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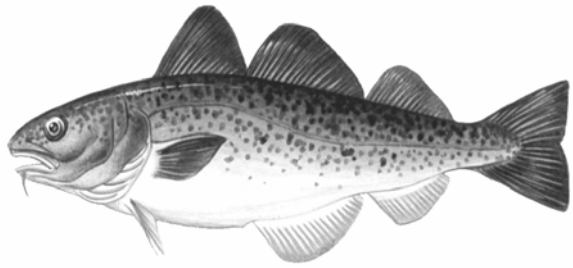
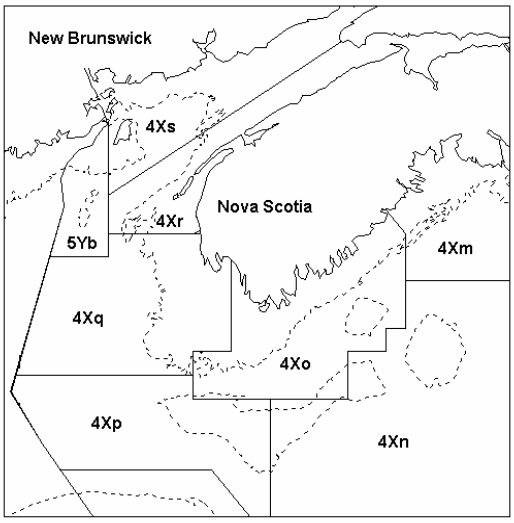
Maritimes Region
Canadian Science Advisory Secretariat
Science Advisory Report 2006/046

COD ON THE SOUTHERN SCOTIAN SHELF AND IN THE BAY OF FUNDY (DIV. 4X/5Y)





Context

Atlantic cod (Gadus morhua) is a bottom dwelling North Atlantic fish. Cod range from Georges Bank to northern Labrador in the Canadian Atlantic. There are several concentrations of cod within this range, including those on the southern Scotian Shelf and Bay of Fundy in NAFO Divisions 4X and 5Y.

Juvenile cod feed on a wide variety of invertebrates and as they grow include fish in their diet. Seasonal movements associated with spawning occur and a number of spawning areas exist in this management area. Cod in this area reach on average 53 cm (21 inches) by age 3 years and increase to 72 cm (29 inches) by age 5 and 110 cm (43 inches) by age 10. Growth rates, however, vary, with more rapid growth noted for cod in the Bay of Fundy. Age at first reproduction generally occurs at 3 years and individuals tend to spawn several batches of eggs during a single spawning period.

Cod has supported a commercial fishery in this area since the 1700s. Following extension of jurisdiction to 200 miles by coastal states in 1977, only Canada has made substantial landings of cod from this area. Minimum mesh size and hook size regulations have been enacted to reduce the catch of small cod. Closure of Browns Bank is in place from 1 February-15 June.

SUMMARY

- Recent landings reflect the restrictive total allowable catch (TAC; Fig. 1). The TAC was reduced to 5500 t in 2005 and landings dropped to the lowest recorded level at 3850 t.
- **Biomass** has remained low since 2000 when the quota was reduced to 6000 t to promote rebuilding.
- There is no indication of a decline in total mortality or relative fishing mortality since 2000.
- Survey recruitment estimates for the 2004 year-class are low.
- While landings of about 4,000t are contributing to a continuing decline in abundance, further restriction of the directed fishery may not be sufficient to lead to an increase in population.
- Removals from all fisheries should be reduced to as low a level as practicable.

INTRODUCTION

Rationale for Assessment

Advice was requested by Fisheries and Aquaculture Management on the stock status of 4X cod to inform the management of the 2007-2008 fishery. Specifically:

- Evaluate whether the latest fisheries and research survey trends indicate any reason to change the advice for this stock for the 2007/08 fishery.

The Fishery

Landings* (000s t)

Year	1970-1979 Avg	1980-1989 Avg.	1990-1999 Avg.	2000-2001 Avg	2002	2003	2004	2005	2006
TAC	-	23.4	15.4	6	6	6	6	5.5	5
Total	22.5	24.9	15.2	5.9	5.8	5.5	4.7	3.8	

*Commencing in 2000, fishing year, landings and TAC refer to the period April 1st of the current year to March 31st of the following year

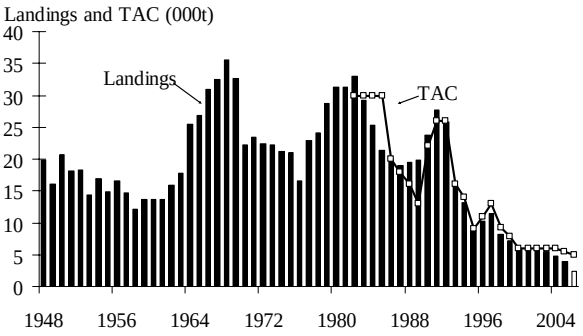


Figure 1. Landings and TAC for 4X cod by quota year.*

In the 1960s, **landings** increased as domestic and foreign otter trawl fleets joined the predominantly hook and line fishery (Fig. 1), then dropped in 1970 as effort declined due to restrictions on haddock fishing. Recent landings reflect the restrictive total allowable catch (TAC; Fig. 1). The TAC was reduced to 5500 t in 2005 and landings dropped to the lowest recorded level at 3850 t. As of November 3rd, 2832 t of the 2006 quota had been landed. With the low quotas, many participants in the fishery are reserving cod as a bycatch in other directed fisheries.

The distribution of the fishery has shifted in 2005 and 2006, with less of the landings coming from the Bay of Fundy. The proportion of landings taken in 4Xp in 2006 is the highest observed in the time series and there has been a slight increase in the landings from the inshore Scotian Shelf. (Fig. 2).

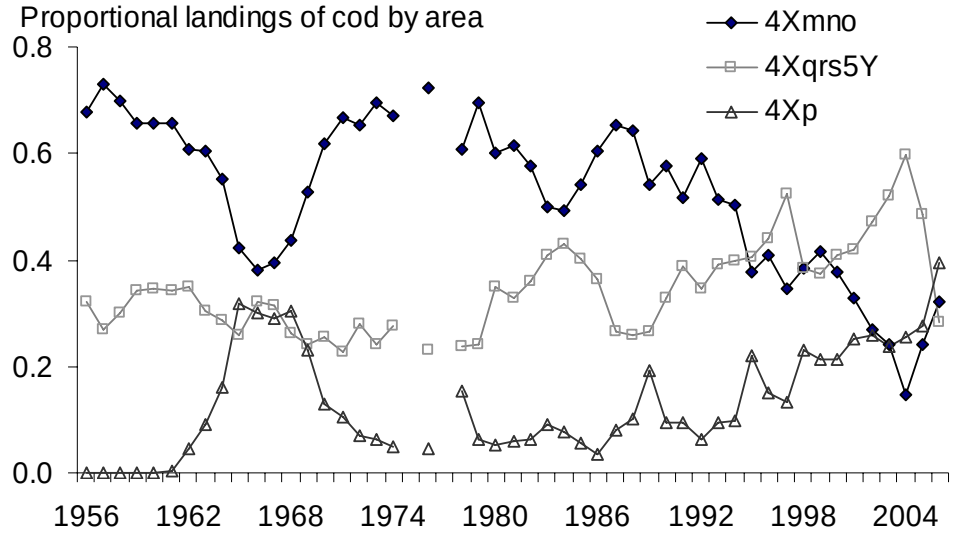


Figure 2. Proportion of cod landings by region.

The number of active vessels, and the number of trips made continued to decline. As a result, in 2005, fixed gear landed only 66% of their cod, and 42% of their haddock quotas. Landings to November 3rd in 2006 are slightly lower than in 2005, and it appears unlikely that the quotas for either cod or haddock will be reached, despite cuts in quotas for both stocks.

ASSESSMENT

Stock Trends and Current Status

On the Scotian Shelf, the research vessel (RV) survey **biomass index** has been declining since the late 1990s and in 2006 is the lowest in the series (Fig. 3). The ITQ survey biomass index also remained low.

In the Bay of Fundy the RV and ITQ survey biomass indices have both declined since quotas were dropped in 2000 to promote rebuilding. The biomass indices in the Bay of Fundy in 2006 were the lowest in the series for both surveys (Fig. 3).

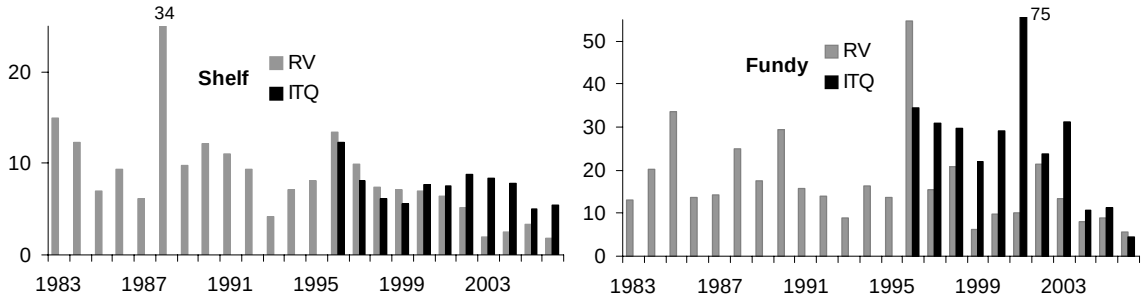


Figure 3. RV and ITQ survey biomass indices (Kg/tow) for 4X cod on the Scotian Shelf and in the Bay of Fundy.

The **indices at age** for the RV and ITQ surveys show abundance of older fish is very low in recent years (Figs. 4 and 5). In 2006, the ITQ survey index on the Shelf is the second highest in the series for age 3, but low for age 2. Indices for the Fundy region are low at all ages. The 2003 year-class dominates the RV survey catch in both the Fundy and Shelf regions, but is still slightly below the median for age 3. The recruitment indices (age 2) from the RV survey are below the median in both areas.

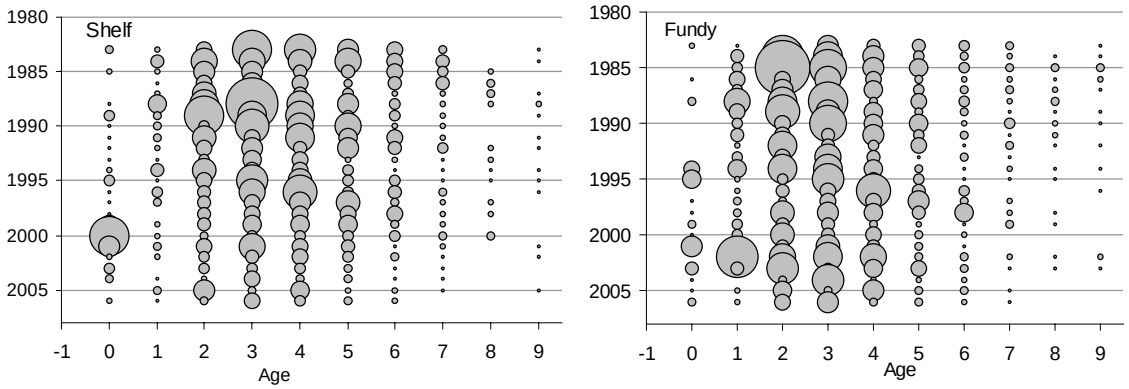


Figure 4. RV survey indices at age by area for 4X cod.

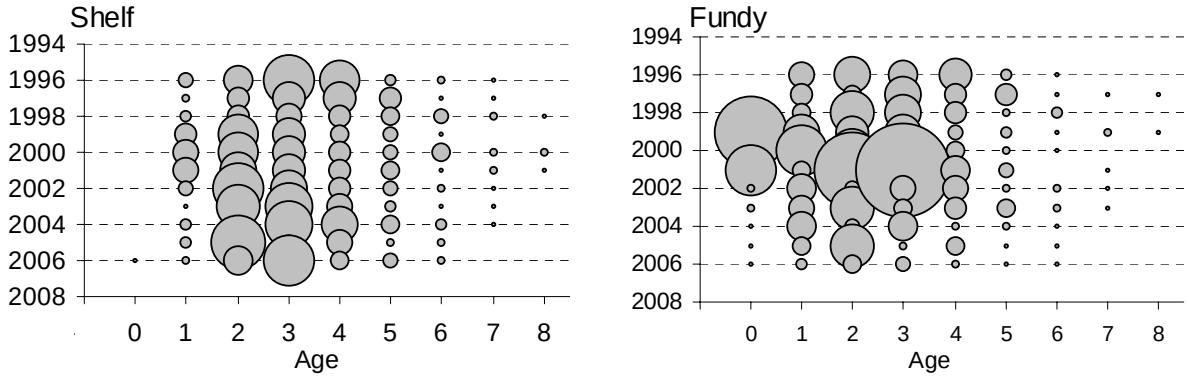


Figure 5. ITQ survey indices at age for 4X cod.

Unlike some other groundfish stocks in the region which have shown a declining trend in **length-at-age** and **condition**, 4X cod have shown no trend over time.

The **relative fishing mortality** (catch biomass/survey biomass index), while generally lower since 1995 than in the previous decade, has not declined since the TAC was dropped to 6,000 t

in 2000. **Total mortality (Z**), calculated from the RV survey, has been high in recent years in both the Bay of Fundy and Scotian Shelf, particularly on ages 4 and over. The total mortality calculated for the ITQ survey is variable without trend for the Bay of Fundy, but is increasing for the Scotian Shelf. Mortality from sources other than directed groundfishing may be contributing to the discrepancy between total and relative mortality. The absence of a decline in total mortality or relative fishing mortality indicates that the TAC reduction has not led to a reduction in mortality.

Results of exploratory Virtual Population Analyses support the survey observations that the population abundance and biomass have declined to their lowest levels. These analyses also suggest that mortality from sources other than directed groundfishing may be increasing.

Sources of Uncertainty

Cod in 4X are a stock complex. Trends may differ among components, complicating the interpretation of overall trends and leading to increased uncertainty.

Misreporting and discarding of cod in 4X can distort the calculation of relative fishing mortality. There were numerous reports of cod being discarded or landed unreported in 2000 and 2001 to avoid exceeding the quota. This is thought to have decreased in 2002. There have been few reports from industry of misreporting and discarding since.

Unrecorded removals from other fisheries will have some impact on total mortality, the extent of which is unknown but could be significant at low population levels. Restriction of the directed fishery may not be sufficient to lead to an increase in the population.

ADDITIONAL STAKEHOLDER PERSPECTIVES

During the data input review meeting in Yarmouth, there were a number of observations that landings and effort are both down in 2006. Fixed gear fishermen noted that there are very few fish inshore, either around Southwest Nova Scotia, or in the Bay of Fundy. Some noted that small cod (likely age 1) had been observed in inshore areas around south-west Nova Scotia and expressed hope that this may reflect higher recruitment to come. Many also expressed the view that an increase in seal population in the region is resulting in higher natural mortality.

The fishing industry generally agrees that stock biomass is currently low and needs rebuilding.

CONCLUSIONS AND ADVICE

Biomass has remained low since 2000 when the quota was reduced to 6000 t to promote rebuilding. There is no indication of a decline in total mortality or relative fishing mortality since 2000. Survey recruitment estimates for the 2004 year-class are low. While landings of about 4,000t are contributing to a continuing decline in abundance, further restriction of the directed fishery may not be sufficient to lead to an increase in population. Removals from all fisheries should be reduced to as low a level as practicable.

OTHER CONSIDERATIONS

Cod and haddock are caught together in groundfish fisheries, and are not necessarily caught in proportion to their relative abundance. With current fishing practices and cod/haddock species

catch ratios, the achievement of rebuilding objectives for cod may constrain the harvesting of haddock. An imbalance in quotas creates potential for discarding and may require improved monitoring. Modifications to fishing gear and practices, with enhanced monitoring, may mitigate these concerns.

SOURCES OF INFORMATION

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