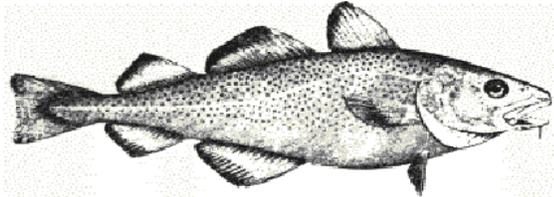




## Newfoundland and Labrador Region

## Stock Status Report A2-02(2002)



### Subdivision 3Ps cod

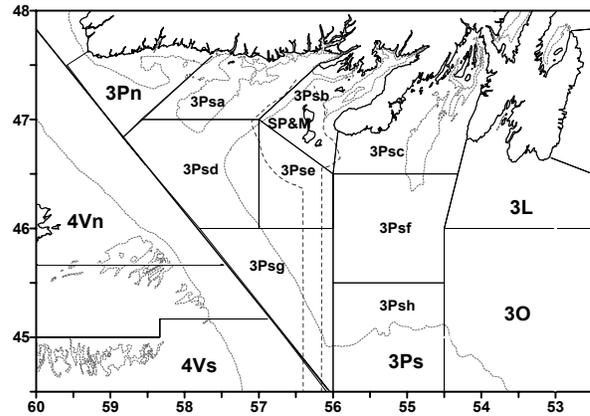
#### Background

In the Northwest Atlantic, cod are distributed from Greenland to Cape Hatteras and are managed as 12 stocks. The 3Ps stock off southern Newfoundland extends from Cape St. Mary's to just west of Burgeo Bank, and over St. Pierre Bank and most of Green Bank.

The distribution of 3Ps cod does not conform well to management boundaries and the stock is considered a complex mixture of sub-components. These may include fish that move seasonally between adjacent areas as well as fish that migrate seasonally between inshore and offshore. The extent to which the different components contribute to the fisheries is not fully understood.

Cod from this stock generally grow faster than those from areas further northward. At least 50% of the females are mature by age 5 (~53cm) in recent cohorts, compared to age 6 (~58cm) among cohorts present in the 1970s-early 1980s.

Catches from this stock have supported an inshore fixed gear fishery for centuries and are of vital importance to the area. Fish are caught offshore by mobile and fixed gear and inshore by fixed gear. Spanish and other non-Canadian fleets heavily exploited the stock in the 1960s and early 1970s. French catches increased in the offshore throughout the 1980s. A moratorium on fishing initiated in August 1993 ended in 1997 with a quota set at 10,000 t. The TAC was increased to 20,000 t for 1998 and to 30,000 t for 1999. Beginning in 2000, the management year was changed to begin on 1 April. An interim quota of 6,000 t was set for Jan.-Mar. 2000. The TAC for 1 April 2000 to 31 March 2001 was set at 20,000 t, but this was reduced to 15,000 t for 1 April 2001 to 31 March 2002 and 1 April 2002 to 31 March 2003.



#### Summary

- Stock status was estimated from commercial landings in conjunction with abundance indices from Canadian (1972-2002) research vessel trawl surveys, industry trawl surveys (1997-2001), and sentinel surveys (1995-2001). Exploitation rates were estimated from tagging experiments and sequential population analyses.
- During 2001, mean exploitation rate estimates from tagging declined slightly from those of 2000 to 0.19 and 0.11 for Placentia Bay and Fortune Bay, respectively, whereas the estimate for Burgeo Bank and Hermitage Channel (3Psd) was unchanged (0.06).
- Absolute size of the spawner biomass estimated from sequential population analyses continues to be very sensitive to model formulations.

- Spawner biomass estimates for 1 January 2002 from the sequential population analysis sensitivity runs ranged from 64,000 t to 167,000 t.
- Projections from all 5 SPA runs indicate that spawner biomass is expected to be higher by 2005 compared to 2002 under TAC options of 10,000, 15,000 and 20,000 t.
- The trends in the 3 year projections depend heavily on the accuracy of the high estimated strengths of the 1997-1999 year classes, and their subsequent survival and recruitment to the fishery in 2003-2005.
- Any TAC option that results in an increased catch in Placentia Bay could exacerbate the high exploitation rates in this area. Out of the 22 tagging experiments carried out in Placentia Bay, from which returns were obtained in 2001, 5 gave exploitation rates exceeding 20%.

### The Fishery

The stock was heavily exploited in the 1960s and early 1970s by non-Canadian fleets, mainly from Spain, with catches peaking at 84,000 t in 1961 (Fig. 1).

After the extension of jurisdiction in 1977, catches averaged around 30,000 t until the mid-1980s when fishing effort by France increased and total landings reached about 59,000 t in 1987. Catches then declined gradually to 36,000 t in 1992.

A moratorium was imposed in August 1993 after only 15,000 t had been landed. Although offshore landings have fluctuated, the inshore fixed gear fishery

reported landings around 20,000 t each year up until the moratorium (Fig. 2).

The fishery reopened in May 1997 with a TAC of 10,000 t. This was subsequently increased to 20,000 t for 1998 and to 30,000 t for 1999. In 2000 the management year was changed to begin on 1 April. An interim quota of 6,000 t was set for the first three months of 2000. For 1 April 2000 to 31 March 2001 the TAC was set at 20,000 t, and for the 2001-2002 and 2002-2003 management years the TAC was set at 15,000.

### Landings (000s t)

Year	77-93 Avg.	94-96 Avg <sup>1</sup>	1997	1998	1999	2000 <sup>2</sup> (J-M)	2000- 2001	2001- 2002 <sup>3</sup>	2002- 2003 <sup>3</sup>
TAC	-	0	10.0	20.0	30.0	6.0 <sup>2</sup>	20.0	15.0	15.0
Can.	25.0	1	7.4	16.6	20.4	3.5	20.3	13.2	8.4
French	14.7	0	1.6	3.1	3.2	4.7 <sup>4</sup>	4.7	2.3	0.8
Others	0.03	-	-	-	-	-	-	-	-
Totals	39.7	1	9	19.6	23.6	8.2	25.0	15.5	9.2 <sup>5</sup>

<sup>1</sup> During the moratorium catches were limited to by-catch and sentinel fishery.

<sup>2</sup> During 2000 the management year was changed to begin on 1 April (rather than 1 January) and an interim TAC of 6,000 t was allocated for the first three months (Jan.-Mar.) of 2000.

<sup>3</sup> Provisional.

<sup>4</sup> France is allocated 15.6% of the TAC but carried forward a portion the 1999 allocation to the first three months (Jan-Mar) of 2000.

<sup>5</sup> Approximate landings to end of September 2002.

In 2001-2002, total reported landings were 15,500 t, mostly (76.0%) from the fixed gear sector. The total includes a recreational fishery catch of 450 t, and a French catch of 2,300 t approximately 1,650 t of which was caught by otter trawlers and the remainder (651 t) by fixed gear, particularly gillnets.

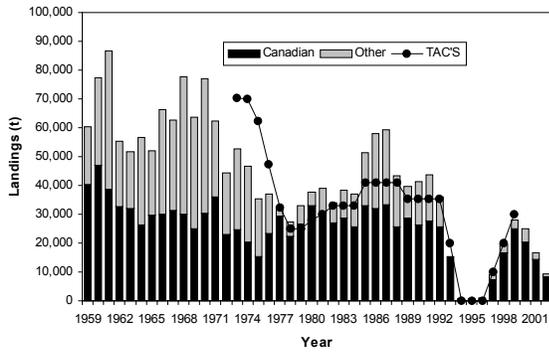


Figure 1. Reported annual landings (t) by country

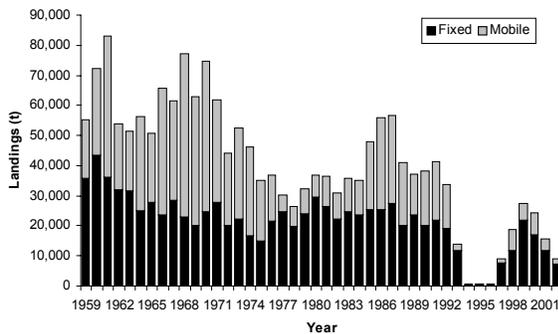


Figure 2. Reported annual landings (t) by gear sector.

The **age composition** of the fixed gear catch from 2001 comprised a range of ages from 3 to 15 with most of the catch (in terms of numbers) comprised of 4-9 year olds with ages 6-7 (1994-1995 year-classes) predominating. The total catch-at-age strongly reflects the selectivity of gillnets for ages around 6-9. Mobile gear catches in the offshore commercial fishery consisted mostly of 7-8 and 11-12 year olds; the older ages (11-12) were more strongly represented in mobile compared to fixed gear catches.

The gillnet catch in the first three months of 2002 was dominated by 6-8 year olds, whereas younger ages (4-7) were well represented in the line-trawl catch. The mobile gear catch for the corresponding period was dominated by 5-9 year olds with

12-13 year olds reasonably well represented.

**Species Biology**

**Stock structure and migration patterns** of 3Ps cod are complex and poorly understood. Migration of offshore components of the stock to inshore areas during spring and summer, as well as the existence of inshore components that remain outside the research vessel trawl survey areas throughout the year, complicate the assessment of stock status.

Annually variable **mixing** of northern Gulf (3Pn4RS) cod with 3Ps cod in the Burgeo Bank-Hermitage Channel area of 3Ps during winter may cause problems with respect to assigning survey and commercial catches to the appropriate stock. The offshore portion of this area (3Psd) has been closed to directed cod fishing from 15 November to 15 April since 1998-1999.

**Tagging studies** initiated in spring 1997 in Placentia Bay were expanded in subsequent years (1998-2001) to include inner and outer Fortune Bay and two offshore areas (Burgeo/Hermitage Channel and Halibut Channel). In these five years over 52,500 fish were tagged and 8,400 reported as recaptured. Cod tagged inshore were mostly recaptured inshore, even 4-5 years after release. Returns also indicated that some cod tagged offshore were recaptured in the inshore fixed gear fishery on the south coast during the summer and fall. Among cod tagged in the Burgeo/Hermitage Channel area in April, recaptures came from 3Pn4RS as well as along the inshore of 3Ps; but the proportions recaptured in each region varied annually

Recaptures also indicated a spring-summer **movement** of cod from the inner reaches of Placentia Bay toward the mouth of the bay. Several of these cod, as well as others tagged offshore in Halibut Channel, were recaptured in 3L particularly during 1998 and 1999. The pattern of recaptures suggests a movement of some 3Ps cod across the stock management boundary into 3L during late spring, with a return migration during late fall. Offshore tagging in southern 3Psh has also revealed some movement of cod between this area and the southern Grand Banks (3NO).

**Maturation** in female cod was estimated by cohort in the current assessment. Proportion of female cod mature at age as sampled during research trawl surveys has increased among younger cod, particularly between the late 1980s and early 1990s (Fig. 3). For example, the proportion of 6 year old females that are mature has increased from about 30% in the 1970s and early 1980s to over 80% in the early 1990s. The reasons for the continuing low age at maturity are not fully understood, but changing age at maturity can have considerable influence in the calculation of spawner biomass.

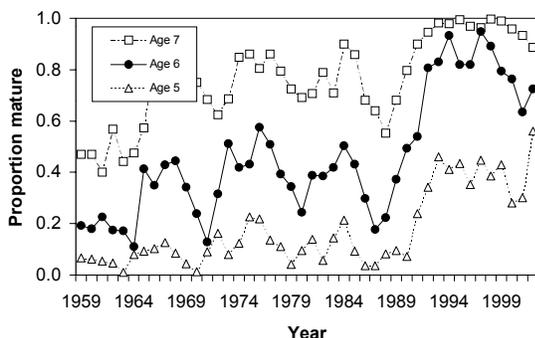


Figure 3. Estimated proportion mature at ages 5-7 (females).

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

**Spawning** is spatially widespread in 3Ps, occurring close to shore as well as on Burgeo Bank, St. Pierre Bank, and in Halibut Channel. Timing of spawning is variable and extremely protracted, with spawning fish present from March until August in Placentia Bay. The proportions of fish at various stages of maturation during the 2002 spring research vessel survey were similar to those observed in recent years.

**Growth**, calculated from length-at-age in research trawl survey samples, has varied over time. A peak occurred in the mid-1970s for young ages (3-4) and progressively later to 1980 for older ages. From the mid-1980s to the present, length-at-age tended to increase at young ages (2-3) and to vary with no clear trend at older ages. Year-to-year variability at older ages was considerable (as much as 20 cm at age 10) during the past decade or so. In general, current values of length at age are not unusual with respect to past values.

The **condition** of cod is typically expressed as  $W/L^3$ , where  $W$  is the gutted weight or liver weight, and  $L$  is the length. Comparison of post-1992 condition with that observed during 1985-1992 is difficult because survey timing has changed. Condition varies seasonally and tends to decline during winter and early spring. In general, condition of cod in the 1993-2002 surveys shows no clear trend but does not appear to be unusual.

## Resource Status

### Sources of information

Stock status at the end of March 2002 was updated using age-disaggregated data from **commercial landings** and **abundance indices** from Canadian (1972-2002) research vessel trawl surveys, industry trawl surveys (GEAC, 1997-2001), acoustic surveys (1996-2001), and sentinel surveys (1995-2001). Age-aggregated catch rate data from logbooks (1997-2001) were also examined. Annual exploitation rates were estimated from tagging experiments conducted in different regions of 3Ps during 1997-2001.

### Research vessel surveys

Canadian research vessel bottom **trawl surveys** were conducted from 1972-1982 by the research vessel A. T. Cameron using a Yankee 41.5 otter trawl. Surveys from 1983 to 1995 were conducted by the Wilfred Templeman, or the sister vessel the Alfred Needler, using the Engel 145 Hi-Lift otter trawl. Since 1996, the surveys have been conducted by the Wilfred Templeman using the Campelen 1800 shrimp trawl. Data collected with the gear used between 1983-1995 were converted to Campelen equivalents based on comparative fishing experiments.

The survey **biomass index** is variable but shows a declining trend from the mid-1980s to the early 1990s and a general upward trend in the more recent period (Fig. 4). The biomass index in 2002 was 66,000 t, slightly lower than the 2001 survey estimate.

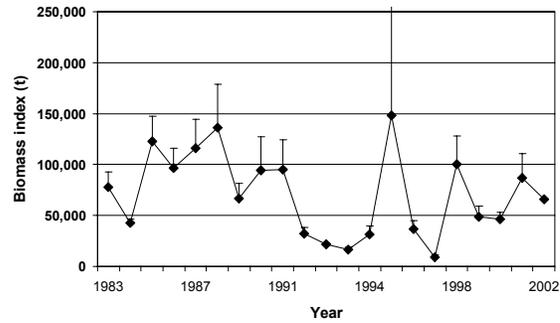


Figure 4. Research vessel survey biomass index (t) (+SD). There were two surveys in 1993.

As in the previous assessment, the survey index was also split into two series, the Burgeo area (western portion) and the remainder of 3Ps (eastern portion) to account for mixing with 3Pn4RS cod in the Burgeo area.

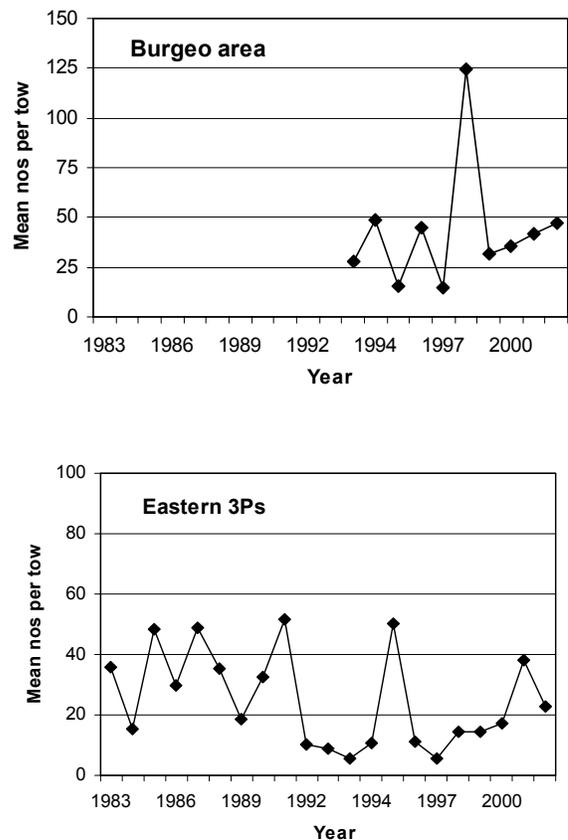


Figure 5. Research vessel survey catch rate index (mean nos per tow) for the Burgeo area and eastern portion of 3Ps.

The survey **catch rate index** for the western (Burgeo) portion of 3Ps shows no trend during 1993-1998 and a slight increase thereafter (Fig. 5). The 1998 survey encountered large numbers of 3-5 year old fish that were not strongly represented in subsequent surveys in this area.

The survey catch rate index for the eastern portion of 3Ps is variable, but shows a declining trend from the mid-1980s to the early 1990s. There has been a general upward trend since the early 1990s. The 1995 catch rate index was strongly influenced by a single large catch and the 1997 survey did not encounter aggregations of fish that were observed in subsequent surveys and commercial catches.

**Spatial distribution:** In the April 2002 survey, cod were less widely distributed across the top of St. Pierre Bank compared to 1999 and 2000 (Fig. 6); this change in distribution correlates well with the return to cooler temperatures in 2001-2002. The largest catches in 2002 were localized in the southern Halibut Channel, Fortune Bay, and in the Burgeo Bank-Hermitage Channel area.

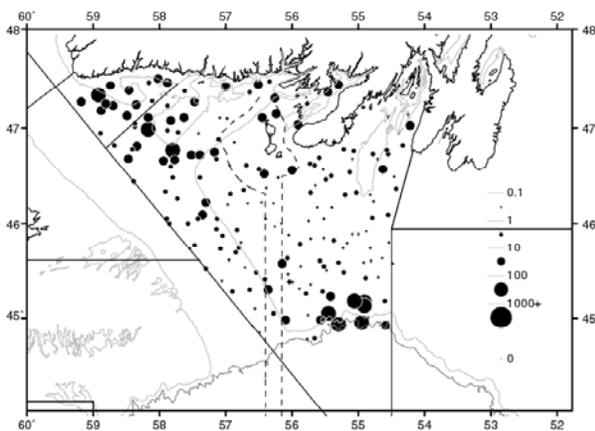


Figure 6. Spatial distribution of 2002 research vessel trawl survey catches.

**Age composition:** The most numerous ages in the 2002 survey were 4 and 5 (1997 and 1998 year-classes). Among older ages, the 1989 year-class is also well represented. However, survey catches over the post-moratorium period have consistently shown few survivors from year-classes born prior to 1989.

**Industry (GEAC, Groundfish Enterprise Allocation Council) trawl survey**

During fall 2001 a fifth consecutive industry survey was conducted with a standardized un-lined commercial trawl. In all years this survey has shown aggregations of cod in the southern Halibut Channel and on or adjacent to St. Pierre Bank.

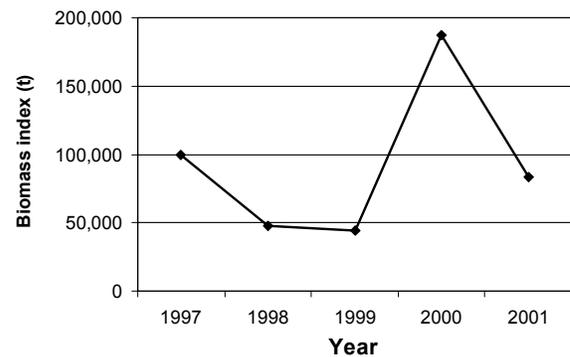


Figure 7. Biomass index from the industry (GEAC) trawl surveys.

The biomass index from the GEAC surveys is variable with no clear trend over time (Fig. 7).

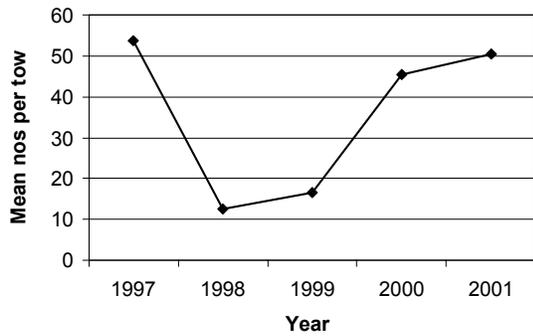


Figure 8. Catch rate index (numbers) from the industry (GEAC) trawl surveys.

The catch rate index (numbers per tow) from the GEAC surveys has also been variable with no clear trend from 1997 to 2001 (Fig. 8).

The 1989 and 1990 year-classes are strongly represented in the industry trawl surveys and in the 2001 results the 1997 and 1998 year-classes are also well represented. These results are in general agreement with those from spring research vessel trawl surveys.

**Sentinel survey**

Fixed gear **sentinel surveys** have been conducted at 16 sites along the south coast of Newfoundland from St. Brides to Burgeo from late February of 1995 and are continuing in 2002. However, the 2002 survey is not yet complete and the analysis could not be extended to include the current year.

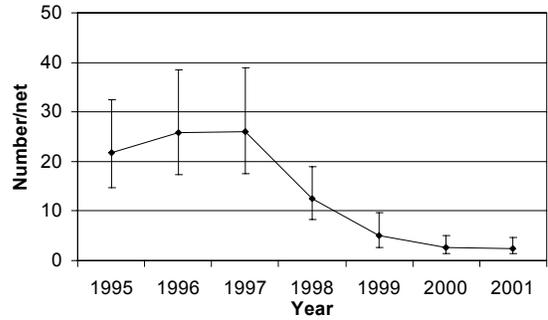
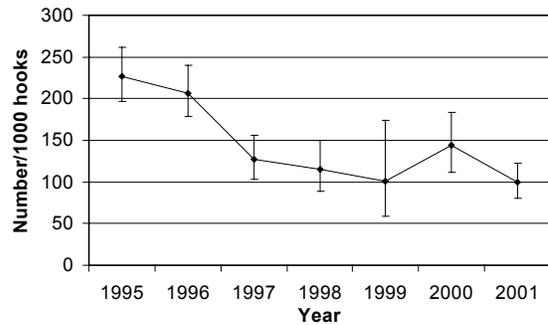


Figure 9. Standardized sentinel catch rate indices for gillnets (upper panel) and line-trawls (lower panel). Error bars are 95% confidence intervals for the estimates



Gillnet catch rates come mostly from sites in Placentia Bay whereas line-trawl catch rates come mostly from sites west of the Burin Peninsula.

The sentinel survey data were standardized to remove site and seasonal effects to produce annual indices of total catch rate and catch rate-at-age.

The standardized total annual **catch rate index** for gillnets shows no clear trend from 1995-1997, but was progressively lower in 1998, 1999 and 2000 and remained low in 2001 (Fig. 9, upper panel). The index for line-trawls shows a decline from 1996 to 1997, but has subsequently been relatively stable (Fig. 9, lower panel).

The standardized age-disaggregated indices for gillnets and line-trawls show

similar trends with the relatively strong 1989 and 1990 year-classes being replaced by subsequent weaker year-classes resulting in an overall decline in catch rates. The incoming 1997 and 1998 year-classes appear to be relatively strong in the line-trawl and gillnet indices in both 2000 and 2001, whereas catch rates for older fish (age classes prior to 1997) have continued to decline substantially.

### Log-books

Further analyses of the catch rate data from science logbooks (<35' sector) were conducted. There have been substantial changes in the management plans in the post-moratorium period, with respect to timing of the fishery, amount of gear fished, trip and weekly limits, as well as a trend toward individual quotas (IQs) rather than a competitive fishery. In addition, experience has shown that catch rates from more mobile fleets are often a poor reflection of overall trends in stock abundance, particularly for stocks in decline. Consequently, these data remain difficult to interpret and are treated with caution in terms of providing information about changes in stock size.

No new analyses of data from logbooks of larger vessels (>35' sector) were conducted. There is substantially less information from this sector and no information from 1997. The results up to 2000 were variable and not found to be informative regarding stock status.

Standardized annual catch rates from the logbooks for vessels fishing gillnets show declining trends during 1998-2000. A declining trend is also observed for line-trawls, particularly during 1997-1999. Note that the commercial index is based

on weight of fish caught whereas the sentinel index is based on numbers.

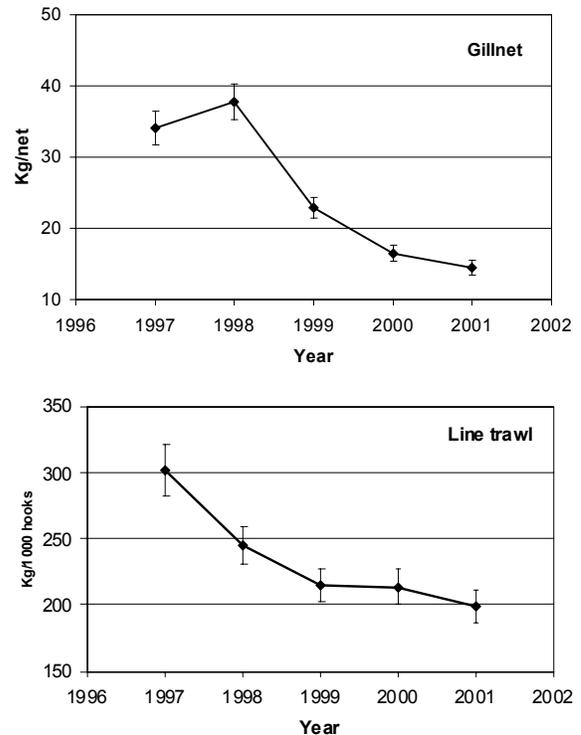


Figure 10. Standardized catch rates for gillnets and line-trawls from science logbooks for vessels <35'. Error bars are 95% confidence intervals of the means.

### Tagging

Information from recaptures of cod tagged in various regions of 3Ps since 1997 was used to estimate average **annual exploitation rates**. Exploitation rates were calculated for cod tagged in specific regions; a portion of the exploitation typically occurred in regions other than where fish were tagged so these estimates could not be converted to exploitable biomass using local catches.

During 1999 and 2000, mean exploitation was high (0.22-0.25) for cod tagged in Placentia Bay (3Psc), intermediate (0.14-0.15) for cod tagged in Fortune Bay

(3Psb), and low (0.04-0.06) for cod tagged in the Burgeo Bank – Hermitage Channel area (3Psd).

During 2001, mean exploitation estimates declined slightly to 0.19 and 0.11 for Placentia Bay and Fortune Bay, respectively, whereas the estimate for Burgeo Bank - Hermitage Channel (3Psd) was unchanged (0.06).

Mean exploitation was much lower (0.02 to 0.03) among cod tagged offshore (3Psh) throughout 1998-2001 in spite of substantial offshore landings. These low offshore exploitation rates are consistent with a large offshore biomass in relation to the magnitude of recent offshore catches. However, the offshore estimates of exploitation are considered uncertain because of restricted offshore tagging coverage and restricted distribution of fishing activity in the offshore, greater uncertainty in the reporting rates of tags from the offshore and lower survival of fish caught for tagging offshore in deep water.

### ***Industry perspective***

A perspective on several aspects of the 2001 commercial fishery is available from the responses to a questionnaire sent by the Fish, Food and Allied Workers (FFAW) Union to the fish harvesters' committees in 44 communities. Twenty of the committees (45%) responded to the questionnaire and 162 fish harvesters provided input. Overall, catch rates were considered to be about average, although half the respondents reported that catch rates were better in 2001 compared to 2000. Changes in management, particularly with respect to the trend away from a competitive fishery to IQ's, made comparison between years difficult.

Ninety-five percent of respondents reported better "sign" of small cod (<18") in 2001 compared to 2000.

Respondents from west of the Burin Peninsula felt the status of the stock may be better than was reflected by commercial and sentinel catch rates. In contrast, respondents from Placentia Bay generally felt that catch rate trends were reflective of stock status.

### ***Other considerations***

#### ***Temperature***

The warming trend seen during 1998-2000 has not continued, although water temperatures in 2002 were not as cold as those observed in 2001 when temperatures cooled to levels observed in the mid-1990s. The areal extent of relatively warm (>1°C) water in 2002 increased slightly over 2001 values. The areal extent of relatively cold (< 0°C) was 20-30%, similar to that observed in 2001.

Cold water in the late 1980s and early 1990s was associated with a disappearance of cod from the shallow strata on top of St. Pierre Bank and a shift to deeper water at the time of year when the research trawl survey was conducted. Survey results from recent years (1998-2000) when waters were warmer indicate some reappearance of cod in these shallow strata; however, in 2001 and 2002 the numbers of cod in these shallow strata were lower.

### Sequential Population Analyses

Five **sequential population analysis** (SPA) model formulations were applied in the current assessment to explore the uncertainty regarding the appropriate model. These constitute the same five model formulations used in the 2001 assessment, updated with one more year of data. In addition to the total reported commercial catch, results from DFO RV surveys, GEAC surveys and sentinel surveys were used in the analysis.

Results from the 5 SPA formulations suggest that there is considerable uncertainty about the absolute size of the cod population. The spawner stock biomass estimates for 1 January 2002 ranged from 64,000 to 167,000 t.

Trends in population size and spawner biomass are similar among different model formulations. The downward trend in 3Ps spawner biomass from 1999 to 2001 is a consistent feature of all SPA formulations considered in the current and previous assessment.

In an SPA run using the same tuning indices and model structure as was used in the 2000 and 2001 assessments of this stock, updated with one more year of data (**comparison SPA run**), population biomass and spawner biomass increased from the late 1970s to a peak in 1985 (Fig. 11). The stock declined from the mid-1980s to the early 1990s, but increased rapidly during 1993-1997 following the moratorium. Spawner biomass is estimated to have decreased during 1999-2001 and to have increased slightly in 2002.

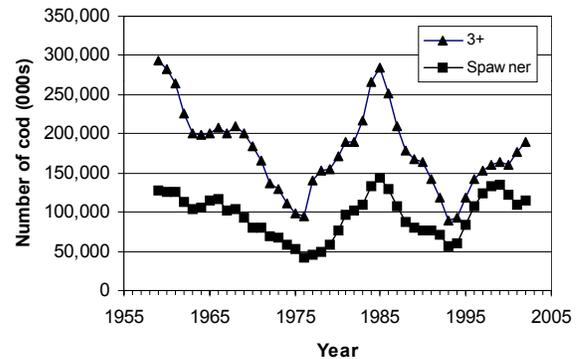


Figure 11. Spawning stock biomass and population (3+) biomass.

Estimates from the comparison SPA show that recruitment has been variable in 3Ps, with a long-term decline between year classes in the mid 1970s and the mid 1990s (Fig. 12). SPA estimates indicate that the 1997 to 1999 year class sizes, particularly the 1998 year class, are estimated to be relatively strong.

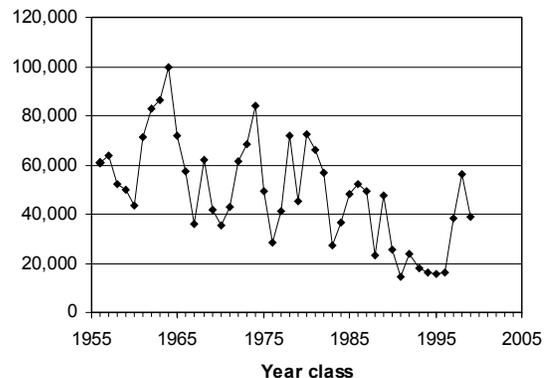


Figure 12. Recruitment (numbers at age 3).

Estimates from the comparison SPA run show that the annual **exploitation rate**, expressed as percentage of 3+ numbers removed by the fishery, varied over time. Exploitation during the late 1970s to 1984 was typically between 10 and 15%, but increased rapidly to between 18 and 26% just prior to the moratorium in 1993 (Fig. 13). With the reopening of the fishery in 1997, exploitation rates were low relative

to the pre-moratorium period and increased to above 10% in 1999, but thereafter have declined to below 10% again. However, fish tagged in Placentia Bay have experienced high exploitation rates in recent years relative to those tagged in other regions of the stock area.

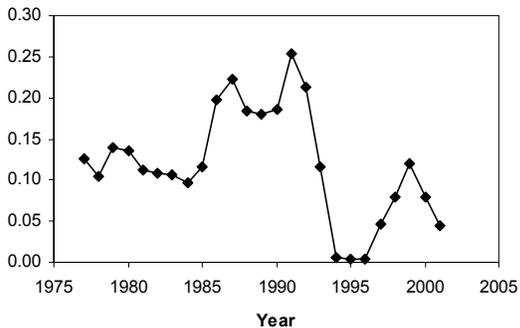


Figure 13. Exploitation rate.

### **Projections**

In the current assessment, 3-year deterministic projections to 1 April 2005 were carried out for all 5 SPA formulations, for TAC options ranging from 10,000 to 20,000 t for the 2003/2004 and 2004/2005 fishing seasons. All five projections indicate that spawner biomass is expected to be higher in 2005 compared to 2002 under the TAC options considered. However, any TAC option that results in an increased catch in Placentia Bay could exacerbate the relatively high exploitation rates in this area.

### **Sources of uncertainty**

Uncertainty in the interpretation of the research vessel survey index is aggravated by past changes in the timing of the survey. In the present assessment, the Burgeo Bank - Hermitage Channel portion of the survey was again treated as a separate index in some analyses due to

possible mixing between 3Pn4RS and 3Ps cod extending into April.

Although both the research vessel survey index and the GEAC survey index have large year effects depending on whether or not cod aggregations have been encountered in the offshore, the age-disaggregated data nevertheless contain useful information for modeling the population.

As described in the 2001 assessment, there is considerable uncertainty regarding the appropriate SPA formulation for this stock. Consequently five different SPA formulations were again evaluated in this assessment to explore this uncertainty.

There is considerable uncertainty regarding the origins of fish found in 3Ps at various times of year. Tagging experiments suggest that the amount of mixing with adjacent stocks can vary from year to year. The assessment is sensitive to mortality on 3Ps cod occurring when fish are outside 3Ps and to the incursions of non-3Ps fish into the stock area at the time of the survey and the fishery.

The sentinel gillnet index and to a lesser extent the line-trawl index show declines that are inconsistent with the SPA and with indices from other portions of the stock area. However, these declines are consistent with the inshore catch rate data from science logbooks and high estimates of relatively high exploitation from tagging in Placentia Bay. These findings suggest that there may be local depletion of the stock sub-components in Placentia Bay.

The 3 year deterministic projections do not take any uncertainties into account. The

trends in the 3 year projections depend heavily on the accuracy of the high estimates of the 1997-1999 year classes, and their subsequent survival and recruitment to the fishery in 2003-2005.

The offshore estimates of exploitation are considered uncertain because of restricted offshore tagging coverage and restricted distribution of fishing activity in the offshore, greater uncertainty in the reporting rates of tags from the offshore and lower survival of fish caught for tagging offshore in deep water.

### **Outlook**

In this assessment the absolute size of the spawner biomass in sequential population analyses was found to be very sensitive to model formulations.

Spawner biomass estimates for 1 January 2002 from the five sequential population analysis sensitivity runs ranged from 64,000 t to 167,000 t. Projections from all five SPA runs indicate that spawner biomass is expected to be higher in 2005 compared to 2002 under TAC options of 10,000, 15,000 and 20,000 t.

The trends in the 3 year projections depend heavily on the accuracy of the high estimates of the 1997-1999 year classes, and their subsequent survival and recruitment to the fishery in 2003-2005. However, any increase in catch at the present time could exacerbate the relatively high exploitation rates in the Placentia Bay fishery.

### **Management Considerations**

The incentive for under-reporting of catches remains with the implementation of trip limits, IQ's, as well as size-based

and quality-based price differentials. Increased monitoring of catches and landings would result in better estimates of deaths caused by fishing.

Because of uncertainties in stock structure, excessive exploitation on sub-components of the stock should be avoided. Measures should be implemented to reduce the relatively high exploitation rate in Placentia Bay (3Psc) that is evident from analyses of the tagging data, sentinel catch rate indices, and commercial catch rate indices for vessels <35'.

The consequences of further area/time closures should be carefully considered as these may result in higher exploitation rates on the components of the stock that remain open to fishing.

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