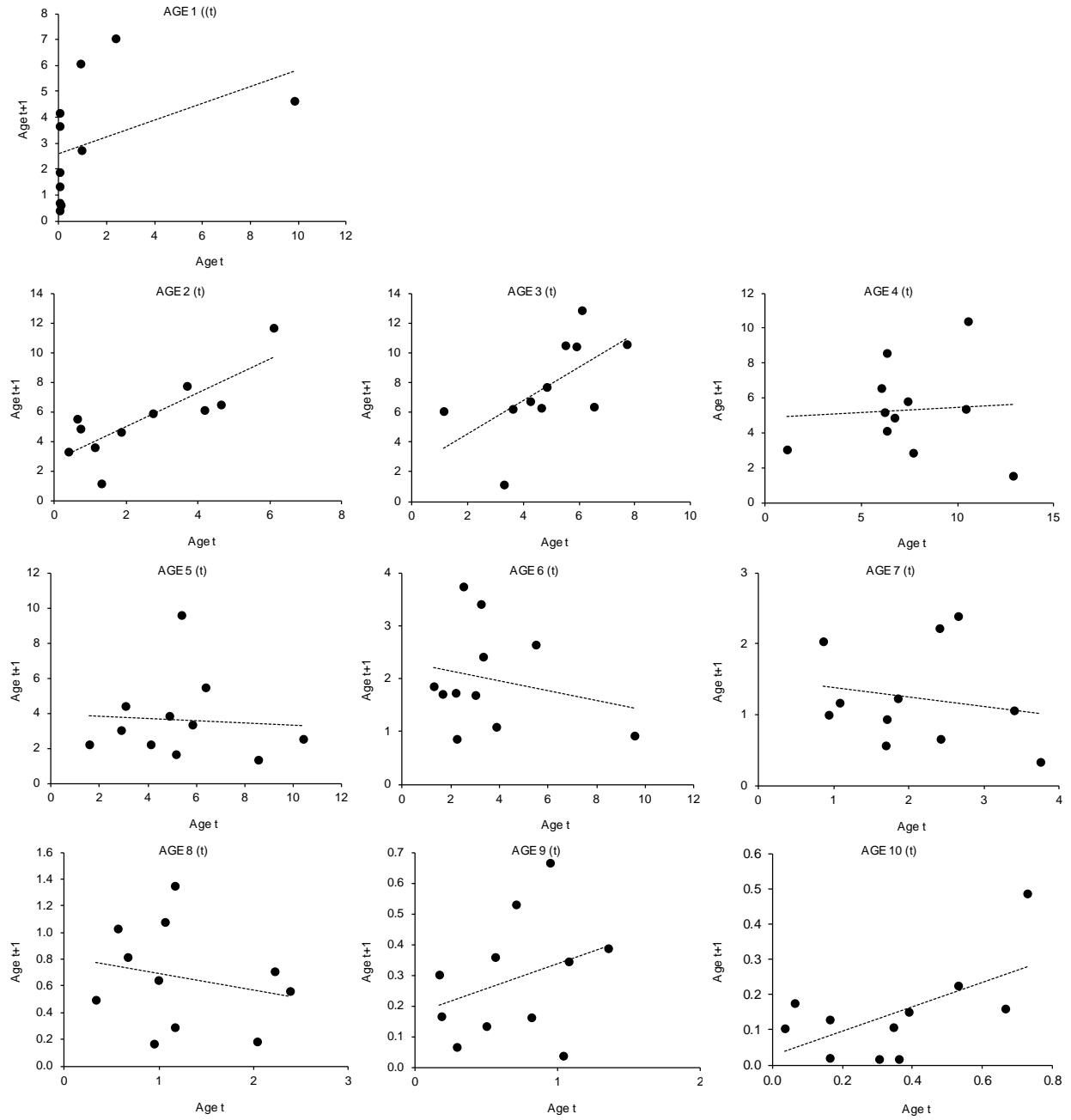
Figure 17c. Coherence at age for the mobile gear sentinel survey > 10 fathoms (2003 to 2014).
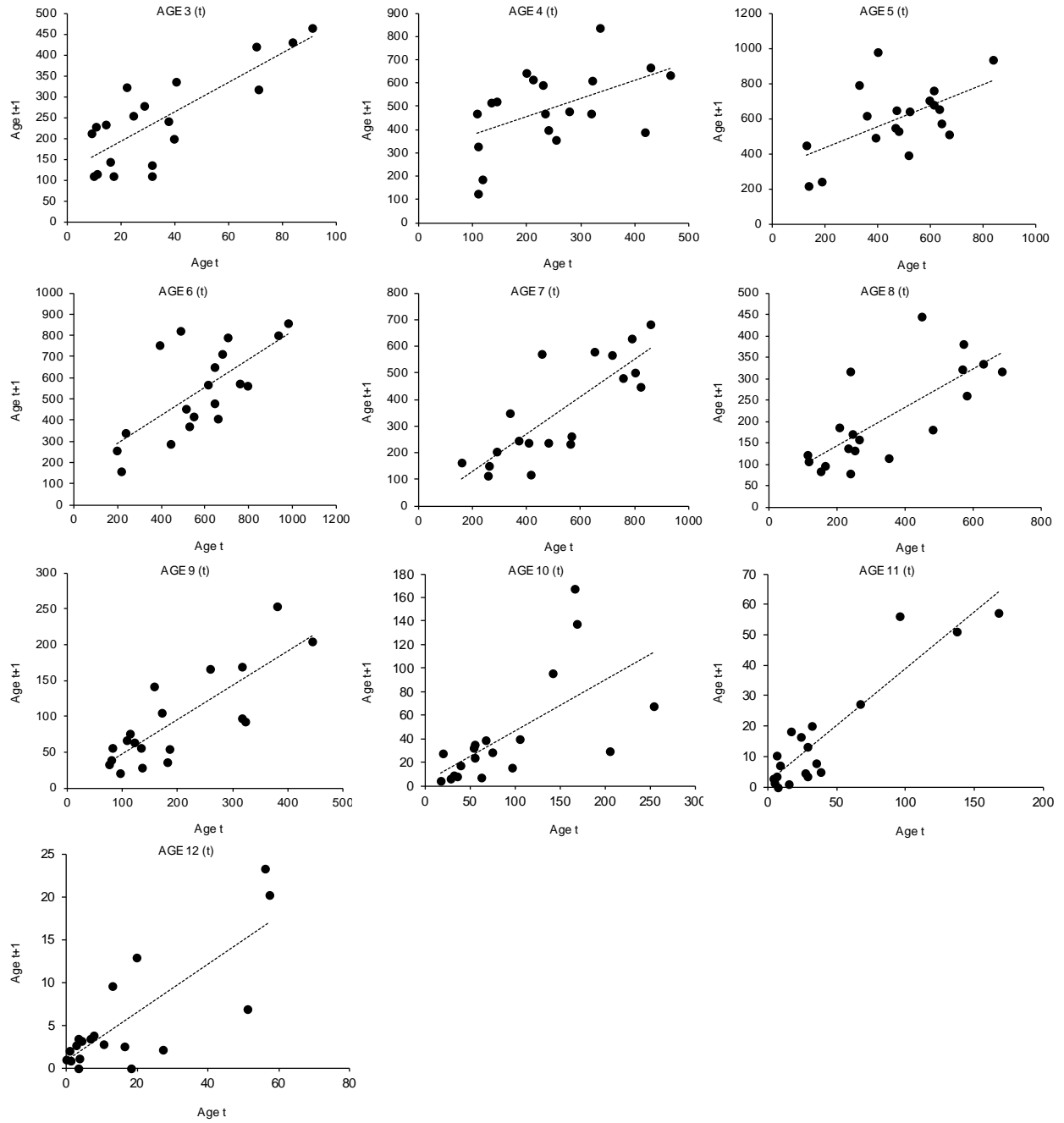
Figure 17d. Coherence at age for longline sentinel survey.
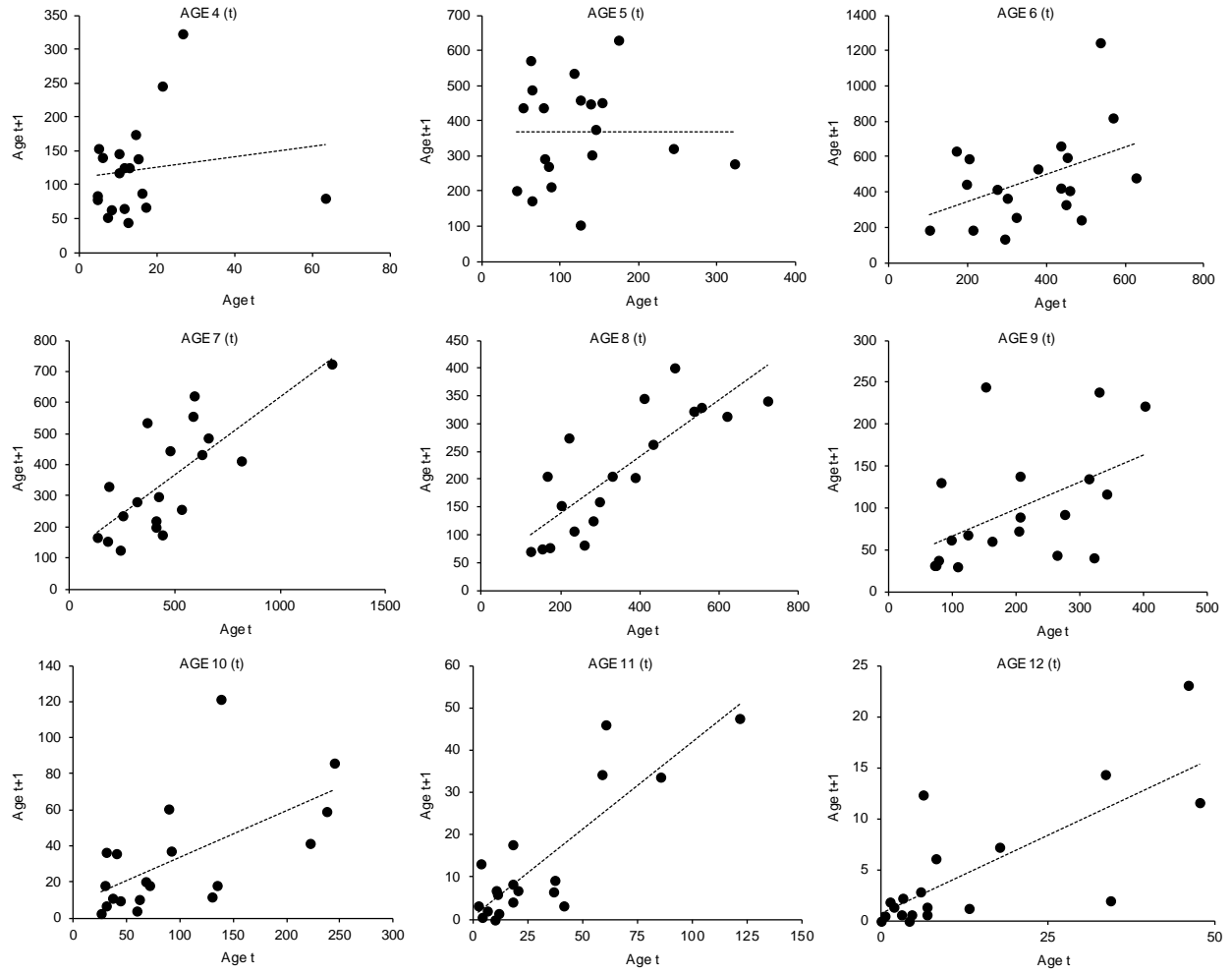
Figure 17e. Coherence at age for gillnet sentinel survey.
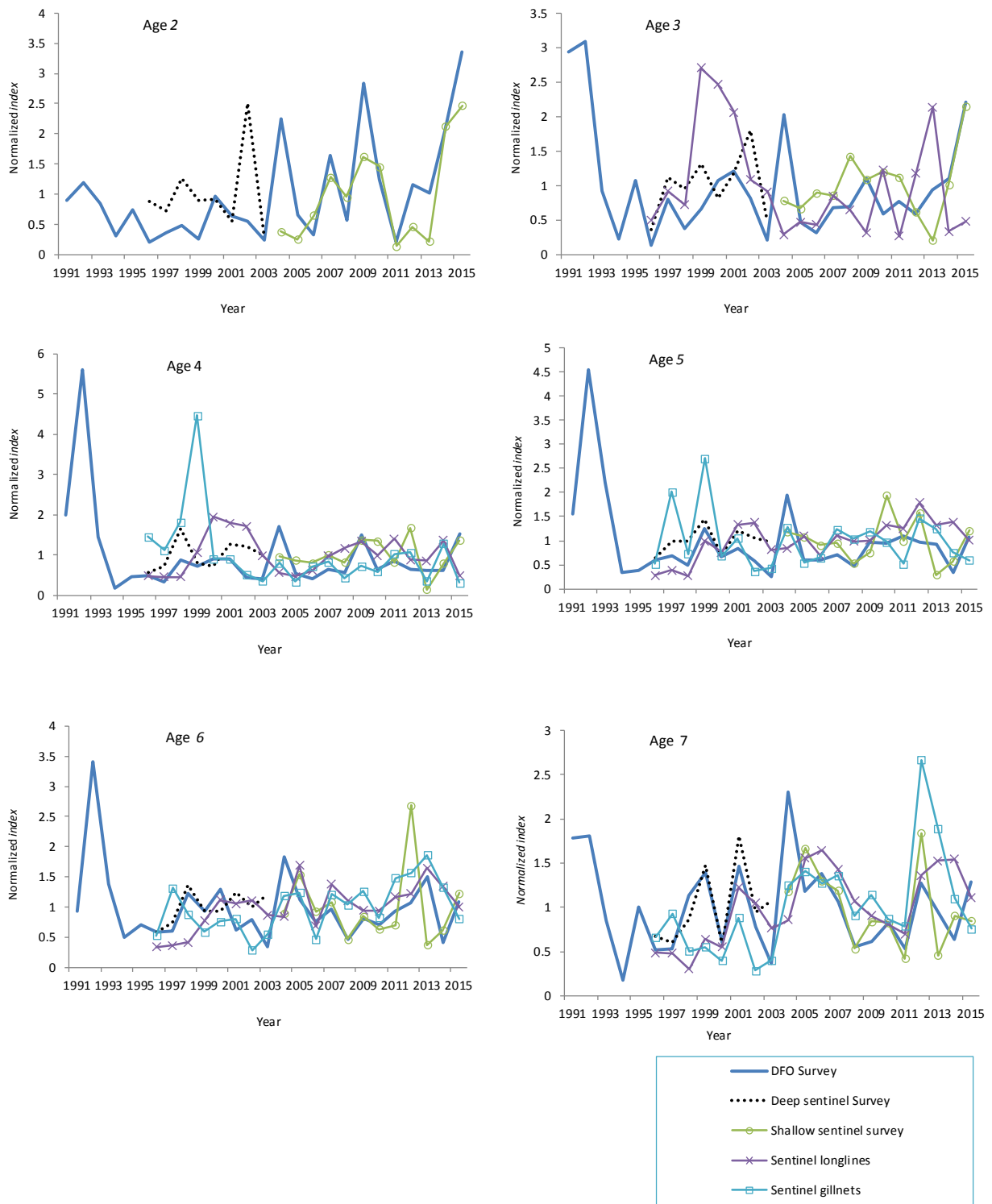
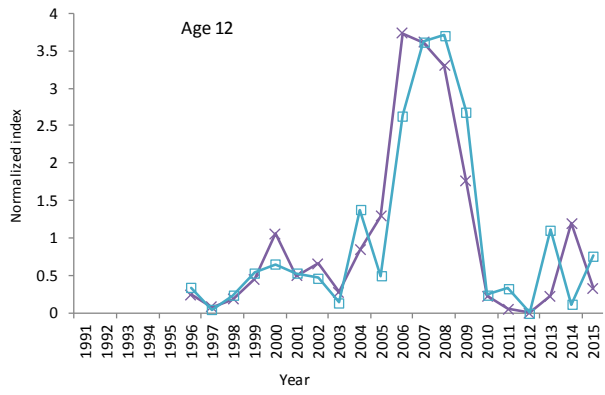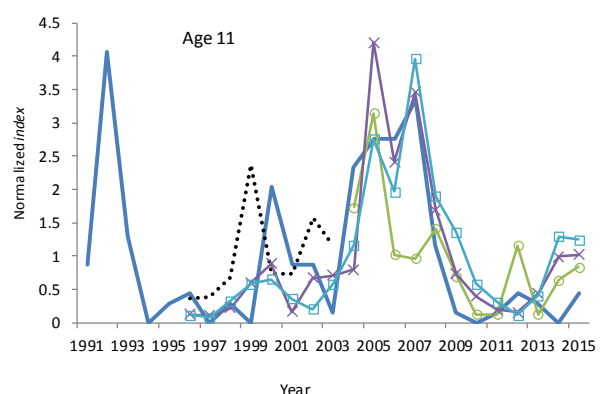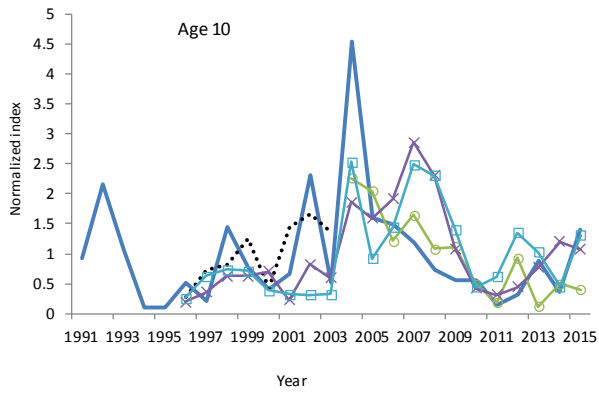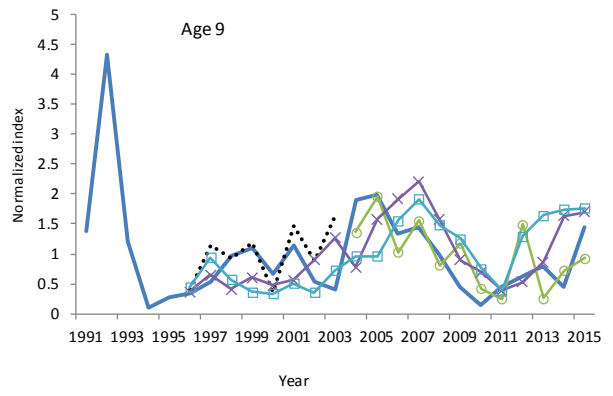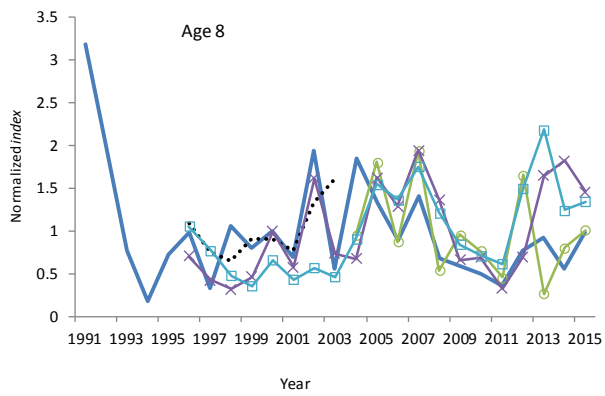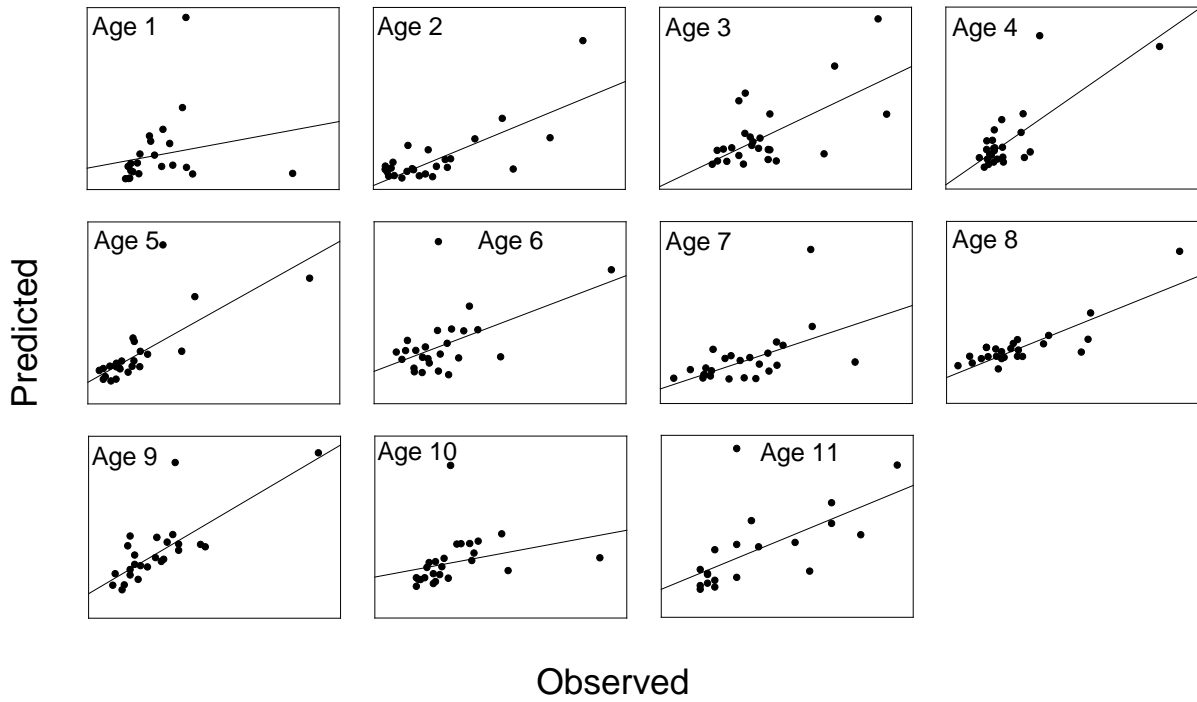*Figure 18. Coherence at age between the five abundance indices.*
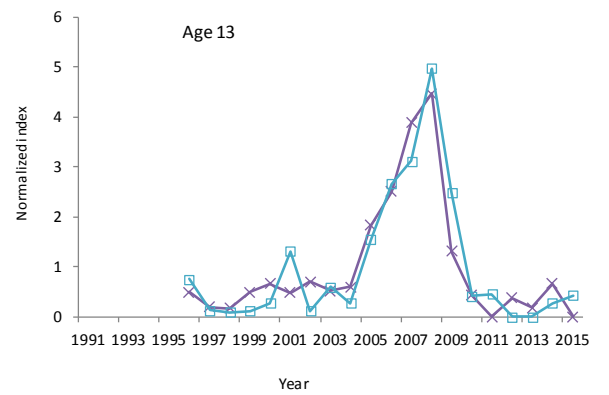
Figure 18. (continued)

A

B

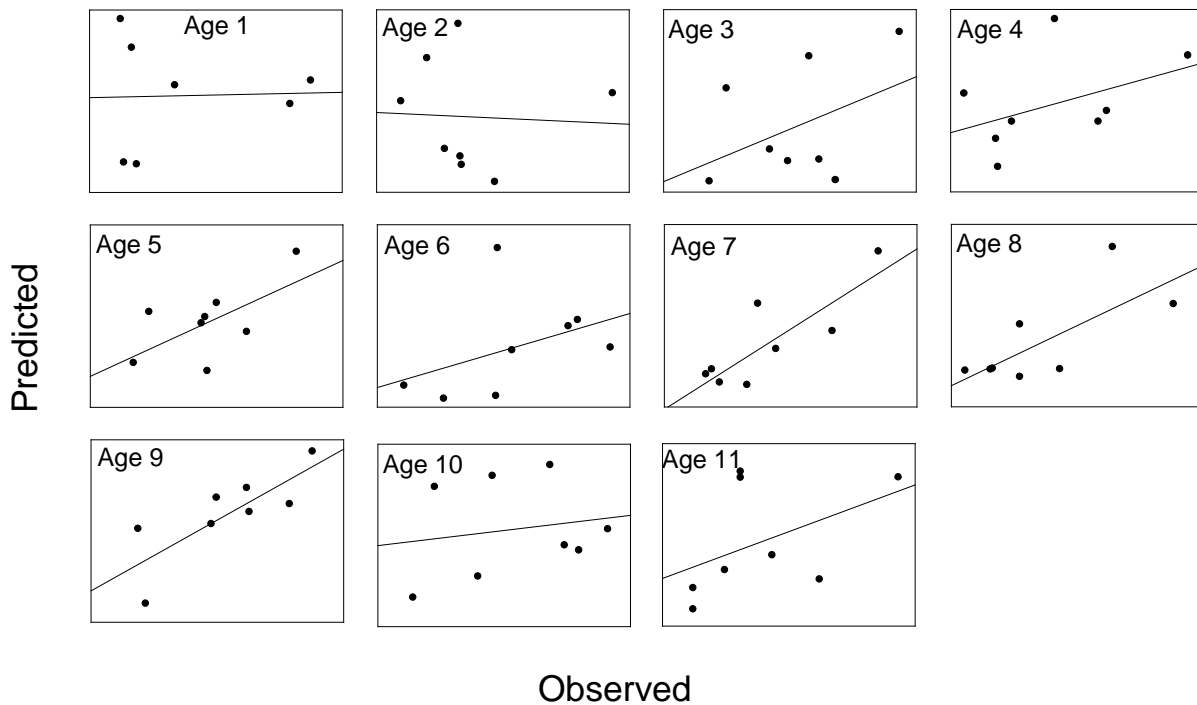*Figure 19. ADAPT adjustment between observed and predicted values at age. A) DFO Survey, B) Mobile gear sentinel survey > 20 fathoms*

C
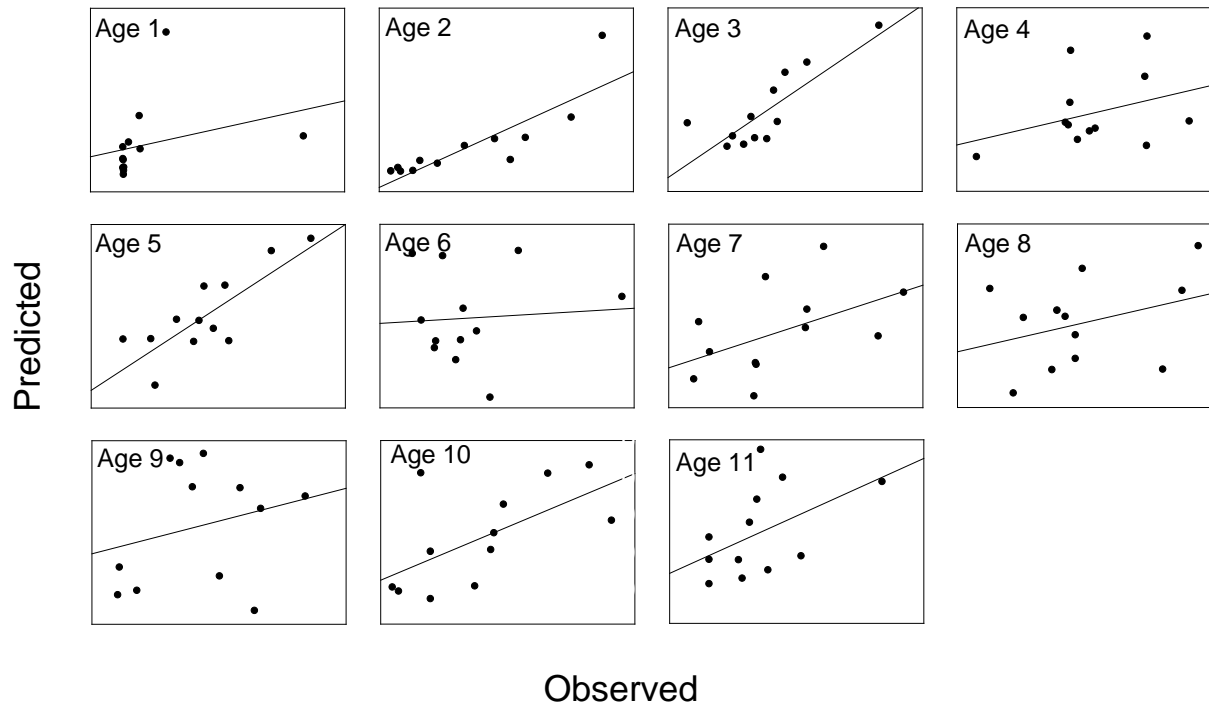
Figure 19. ADAPT adjustment between observed and predicted values at age. C) Mobile gear sentinel survey > 10 fathoms.

D
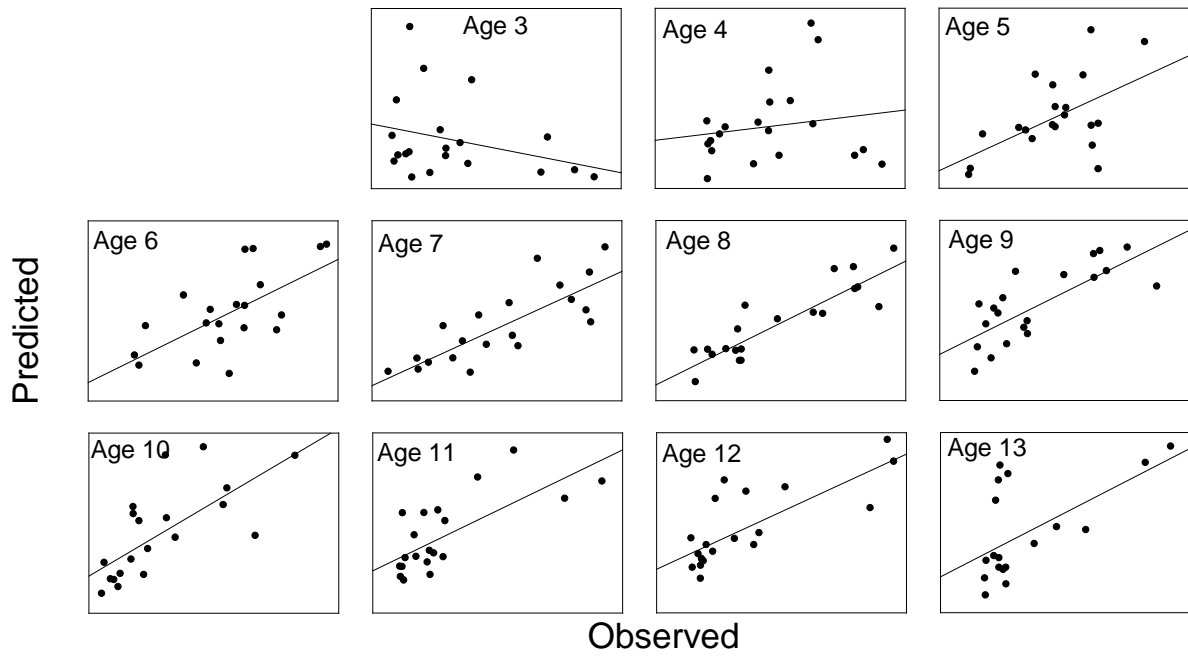
E
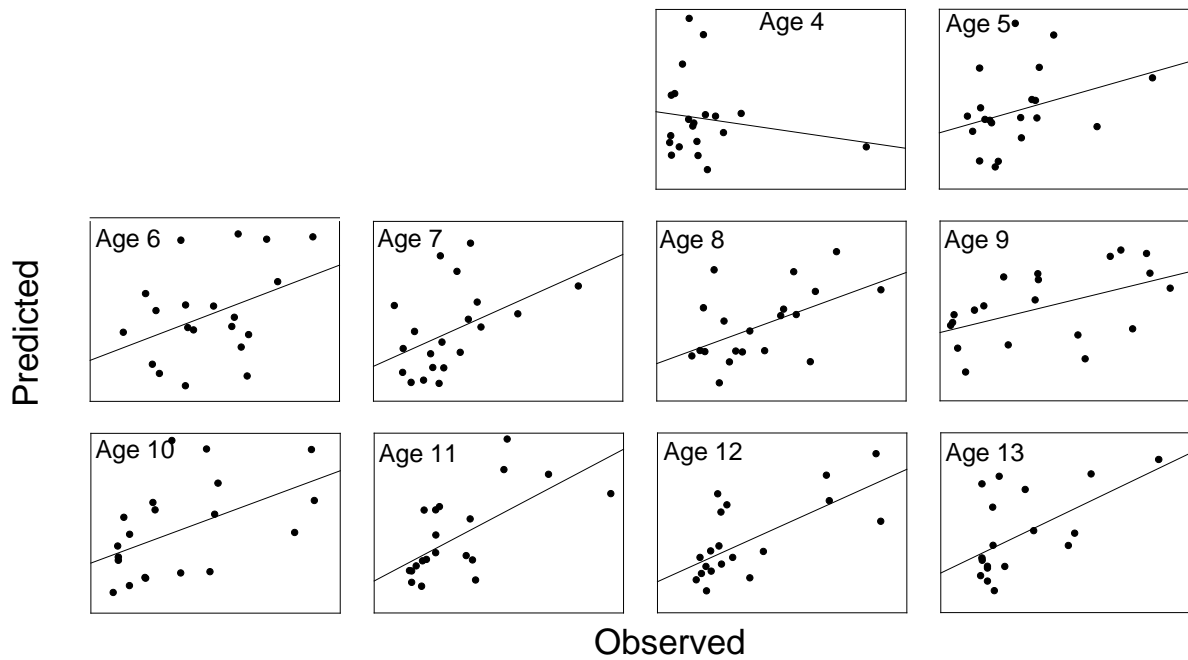
Figure 19. ADAPT adjustment between observed and predicted values at age. D) Longline sentinel survey, E) Gillnet sentinel survey.

A)
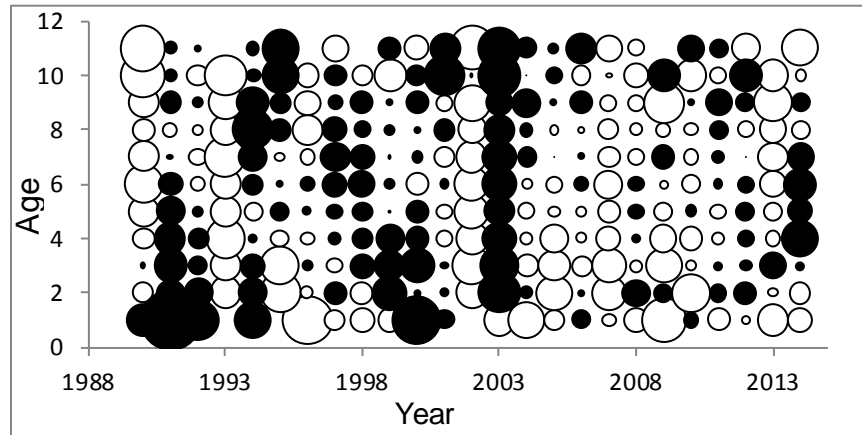
B)
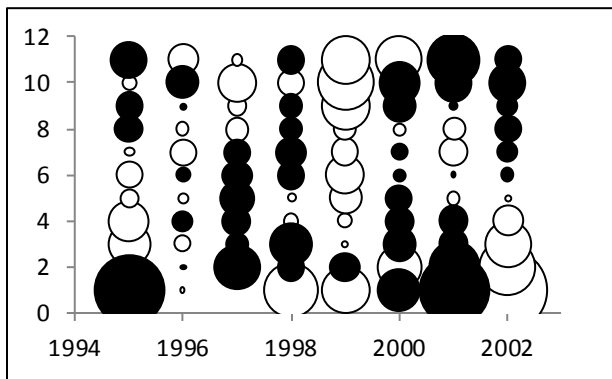
C)

D)
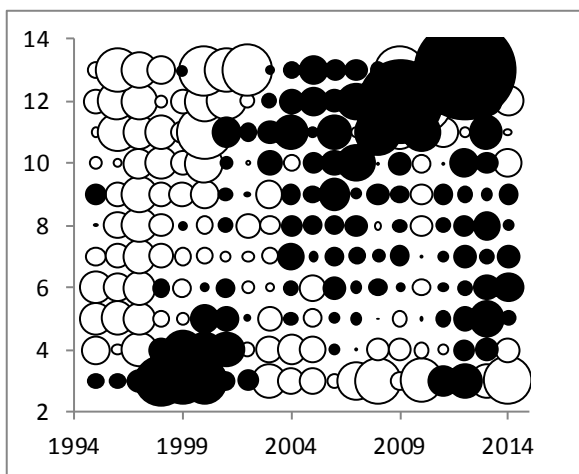
E)
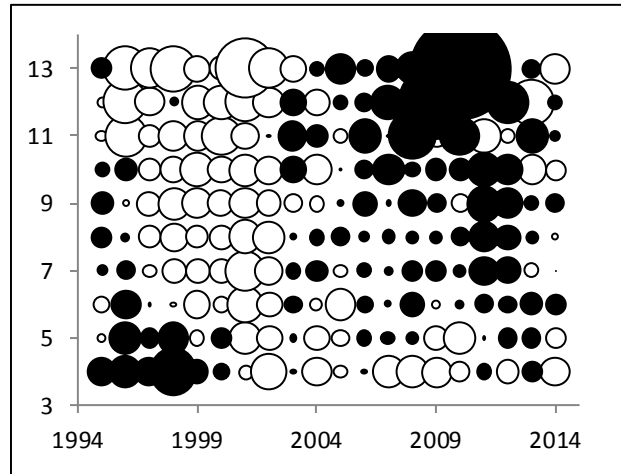
Dark = positive, clear = negative

Figure 20. Distribution of residuals from the ADAPT model. A = DFO Survey, B = Mobile gear sentinel survey > 20 f., C = Mobile gear sentinel survey > 10 f., D = Longline sentinel survey, E) Gillnet sentinel survey.
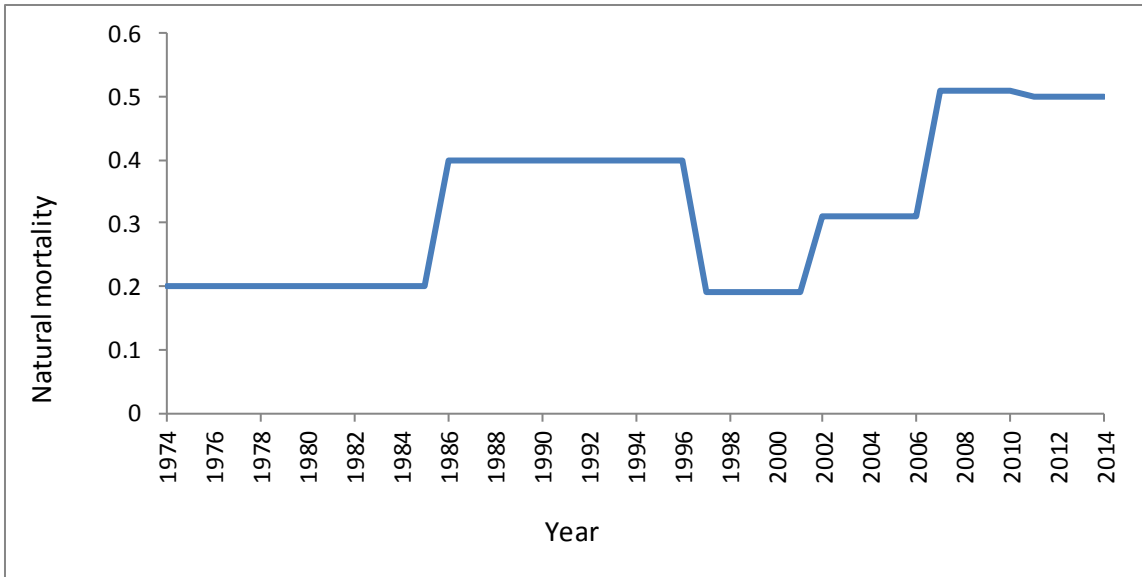
Figure 21. Natural mortality set values from 1974 to 2001. Estimated values from 2002 to 2014 (three four-year blocks).

A)
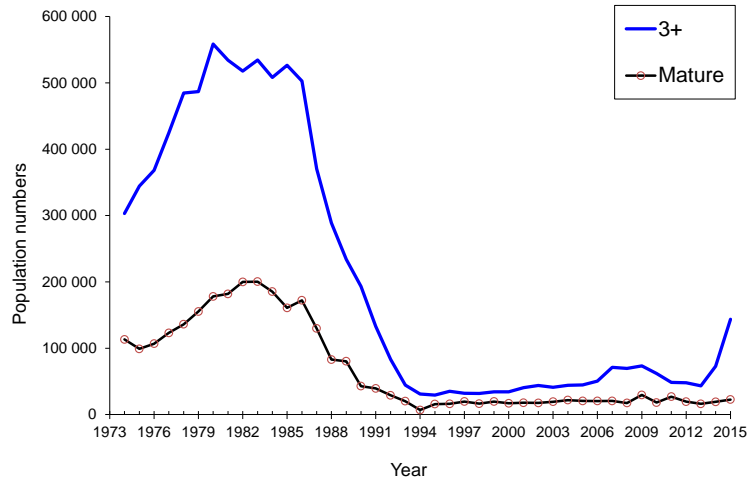
B)
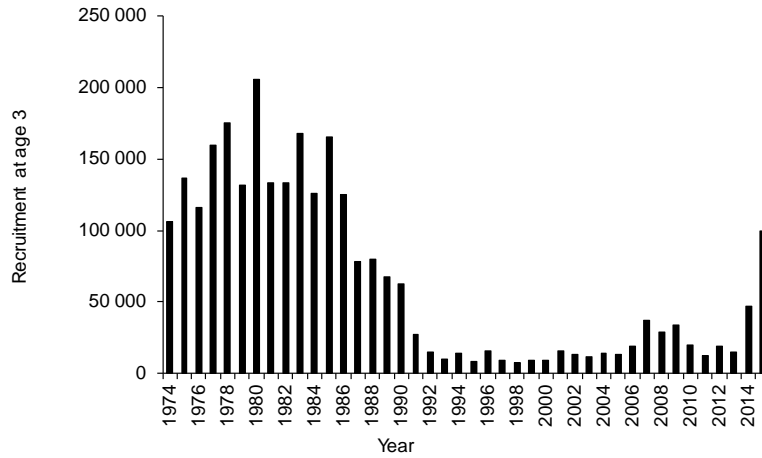
C)
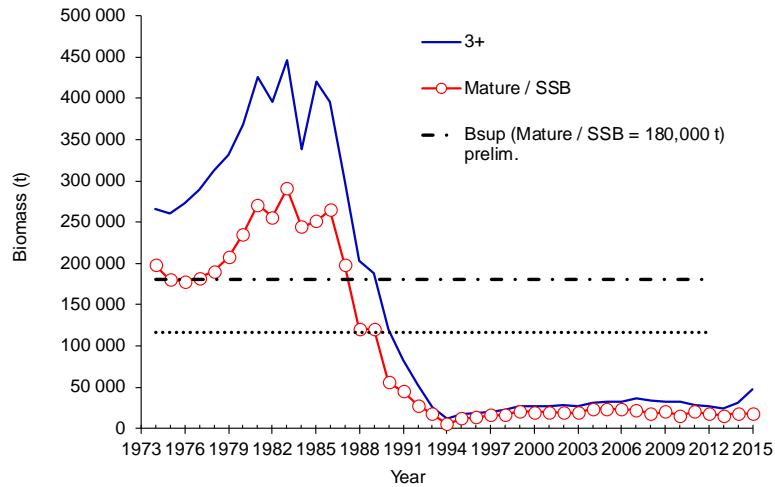
Figure 22. Main assessment findings A = Population, B = Recruitment, C = Biomass.

D)
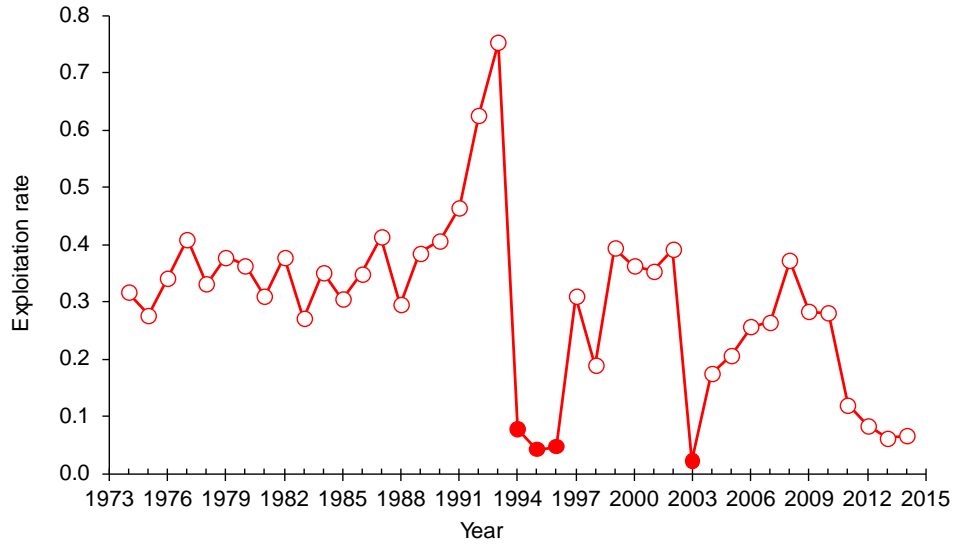
E)
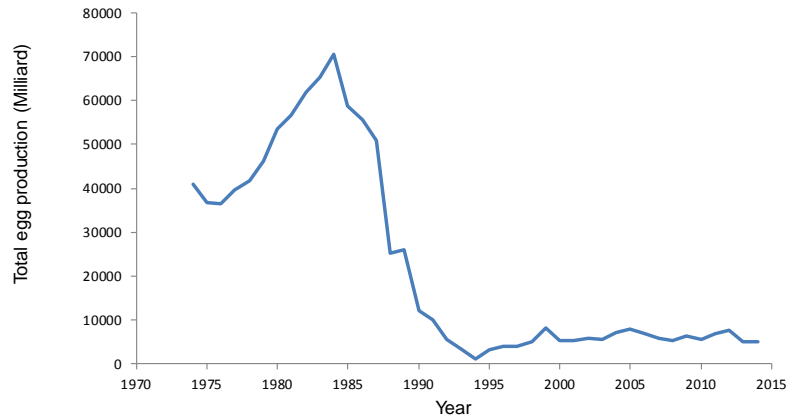
F)
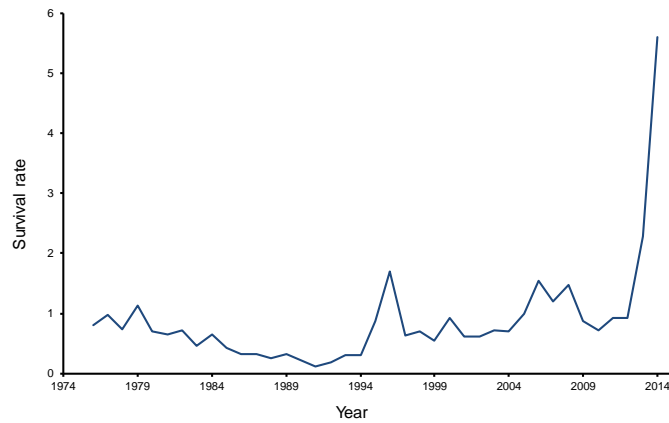
Figure 22. Main assessment findings D = Exploitation rate, E = Egg production, F= Survival rate.
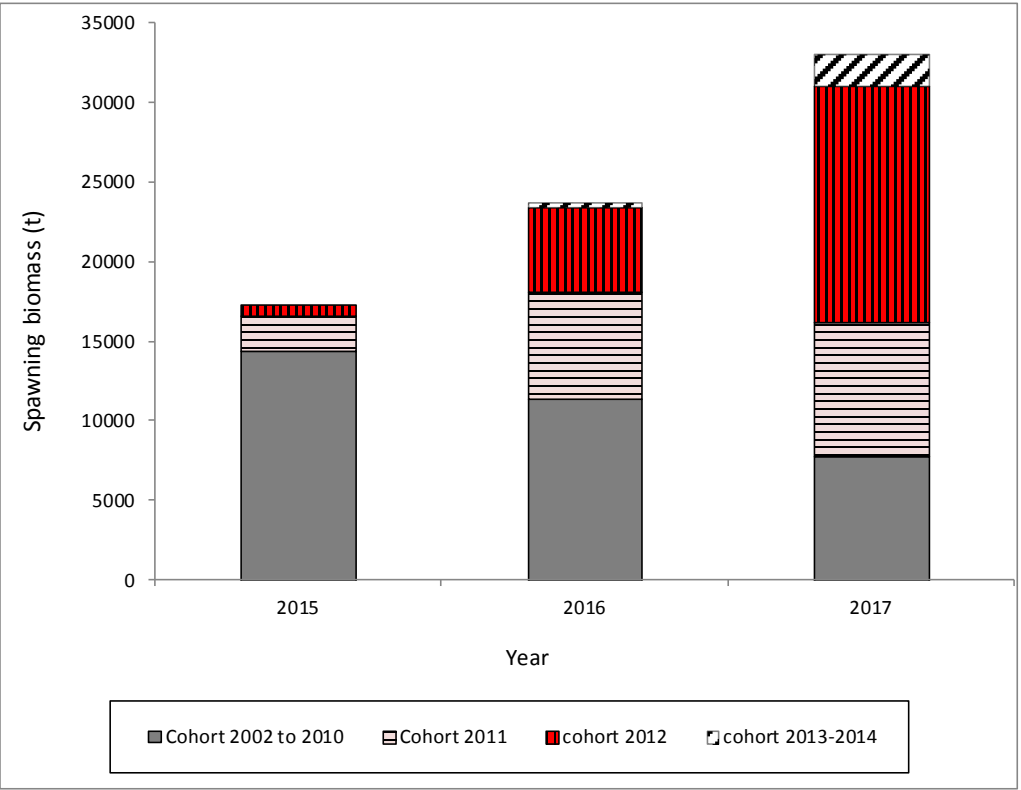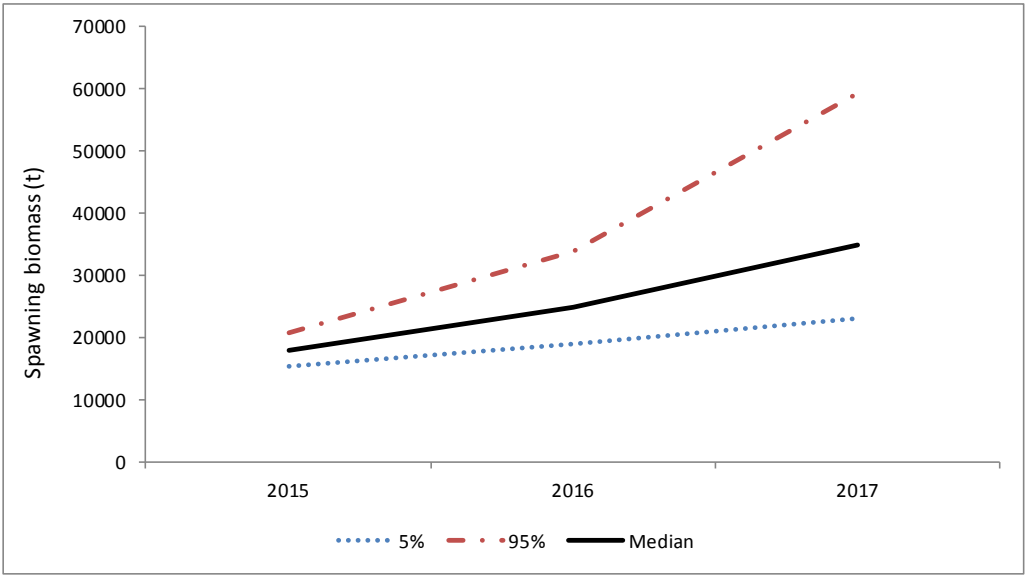
Figure 23. Projection-at-age analysis results with a 1500 t/year harvest (NFT AGEPRO).

10. APPENDICES

Appendix 1. Questionnaire from the industry telephone survey on Cod fishery.

Questions for Industry Telephone Survey of Fixed Gear Cod Fishers (3Pn, 4R) - 2014.

Questions on Biology

1. What zone did you primarily fish in this year 2014(3Pn, 4Ra, b, c, d)?

2. How would you compare the size (overall length) of fish this year (2014) with last year (2013)?

(1 - much smaller, 2 - smaller, 3 - same, 4 - larger, 5 - much larger)

3. How would you compare the condition (fatness, health) of fish captured in late summer / fall season this year (2014) with last year (2013)?

(1 - much lower, 2 - lower, 3 - same, 4 - higher, 5 - much higher)

Questions on Catch Rates

4. Using a scale of 1-10 (poor to excellent), how would you rate your catch rates during July-September (4R), and October-November (3Pn) this year (2014)?

5. Using a scale of 1-10 (poor to excellent), how would you rate your catch rates during July-September (4R), and October-November (3Pn) last year (2013)?

*Use the following as a general number index!

In other words, for the amount of gear you fished, would you describe the fishing as;

Poor (1-3), average (4-6), good (7-8), excellent (9-10).

Additional Questions on Cod Tagging

6. Did you recapture a cod(s) with tag(s) in 2014?

(1- Yes or 2 – No)

7. Did you report (i.e. send into FFAW or DFO) yet?

(1- Yes or 2 – No)

If No to question 7, please inform them that we receive the tags and request that they send in ASAP – try to ensure that they record our address. (FFAW – P.O. Box 548, Corner Brook, NL, A2H 6E6). If possible, provide recovery date, location of recapture, depth of water, length, weight, gear used.

Questions on Atlantic Halibut Fishing / Tagging

8. Did you fish Atlantic Halibut in 2014? (1- Yes or 2 – No)

9. Did you recapture Atlantic Halibut(s) with tag(s) in 2014?

(1- Yes or 2 – No)

10. Did you report Atlantic Halibut Tag(s) (i.e. send into FFAW or DFO) in 2014?

(1- Yes or 2 – No)

If No to question 10, please inform them that we receive the tags and request that they send in ASAP – try to ensure that they record our address. (FFAW – P.O. Box 548, Corner Brook, NL, A2H 6E6). If possible, provide recovery date, location of recapture, depth of water, length, weight, gear used.

Appendix 2. List of Collaborators for 2012-2014 Sentinel Fisheries.

Maurice Lamontagne Institute:

Philippe Schwab	Coralie Tournois
Johanne Gauthier	Sylvain Hurtubise
Claude Brassard	Denis Bernier
Hélèna Talbot	Pierre-Marc Scallon-Chouinard
Marie-Hélène Soucy	Marie-Claude Marquis

F.F.A.W (Corner Brook):

David Decker	Jason Spingle
Loomis Way	Gerald MacDonald
Monty Way	Myra Swyers

Association de Pêcheurs de la Basse-Côte-Nord (La Tabatière):

Paul Nadeau	Frank Collier
Monica Green	Marty Evans

Association des Capitaines Propriétaires de la Gaspésie (Rivière-au-Renard):
Jean-Pierre Couillard

Fishers :

Master	Crew	Location
Quebec mobile gear:		
Jean-Pierre Élement	Rémy Élément	Sept-Iles
	Martin Élément	
Clément Samuel	Normand Samuel	Rivière-au-Renard
	Michel Campion	
	Sylvain Bujold	
Marcel Roy	Paul-René Clavet	Rivière-au-Renard
	Jean-Guy Côté	Cloridorme
Quebec fixed gear:		
Keith Anderson	Rodney Jones	Harrington Harbour
Marty Etheridge	Garry Etheridge	Bradore Bay
Ian Anderson	Daren Anderson	Chevery
Dennis Keats	Donald Keats	St. Paul's River
Norman Keats	Edward Keats	St. Paul's River
Wesley Etheridge	Bobby Etheridge	Bradore Bay
Jean-Yves Mercier	André Mercier	Port-Cartier
	Michel Mercier	
Irené Marcoux	Francis Marcoux	Tête-à-la-Baleine
Victor Monger	Jerry Mansbridge	Tête-à-la-Baleine
	Marius Marcoux	
Jean-Louis Monger	Slyva Marcoux	Tête-à-la-Baleine

Master	Crew	Location
Newfoundland mobile gear:		
Winsor Hedderson	Milton Lawless	Port Saunders
	Jamie Walters	
	Bryan Plowman	
	Jarvis Pittman	
	Camille Bolger	
	Randy Gould	
	Victor Bussey	
Leonard Warren	Enos Gaulton	Cook's harbour
	Curtis Dredge	
	Jamie Warren	
Dereck Coles	Noah Doyle	Sandy Cove
	Nelson Coles	
	Marcus White	
Murray Lavers	Philip Ryan	Port Saunders
	Barry Ryan	
	Warren House	
	Thomas Lavers	
Dan Genge Jr.	Kevin Genge	Flower's Cove
	Hank Poole	
	Daniel Genge	
	Gregory Genge	
Newfoundland fixed gear:		
Peter Francis	Selena Francis	Lapoile
Wilfred Munden	Harry Munden	Rose Blanche
	Albert Munden	
Kevin Hardy	Blandford Francis	Burnt Islands
Charles Riles	Fredrick Riles	Port aux Basques
Cecil Coley	John Coley	Isle aux Morts
Carl Bennett	Pius Anderson	Codroy
Bernard Barter	Deanna Barter	Lourdes
	Calvin Duffney	
John C. Hardy	Peter W. Herritt	Burnt Islands
Terry Decker	No Crewmember	Rocky Harbour
Alvin House	Shawn Perry	Daniels Harbour
	Sheila House	
	Kent House	
	Bruce Pieroway	
Joseph Brake	Shawn White	Trout River
	Lori Ann Hann	
Colby Cullihall	Roland McLean	Green Island Cove
	Dwight Macey	
Clayton Taylor	John Taylor	St. Anthony
Mervin Layden	Eric Layden	Red Bay
Cecil Ryland	Douglas Ryland	L'Anse au Loup
Randy Gould	No Crew Member	Port au Choix
Harry Vautier	Dolores Vautier	Lapoile

Appendix 3. Fixed gear sentinel survey program, number of activities by zone, site, gear, and month in 2014.

		Gillnet								Longline													Total
		Month								Month													
Zone	Site	1	6	7	8	9	10	11	Total	1	2	3	4	5	6	7	8	9	10	11	12	Total	Total
1	1											1		5	1					1		8	8
	2													2	4	1	1	4	1		2	15	15
	4													2	1	1	2	1	3	1	2	13	13
	5									1	2			2	2	2	2	2	2	3	2	20	20
	6									1	1	1	1	2	2	1	2	3	2	2	3	21	21
	7														3	3	4	3	5		2	20	20
2	8														4		4	6	4	2	2	22	22
	11															5	7		6			18	18
3	14			8	8	4			20														20
	15			9	7	4	1		21														21
	17															2	9			1		12	12
	21			3	6	4	5		18														18
4	23		1	9	8	1	2	1	22														22
	24		2	6	6	4			18														18
	28			6	10	2			18														18
5	30		2	15	5				22								5	4				9	31
	34			12	8				20						3	3	2	4				12	32
	36		3	18	11	1			33														33
	37	1	3	16	11	2			33														33
6	42		7	13	13				33														33
	44		4	16	12				32														32
	46		6	14	13				33														33
	46.5		7	13	13				33														33
	48		6	13	11				30														30
Total		1	41	171	142	22	8	1	386	2	3	2	1	13	17	15	30	23	23	10	13	152	556

Appendix 4. Standardized catch per unit effort (CPUE) for the gillnet sentinel survey program from 1995 to 2014.

```
          Frequency tables of the categories affecting catch rates
                          The FREQ Procedure
                               Year

   YEAR        Frequency        Percent      Cumulative       Cumulative
                                             Frequency         Percent
   1995          792             5.93           792             5.93
   1996          916             6.86          1708            12.79
   1997          934             7.00          2642            19.79
   1998         1087             8.14          3729            27.93
   1999         1237             9.27          4966            37.20
   2000         1169             8.76          6135            45.96
   2001         1040             7.79          7175            53.75
   2002          956             7.16          8131            60.91
   2003          454             3.40          8585            64.31
   2004          455             3.41          9040            67.72
   2005          524             3.93          9564            71.65
   2006          489             3.66         10053            75.31
   2007          431             3.23         10484            78.54
   2008          423             3.17         10907            81.71
   2009          413             3.09         11320            84.80
   2010          422             3.16         11742            87.96
   2011          411             3.08         12153            91.04
   2012          417             3.12         12570            94.16
   2013          403             3.02         12973            97.18
   2014          376             2.82         13349           100.00


   MONTH       Frequency        Percent      Cumulative       Cumulative
                                             Frequency         Percent
     6          1391            10.42          1391            10.42
     7          4459            33.40          5850            43.82
     8          4959            37.15         10809            80.97
     9          2044            15.31         12853            96.28
    10           496             3.72         13349           100.00


   zonen       Frequency        Percent      Cumulative       Cumulative
                                             Frequency         Percent
     2           760             5.69           760             5.69
     3          2985            22.36          3745            28.05
     4          1966            14.73          5711            42.78
     5          3328            24.93          9039            67.71
     6          4310            32.29         13349           100.00


          Frequency tables of the categories affecting catch rates
                          The FREQ Procedure
  hrs_cod2     Frequency        Percent      Cumulative       Cumulative
                                             Frequency         Percent
     1          1270             9.52          1270             9.52
     2         10593            79.44         11863            88.97
     3           411             3.08         12274            92.05
     4          1060             7.95         13334           100.00
```

Frequency Missing = 15

Regression of the log catch rates with the categories

The GLM Procedure
Class Level Information

Class	Levels	Values
YEAR	20	1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
MONTH	5	6 7 8 9 10
zonen	5	2 3 4 5 6
hrs_cod2	4	1 2 3 4

Number of Observations Read 13370
Number of Observations Used 13334

Regression of the log catch rates with the categories
The GLM Procedure
Dependent Variable: logcpue Log of catch rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	30	5672.65890	189.08863	142.71	<.0001
Error	13303	17625.85778	1.32495		
Corrected Total	13333	23298.51669			

R-Square	Coeff Var	Root MSE	logcpue Mean
0.243477	50.53917	1.151066	2.277573

Source	DF	Type III SS	Sum of Squares	F Value	Pr > F
MONTH	4	1291.645229	322.911307	243.72	<.0001
zonen	4	2001.810560	500.452640	377.71	<.0001
hrs_cod2	3	42.693037	14.231012	10.74	<.0001
YEAR	19	2306.671926	121.403786	91.63	<.0001

```
Parameter          Estimate          Standard Error  t Value      Pr > |t|
Intercept          2.053742768 B     0.08807231      23.32        <.0001
MONTH 6            0.272310346 B     0.06291491      4.33         <.0001
MONTH 7            0.880643420 B     0.05721103      15.39        <.0001
MONTH 8            0.294462497 B     0.05612143      5.25         <.0001
MONTH 9            0.057559164 B     0.05889591      0.98         0.3284
MONTH 10           0.000000000 B     .               .            .
zonen 2            0.687819972 B     0.04682212      14.69        <.0001
zonen 3            0.830328628 B     0.02870138      28.93        <.0001
zonen 4           -0.279893433 B     0.03199539     -8.75         <.0001
zonen 5            0.468361244 B     0.02675090      17.51        <.0001
zonen 6            0.000000000 B     .               .            .
hrs_cod2 1        -0.194194941 B     0.05022514     -3.87         0.0001
hrs_cod2 2        -0.211997671 B     0.03785740     -5.60         <.0001
hrs_cod2 3        -0.244712088 B     0.06733489     -3.63         0.0003
hrs_cod2 4         0.000000000 B     .               .            .
YEAR 1995         -0.690208075 B     0.07341302     -9.40         <.0001
YEAR 1996         -0.273285847 B     0.07097699     -3.85         0.0001
YEAR 1997         -0.715009580 B     0.07067416     -10.12        <.0001
YEAR 1998         -0.472392236 B     0.06934410     -6.81         <.0001
YEAR 1999         -0.566116885 B     0.06815328     -8.31         <.0001
YEAR 2000         -0.454650594 B     0.06852259     -6.64         <.0001
YEAR 2001         -1.004406075 B     0.06965007     -14.42        <.0001
YEAR 2002         -0.736472350 B     0.07043695     -10.46        <.0001
YEAR 2003          0.155314088 B     0.08068920      1.92         0.0543
YEAR 2004          0.211521774 B     0.08043573      2.63         0.0086
YEAR 2005          0.138275782 B     0.07802544      1.77         0.0764
YEAR 2006          0.449429511 B     0.07909204      5.68         <.0001
YEAR 2007          0.186824954 B     0.08137112      2.30         0.0217
YEAR 2008          0.081045911 B     0.08169146      0.99         0.3212
YEAR 2009         -0.340319271 B     0.08215772     -4.14         <.0001
YEAR 2010         -0.373989414 B     0.08170178     -4.58         <.0001
YEAR 2011          0.376260437 B     0.08224661      4.57         <.0001
YEAR 2012          0.450962679 B     0.08190018      5.51         <.0001
YEAR 2013          0.068094212 B     0.08259971      0.82         0.4097
YEAR 2014          0.000000000 B     .               .            .
```

NOTE: The X'X matrix has been found to be singular, and a generalized inverse
      was used to solve the normal equations. Terms whose estimates are
      followed by the letter 'B' are not uniquely estimable.

```
                Regression of the log catch rates with the categories
                              The GLM Procedure
                            Least Squares Means

      MONTH            Logcpue           Standard          Pr > |t|
                       LSMEAN             Error
       6              2.32919417        0.03644952          <.0001
       7              2.93752725        0.02574693          <.0001
       8              2.35134632        0.02479898          <.0001
       9              2.11444299        0.03188259          <.0001
      10              2.05688383        0.05567056          <.0001

      zonen            Logcpue           Standard          Pr > |t|
                       LSMEAN             Error
       2              2.70437560        0.04692237          <.0001
       3              2.84688426        0.02746416          <.0001
       4              1.73666220        0.03240864          <.0001
       5              2.48491687        0.02876693          <.0001
       6              2.01655563        0.02715537          <.0001

      hrs_cod2         Logcpue           Standard          Pr > |t|
                       LSMEAN             Error
       1              2.32641015        0.03499565          <.0001
       2              2.30860742        0.01720496          <.0001
       3              2.27589300        0.05839646          <.0001
       4              2.52060509        0.03891358          <.0001

      YEAR             Logcpue           Standard          Pr > |t|
                       LSMEAN             Error
      1995            1.84312688        0.04501276          <.0001
      1996            2.26004911        0.04241964          <.0001
      1997            1.81832538        0.04256321          <.0001
      1998            2.06094272        0.03943330          <.0001
      1999            1.96721808        0.03818472          <.0001
      2000            2.07868437        0.03907869          <.0001
      2001            1.52892889        0.04049865          <.0001
      2002            1.79686261        0.04188603          <.0001
      2003            2.68864905        0.05778546          <.0001
      2004            2.74485673        0.05739360          <.0001
      2005            2.67161074        0.05409068          <.0001
      2006            2.98276447        0.05634488          <.0001
      2007            2.72015991        0.05897124          <.0001
      2008            2.61438087        0.05975244          <.0001
      2009            2.19301569        0.06088840          <.0001
      2010            2.15934555        0.06028813          <.0001
      2011            2.90959540        0.06072118          <.0001
      2012            2.98429764        0.06055539          <.0001
      2013            2.60142917        0.06157301          <.0001
      2014            2.53333496        0.06356680          <.0001
```

```
The standard category is defined by:

month = 8
zonen = 3
hrs_cod2 = 2

In 1995 the predicted catch rate is 18.871 with standard error 0.915576.
In 1996 the predicted catch rate is 28.63543 with standard error 1.331706.
In 1997 the predicted catch rate is 18.41139 with standard error 0.836801.
In 1998 the predicted catch rate is 23.46928 with standard error 1.010781.
In 1999 the predicted catch rate is 21.37156 with standard error 0.873046.
In 2000 the predicted catch rate is 23.89084 with standard error 0.994572.
In 2001 the predicted catch rate is 13.78591 with standard error 0.603764.
In 2002 the predicted catch rate is 18.02091 with standard error 0.808757.
In 2003 the predicted catch rate is 43.92698 with standard error 2.632057.
In 2004 the predicted catch rate is 46.46739 with standard error 2.77321.
In 2005 the predicted catch rate is 43.19481 with standard error 2.41738.
In 2006 the predicted catch rate is 58.95654 with standard error 3.375716.
In 2007 the predicted catch rate is 45.33228 with standard error 2.731462.
In 2008 the predicted catch rate is 40.77996 with standard error 2.490408.
In 2009 the predicted catch rate is 26.75733 with standard error 1.641515.
In 2010 the predicted catch rate is 25.87149 with standard error 1.585809.
In 2011 the predicted catch rate is 54.78148 with standard error 3.392517.
In 2012 the predicted catch rate is 59.03038 with standard error 3.657787.
In 2013 the predicted catch rate is 40.25006 with standard error 2.54035.
In 2014 the predicted catch rate is 37.59657 with standard error 2.434086.
```

Appendix 5. Standardized catch per unit effort (CPUE) for the longline sentinel fisheries program from 1995 to 2014.

```
          Frequency tables of the categories affecting catch rates
                           The FREQ Procedure
                                 Year
```

YEAR	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1995	812	10.10	812	10.10
1996	749	9.31	1561	19.41
1997	586	7.29	2147	26.69
1998	470	5.84	2617	32.54
1999	441	5.48	3058	38.02
2000	495	6.15	3553	44.18
2001	587	7.30	4140	51.47
2002	596	7.41	4736	58.88
2003	394	4.90	5130	63.78
2004	379	4.71	5509	68.49
2005	271	3.37	5780	71.86
2006	320	3.98	6100	75.84
2007	312	3.88	6412	79.72
2008	313	3.89	6725	83.61
2009	277	3.44	7002	87.06
2010	258	3.21	7260	90.26
2011	248	3.08	7508	93.35
2012	198	2.46	7706	95.81
2013	169	2.10	7875	97.91
2014	168	2.09	8043	100.00

Month	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	225	2.80	225	2.80
2	150	1.86	375	4.66
4	192	2.39	567	7.05
5	366	4.55	933	11.60
6	597	7.42	1530	19.02
7	1078	13.40	2608	32.43
8	1651	20.53	4259	52.95
9	1562	19.42	5821	72.37
10	1029	12.79	6850	85.17
11	760	9.45	7610	94.62
12	433	5.38	8043	100.00

zonen	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	3856	47.94	3856	47.94
2	1527	18.99	5383	66.93
3	971	12.07	6354	79.00
4	921	11.45	7275	90.45
5	768	9.55	8043	100.00

gear	Frequency	Percent	Cumulative Frequency	Cumulative Percent
51	4303	53.50	4303	53.50
52	3740	46.50	8043	100.00

Hrs_cod2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	1698	21.14	1698	21.14
2	4046	50.37	5744	71.51
3	1187	14.78	6931	86.28
4	1102	13.72	8033	100.00

Frequency Missing = 10

Regression of the log catch rates with the categories

The GLM Procedure
Class Level Information

Class	Levels	Values
Year	20	1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Month	11	1 2 4 5 6 7 8 9 10 11 12
Zonen	5	1 2 3 4 5
gear	2	51 52
hrs_cod2	4	1 2 3 4

Number of Observations Read 8064
Number of Observations Used 8033

Regression of the log catch rates with the categories
The GLM Procedure

Dependent Variable: logcpue Log of catch rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	37	9741.63182	263.28735	197.37	<.0001
Error	7995	10665.36936	1.33400		
Corrected Total	8032	20407.00118			

R-Square	Coeff Var	Root MSE	logcpue Mean
0.477367	24.94339	1.154991	4.630450

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Month	10	2594.333133	259.433313	194.48	<.0001
Zonen	4	3145.952318	786.488080	589.57	<.0001
gear	1	6.957527	6.957527	5.22	0.0224
hrs_cod2	3	91.364216	30.454739	22.83	<.0001
Year	19	1001.349070	52.702583	39.51	<.0001

Parameter	Estimate	Standard Error	t Valeur	Pr > |t|
Intercept	4.034003056 B	0.12664139	31.85	<.0001
Month 1	-1.871424870 B	0.09565190	-19.56	<.0001
Month 2	-2.630075064 B	0.11047739	-23.81	<.0001
Month 4	-1.082173394 B	0.10119716	-10.69	<.0001
Month 5	0.156755676 B	0.08259956	1.90	0.0578
Month 6	0.036548138 B	0.07467334	0.49	0.6245
Month 7	-0.152307798 B	0.06850330	-2.22	0.0262
Month 8	0.247371974 B	0.06698725	3.69	0.0002
Month 9	0.137151680 B	0.06733241	2.04	0.0417
Month 10	0.253280632 B	0.06789363	3.73	0.0002
Month 11	0.773689652 B	0.06985034	11.08	<.0001
Month 12	0.000000000 B	.	.	.

```
Parameter        Estimate           Standard Error  t Valeur    Pr > |t|
zonen 1          1.124383326 B      0.05470295      20.55       <.0001
zonen 2          0.873981332 B      0.05849545      14.94       <.0001
zonen 3          0.223330455 B      0.06544432      3.41        0.0006
zonen 4          -1.274888048 B     0.05795186      -22.00      <.0001
zonen 5          0.000000000 B      .               .           .
GEAR 51          -0.105919259 B     0.04637951      -2.28       0.0224
GEAR 52          0.000000000 B      .               .           .
hrs_cod2 1       0.379815096 B      0.05030995      7.55        <.0001
hrs_cod2 2       0.147835476 B      0.04484491      3.30        0.0010
hrs_cod2 3       0.207459422 B      0.04976351      4.17        <.0001
hrs_cod2 4       0.000000000 B      .               .           .
YEAR 1995        -0.893899739 B     0.10617149      -8.42       <.0001
YEAR 1996        -0.707018777 B     0.10702701      -6.61       <.0001
YEAR 1997        -0.850287491 B     0.10959018      -7.76       <.0001
YEAR 1998        -0.261323094 B     0.11126081      -2.35       0.0189
YEAR 1999        -0.053607735 B     0.11125162      -0.48       0.6299
YEAR 2000        0.075514987 B      0.10602774      0.71        0.4763
YEAR 2001        0.236023362 B      0.10320711      2.29        0.0222
YEAR 2002        -0.098423430 B     0.10261032      -0.96       0.3375
YEAR 2003        -0.016741349 B     0.10748237      -0.16       0.8762
YEAR 2004        0.504988937 B      0.10782962      4.68        <.0001
YEAR 2005        0.383248721 B      0.11406425      3.36        0.0008
YEAR 2006        0.558246778 B      0.11050453      5.05        <.0001
YEAR 2007        0.353512621 B      0.11092263      3.19        0.0014
YEAR 2008        -0.039650573 B     0.11101318      -0.36       0.7210
YEAR 2009        -0.203982515 B     0.11323472      -1.80       0.0717
YEAR 2010        -0.368723549 B     0.11475524      -3.21       0.0013
YEAR 2011        -0.084752082 B     0.11575558      -0.73       0.4641
YEAR 2012        0.169297650 B      0.12131086      1.40        0.1629
YEAR 2013        0.282638531 B      0.12609155      2.24        0.0250
YEAR 2014        0.000000000 B      .               .           .
```

NOTE: The X'X matrix has been found to be singular, and a generalized inverse
      was used to solve the normal equations. Terms whose estimates are
      followed by the letter 'B' are not uniquely estimable.

                Regression of the log catch rates with the categories
                            The GLM Procedure
                          Least Squares Means

MONTH	Logcpue LSMEAN	Standard Error	Pr > |t|
1	2.43201053	0.08150722	<.0001
2	1.67336034	0.09825360	<.0001
4	3.22126201	0.08847890	<.0001
5	4.46019108	0.06600417	<.0001
6	4.33998354	0.05057784	<.0001
7	4.15112760	0.03842300	<.0001
8	4.55080738	0.02979445	<.0001
9	4.44058708	0.03160596	<.0001
10	4.55671603	0.04042321	<.0001
11	5.07712505	0.04892720	<.0001
12	4.30343540	0.06180002	<.0001

zonen	Logcpue LSMEAN	Standard Error	Pr > |t|
1	4.86289519	0.02598242	<.0001
2	4.61249319	0.03565323	<.0001
3	3.96184232	0.04559988	<.0001
4	2.46362381	0.04866101	<.0001
5	3.73851186	0.05347414	<.0001

GEAR	Logcpue LSMEAN	Standard Error	Pr > |t|
51	3.87491365	0.03576993	<.0001
52	3.98083291	0.03340461	<.0001

hrs_cod2	Logcpue LSMEAN	Standard Error	Pr > |t|
1	4.12391087	0.03623230	<.0001
2	3.89193125	0.02947369	<.0001
3	3.95155520	0.04091905	<.0001
4	3.74409578	0.04355869	<.0001

YEAR	Logcpue LSMEAN	Standard Error	Pr > |t|
1995	3.08472047	0.05235801	<.0001
1996	3.27160144	0.05464267	<.0001
1997	3.12833272	0.05884930	<.0001
1998	3.71729712	0.06365908	<.0001
1999	3.92501248	0.06368712	<.0001
2000	4.05413520	0.05653263	<.0001
2001	4.21464357	0.05151022	<.0001
2002	3.88019678	0.05139326	<.0001
2003	3.96187886	0.06232428	<.0001
2004	4.48360915	0.06406670	<.0001
2005	4.36186893	0.07591120	<.0001
2006	4.53686699	0.06939396	<.0001
2007	4.33213283	0.07017311	<.0001
2008	3.93896964	0.06953060	<.0001
2009	3.77463770	0.07516413	<.0001
2010	3.60989666	0.07669242	<.0001
2011	3.89386813	0.07843536	<.0001
2012	4.14791786	0.08705723	<.0001
2013	4.26125874	0.09359459	<.0001
2014	4.26125874	0.09359459	<.0001

The standard category is defined by:

month = 9
zonen = 4
GEAR = 52
hrs_cod2 = 2

In 1995 the predicted catch rate is 16.67573 with standard error 1.34239.

In 1996 the predicted catch rate is 20.09843 with standard error 1.665187.

In 1997 the predicted catch rate is 17.40924 with standard error 1.518035.

In 1998 the predicted catch rate is 31.36929 with standard error 2.78341.

In 1999 the predicted catch rate is 38.60791 with standard error 3.46333.

In 2000 the predicted catch rate is 43.96492 with standard error 3.526585.

In 2001 the predicted catch rate is 51.63581 with standard error 3.935179.

In 2002 the predicted catch rate is 36.96122 with standard error 2.767944.

In 2003 the predicted catch rate is 40.09397 with standard error 3.171014.

In 2004 the predicted catch rate is 67.55316 with standard error 5.377697.

In 2005 the predicted catch rate is 59.76411 with standard error 5.300183.

In 2006 the predicted catch rate is 71.2226 with standard error 5.983262.

In 2007 the predicted catch rate is 58.03381 with standard error 4.909699.

In 2008 the predicted catch rate is 39.17047 with standard error 3.285907.

In 2009 the predicted catch rate is 33.22779 with standard error 2.866692.

In 2010 the predicted catch rate is 28.17515 with standard error 2.496444.

In 2011 the predicted catch rate is 37.42282 with standard error 3.370265.

In 2012 the predicted catch rate is 48.21577 with standard error 4.671711.

In 2013 the predicted catch rate is 53.96562 with standard error 5.591077.

In 2014 the predicted catch rate is 40.68127 with standard error 4.191775.

Appendix 6. Distribution of catch rates (kg/tow) and bottom temperatures during the May 2012, 2013 and 2014 reproductive potential survey.

2012
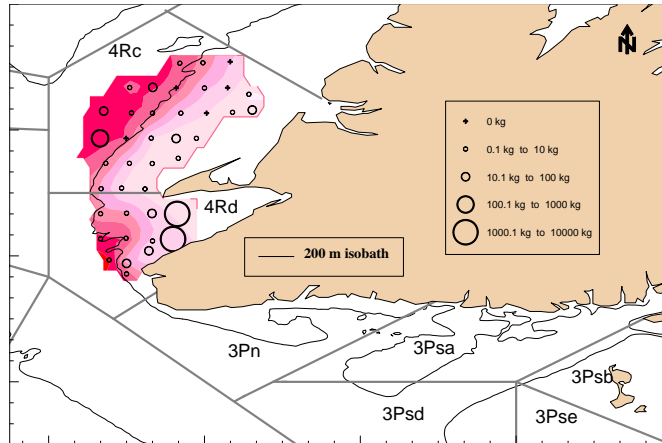
2013
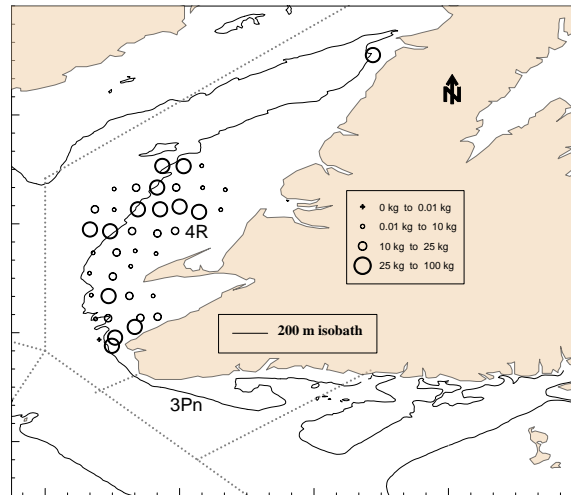
2014
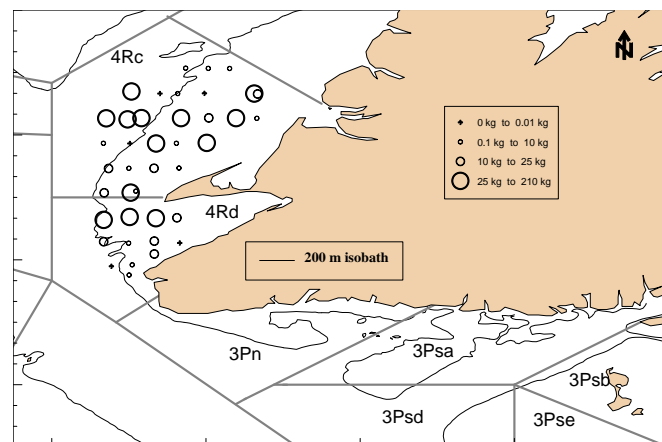
Appendix 7. Parameters of the sequential population analysis (SPA), conducted using the ADAPT/NFT model (VPA/ADAPT, version 3.4.5, NOAA Fisheries Toolbox, 2014).

- ❖ Catch at age (landing): $C_{i,t}$ {(i=1,13);(t=1974,2014)}
  The model assumes that the landed values contain no errors.

- ❖ Abundance index
  (DFO survey) $_{i,t}$ {(i=1,13);(t=1990,2014)}
  (Mobile sentinel, more than 20 fathoms) $_{i,t}$ {(i=1,13);(t=1995,2002)}
  (Mobile sentinel, more than 10 fathoms) $_{i,t}$ {(i=1,13);(t=2003,2014)}
  (Fixed sentinel – longline) $_{i,t}$ {(i=3,13);(t=1995,2014)}
  (Fixed sentinel – gillnet) $_{i,t}$ {(i=4,13);(t=1995,2014)}

- ❖ Weight at age (commercial catches): $CW_{i,t}$ {(i=1,13);(t=1974,2014)}

- ❖ Weight at age (as of January 1, Rivard methodology): $SW_{i,t}$
  {(i=1,13);(t=1974,2014)}

- ❖ Maturity at age: $Mat_{i,t}$ {(i=1,13);(t=1974,2014)}

- ❖ Natural mortality
  $M_{i,t}$ {(i=1,13);(t=1974,1985)} =0.2
  $M_{i,t}$ {(i=1,13);(t=1986,1996)} =0.4
  $M_{i,t}$ {(i=1,13);(t=1997,2014)} =0.2
  Note: The M values were subsequently estimated in four-year blocks (ages 3 to 12) by means of a sensitivity analysis (VPA/ADAPT/NFT).

- ❖ Starting population estimate
  Age 2=160 000; age 3=140 000; age 4=120 000, age 5=120 000; age 6=100 000;
  Age 7=90 000; Age 8=3 000; age 9=2 000; Âge10=1 000; age 11=300; age 12=200;

- ❖ Estimate of abundance at age for 2015:
  Geometric mean of abundance estimates from 2011 to 2014.

- ❖ Partial recruitment for 2014:
  Age 2=.00071; age 3=.00071; age 4=.01257, age 5=.05416; age 6=.23 725; age 7=35 911; age 8=5 845; age 9=93 256; age 10=1.0; age 11=99 125; age 12=.95 785; age 13=.91 143.

- ❖ Fishing mortality (Full-F) for the final year: Conventional method

- ❖ Fishing mortality (F) for the final year and last age group: Heincke's method

- ❖ Fishing mortality (F) for the last age group: Heincke's method applied to ages 11 and 12.

Appendix 8. Tagging: *a priori* used in the Bayesian approach to calculate initial mortality, tag return, and tag loss rates.

Parameter	Distribution
Initial mortality rate (June-October)	Beta(15.65)
Initial mortality rate (November-May)	Beta(5.70)
Simple tag returns	Beta(17.7)
Double tag returns	Beta(14.2)
High value tag returns	Beta(50.7)
Tag return rate: slope	Norm(0,0.001)
Tag return rate: intercept	Norm(0,0.001)

Appendix 9. Northern Gulf of St. Lawrence Cod Recovery Strategy (Gadus morhua) NAFO Divisions 3Pn, 4RS May 2013 – May 2018, harvest control rules in the event of an increase or decrease in spawning stock biomass (SSB).

SSB (t)	Harvest control rules (TAC (t) or F)	Corresponding measure TAC (t) or F or other measures
< 12,000		Moratorium
12,000 à < 15,000	$F^1 = 0.075$	Stewardship / by-catch
15,000 à < 18,000	F = 0.075	Variable (1,200 < 1,500 t)
18,000 < 25,000	TAC = 1,500 t	1,500 t
25,000 < 30,000	1,800 t	~F^1 = 0.067
30,000 < 40,000	3,185 t	~F^1 = 0.101

1. For fish aged 7 to 9, the F value is based on 2012 stock assessment data.

Appendix 10. Input parameters for the projection (2015-2017) based on 1,500 t/year landings (AGEPRO-NFT).

Age	1	2	3	4	5	6	7	8	9	10	11	12	13
Weight at age[1]	0.022	0.07	0.198	0.379	0.65	0.911	1.141	1.391	1.747	2.456	2.725	3.298	3.568
Weight at age (fishery)[2]	0.022	0.070	0.534	0.731	1.118	1.533	1.867	2.197	2.616	3.061	3.749	4.190	5.519
Maturity[3]	0.000	0.000	0.040	0.207	0.610	0.903	0.960	0.990	1.000	1.000	1.000	1.000	1.000
Partial recruitment[4]	0.0006	0.0006	0.0006	0.0122	0.0493	0.2260	0.3427	0.5482	0.7989	0.8168	1.0000	0.9560	0.9018
Natural mortality[5]	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

1 = Estimated values as of January 1, 2015 (Rivard method) based on DFO research survey.

2 = Average commercial fishery from 2012 to 2014.

3 = 2012 to 2014 average.

4 = Average fishing mortality from 2012 to 2014 (weighted by population).

5 = Values calculated using NFT-ADAPT (2012 to 2014 block).

Appendix 11a. Fixed gear sentinel survey program, longline operations from 1995 to 2014. Total catch over total effort (kg / 1000 hooks) per sentinel fishing area. Annual value with a 95% confidence interval. The solid line represents the 1995-2013 average. The dotted lines represent ± ½ standard deviation around the average.
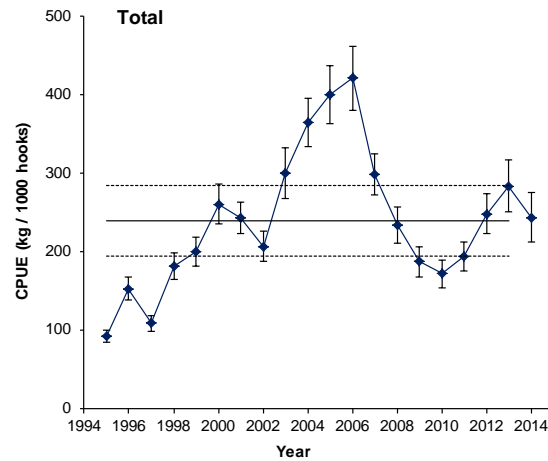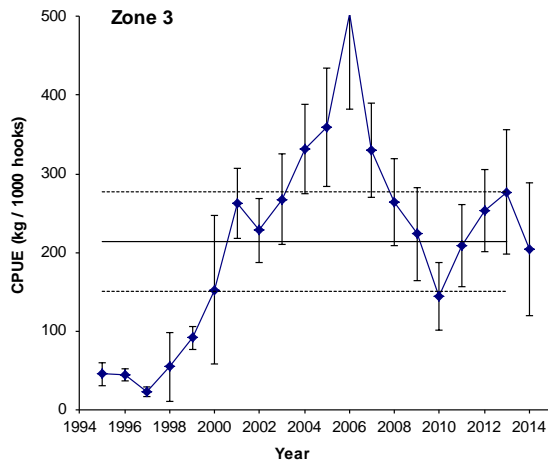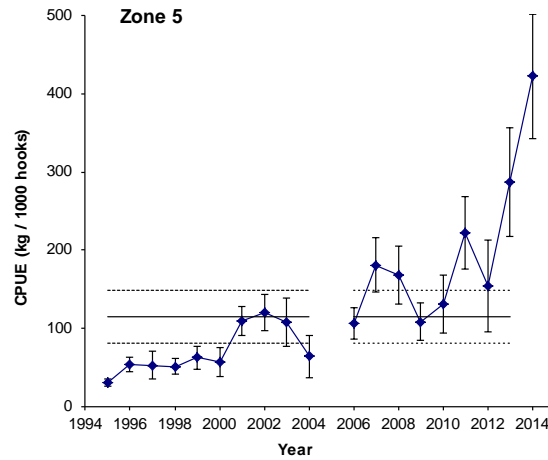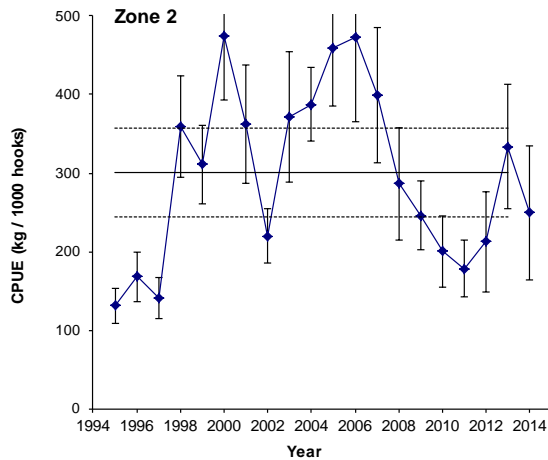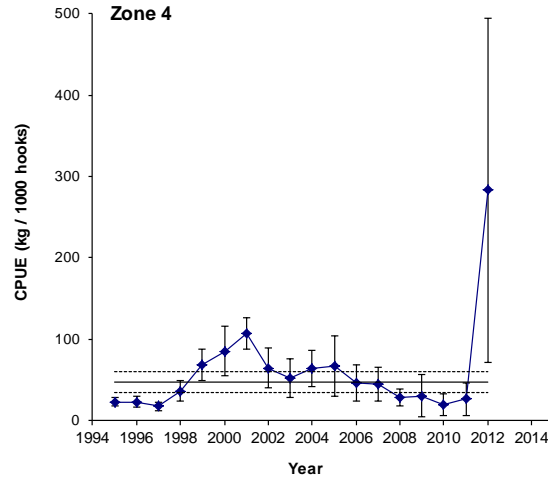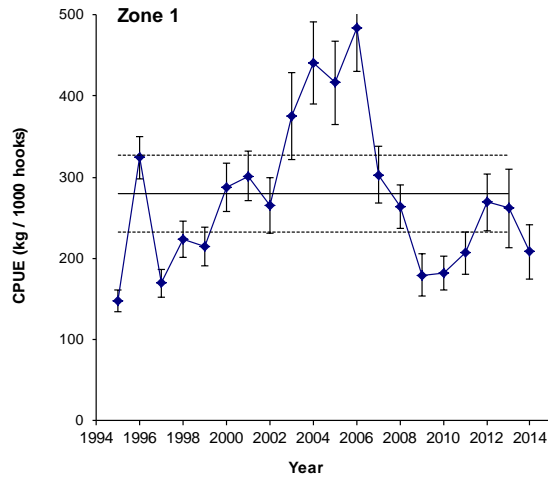
Appendix 11b. Fixed gear sentinel survey program, gillnet operations from 1995 to 2014. Total catch over total effort (kg / net) per sentinel fishing area. Annual value with a 95% confidence interval. The solid line represents the 1995-2013 average. The dotted lines represent ± ½ standard deviation around the average.
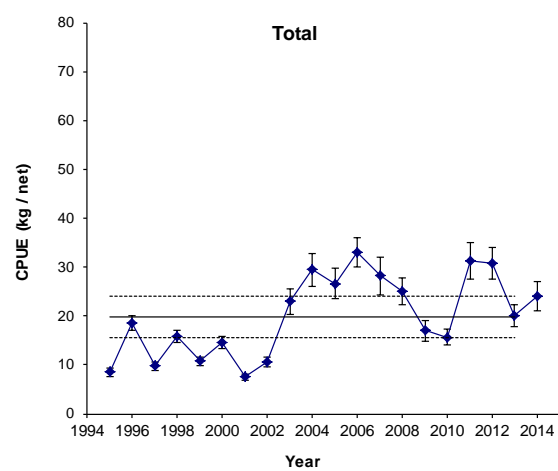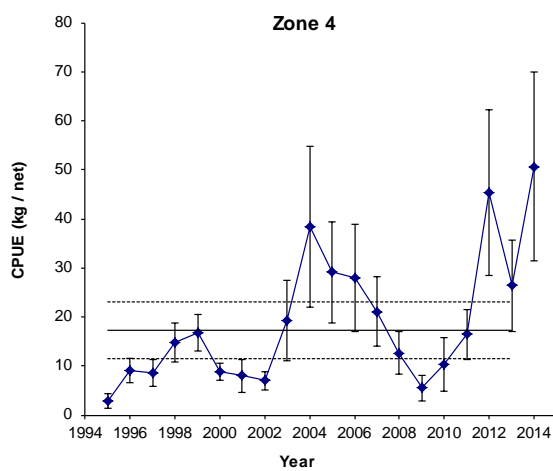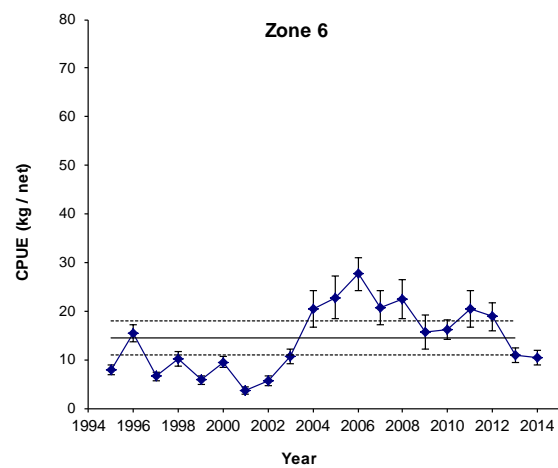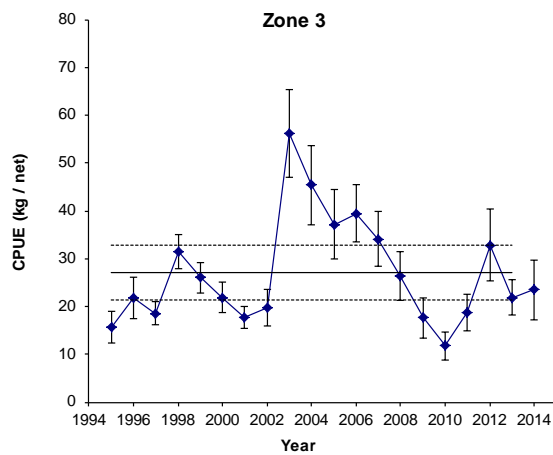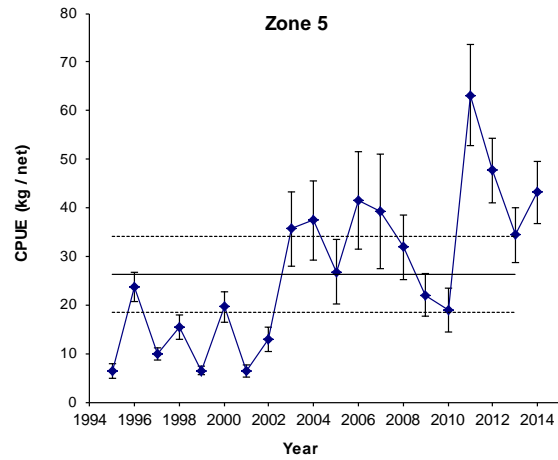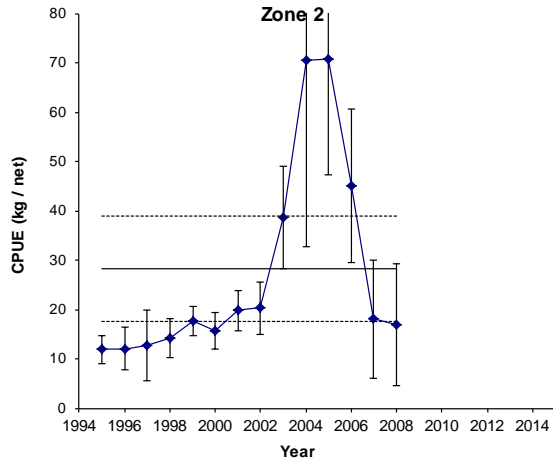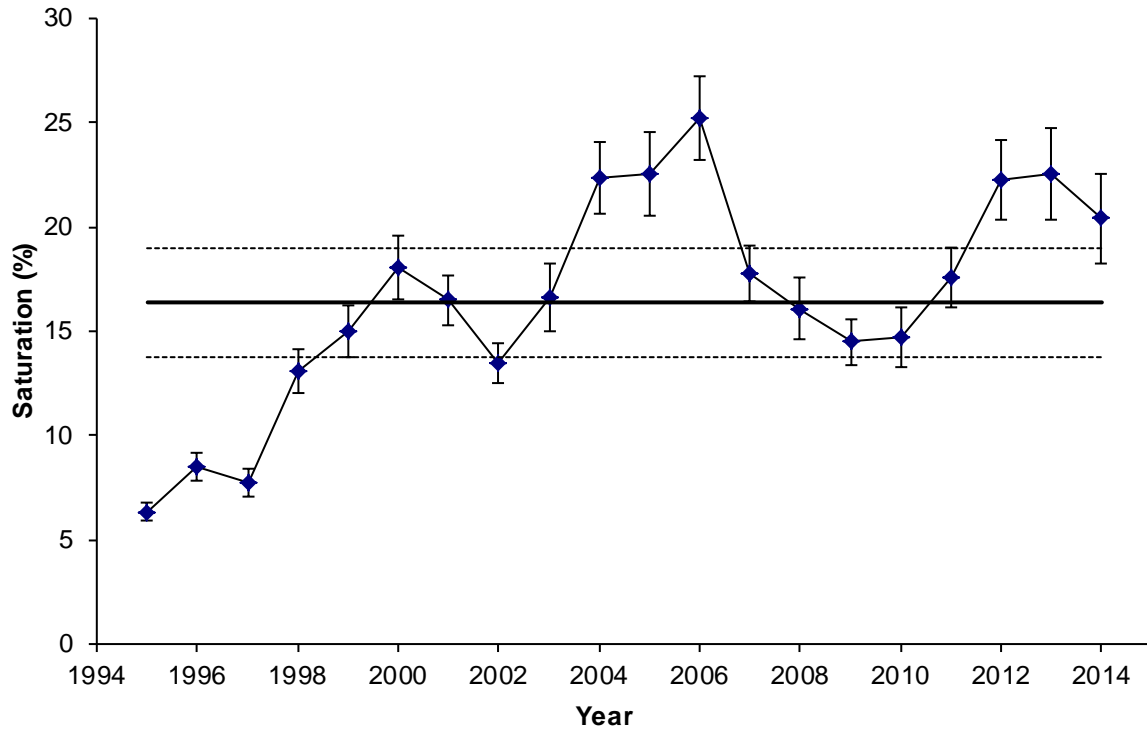
Appendix 12. Average annual longline saturation during sentinel survey program operations.

Appendix 13a. Number of tagged cod (NTC) and number of tag returns.

Year	NTC	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total	%
1995	1137	15	15	3	6	1	1	0	0	0	0	1	1	0	0	0	0	0	0	1	44	3.9
1996	10638	20	96	61	56	24	19	31	6	4	1	0	34	2	0	0	0	0	1	0	355	3.3
1997	5600		33	36	39	22	15	19	1	6	3	1	9	1	0	0	0	0	0	0	185	3.3
1998	5240			21	63	41	40	25	0	6	1	0	3	1	0	1	1	0	0	0	203	3.9
1999	6423				93	102	64	49	2	9	9	2	11	4	1	0	0	0	0	0	346	5.4
2000	7207					99	147	116	7	22	11	10	14	2	2	0	0	0	0	0	430	6.0
2001	6929						131	211	16	27	27	18	13	8	1	0	0	0	0	0	452	6.5
2002	5433							210	25	65	28	28	18	8	2	0	1	0	0	0	385	7.1
2003	2444								6	94	74	39	19	0	1	3	0	0	0	0	236	9.7
2004	1662									120	78	55	19	5	5	1	1	0	0	0	284	17.1
2005	3850										353	225	85	30	7	1	3	0	0	0	704	18.3
2006	3137											317	166	45	13	5	2	0	0	0	548	17.5
2007	4320												424	149	50	7	6	0	0	0	636	14.7
2008	2021													109	87	26	12	1	1	0	236	11.7
2009	1464														114	17	6	3	0	1	141	9.6
2010	1482															36	20	6	2	0	64	4.3
2011	2152																84	53	15	1	153	7.1
2012	2363																	80	40	18	138	5.8
2013	1300																		36	45	81	6.2
2014	2080																			39	39	1.9
Total	76882	35	144	121	257	289	417	661	63	353	585	696	816	364	283	97	136	143	95	105	5660	

Appendix 13b. Number of tag returns by NAFO Division.

Year	Tag return numbers										Total
	2J	3K	3L	4T	4Vn	3Ps	3Pn	4R	4S	na	
1996						3	20	30			54
1997						36	114	85	13		250
1998			1		1	48	109	99	18		277
1999	1	2	5	1		79	97	200	23		410
2000		2	1	2		53	106	243	34		443
2001		1				44	210	290	32	2	581
2002						36	370	278	38	11	734
2003						30	33	26	4	11	104
2004			3	1		70	231	115	17	5	442
2005				2		76	372	217	8	29	704
2006			3			57	355	344	7	25	791
2007						28	227	598	8	14	875
2008					2	20	126	231	12	6	397
2009						12	137	147	4	11	310
2010			1			9	51	46		5	112
2011						13	117	18	2	1	103
2012						11	133	10	0	2	156
2013						6	81	15		3	105
2014						4	95	11		4	114
Total	1	5	14	6	3	635	2984	3003	220	129	7000
%	0	0.1	0.2	0.1	0	9.1	42.6	42.9	3.1	1.8	