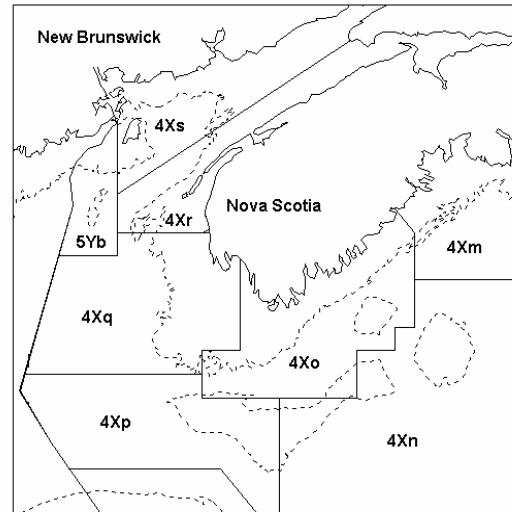
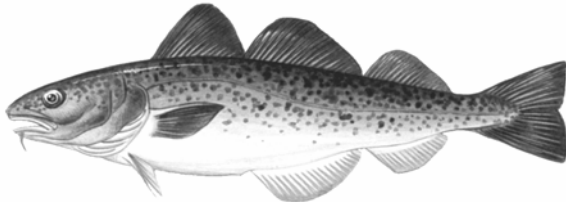




COD ON THE SOUTHERN SCOTIAN SHELF AND IN THE BAY OF FUNDY (DIV. 4X/5Y)



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

- The TAC from 2000-2004 was 6000 t annually and landings dropped to the lowest recorded in 2004 at 4700 t.
- On the Scotian Shelf, the recruitment index for the 2003 yearclass was the highest since 1994, while in the Bay of Fundy it was higher than most in the past decade.
- Biomass for 4X cod has likely declined since 2000 when the quota was reduced to 6000 t to promote rebuilding.
- There has been no indication of a decline in total or fishing mortality since 2000.
- Prospects for rebuilding are very dependent on the incoming 2003 yearclass. To conserve this yearclass, fishery removals should be reduced to the lowest level practicable.
- The achievement of rebuilding objectives for cod and pollock may constrain the harvesting of haddock.

DESCRIPTION OF THE ISSUE

Rationale for Assessment

Advice was requested by Fisheries Management on the stock status of 4X cod in order to determine a TAC that would be consistent with the management plan. Specifically:

- Evaluate the completeness and accuracy of fishery statistics for cod in 4X/5Yb for 2004/05, commenting on implications for status determination.
- Determine if the biomass and fishing mortality rate of cod has increased or decreased. Evaluate the prospects for rebuilding if catches are maintained at the current TAC of 5,500t. Provide details for the Bay of Fundy and Scotian Shelf separately.

The Fishery

Landings* (000s t)									
Year	1970-	1980-	1990-	2000	2001	2002	2003	2004	2005
	1979	1989	1999						
	Avg.	Avg.	Avg.						
TAC	-	23.4	15.4	6	6	6	6	6	5.5
Total	22.5	24.9	15.2	5.8	5.9	5.8	5.5	4.7	

*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

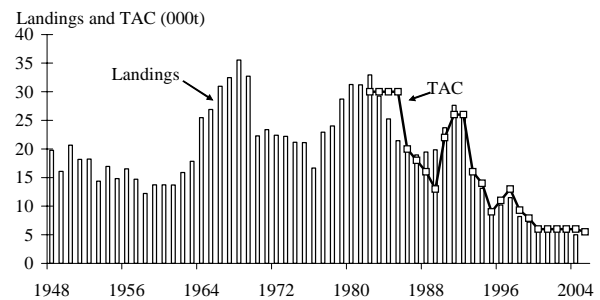


Figure 1. Landings* and TAC for 4X cod by quota year.

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 from 2000-2004 was 6000 t annually and landings dropped to the lowest recorded in 2004 at 4700 t. As of October 27th, 3380 t of the 2005 quota had been landed.

The distribution of the fishery has shifted in recent years, with the Bay of Fundy (4Xqrs5Y) and Georges and Crowell basins in 4Xp increasing in importance (Fig. 2). This is a general pattern

in the groundfish fishery, and reflects shifts in fishing patterns and distribution of abundance for a number of species.

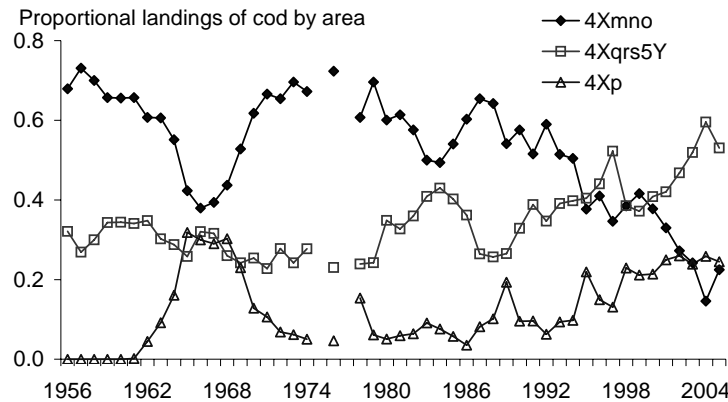


Figure 2. Proportion of cod landings by region.

In 2004 and 2005, fishing continued to be poor in coastal areas and on the Scotian Shelf. The number of active vessels, and the number of trips made declined, reportedly due to the poor economic return resulting from high costs (bait and fuel), and poor catches and prices for groundfish. As a result, in 2004, fixed gear landed only 70% of their cod and 30% of their haddock quotas. Landings to October 27 in 2005 are similar to those for 2004, and it appears unlikely that the quotas for either cod or haddock will be reached, despite cuts in TAC for both stocks.

RESOURCE ASSESSMENT

Stock Trends and Current Status

On the **Scotian Shelf**, the research vessel (RV) survey **biomass index** shows a declining trend from 1996 to 2003 with a modest increase since, though the last three years are the lowest in the time series (Fig. 3). The ITQ survey biomass index on the Scotian Shelf has shown no trend, but the 2005 observation is the lowest in the series.

In the **Bay of Fundy**, the RV and ITQ survey **biomass indices** have shown no increase since quotas were dropped in 2000 to promote rebuilding (Fig. 3).

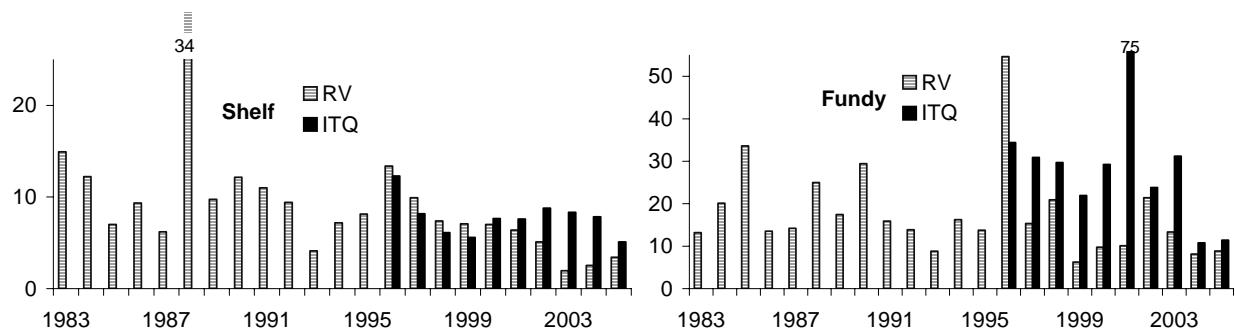


Figure 3. RV and ITQ survey biomass indices (Kg/tow) for 4X cod on the Scotian Shelf and in the Bay of Fundy.

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 2005, this is more pronounced, with indices low for all ages 5 and older, both on the Scotian Shelf and in the Bay of Fundy. The 2001 yearclass appears to be fairly strong in both areas in 2005, but indices for the 2002 cohort have been consistently low. On the Scotian Shelf, the recruitment index for the 2003 yearclass (age 2) was the highest since 1994, while in the Bay of Fundy it was higher than most in the past decade.

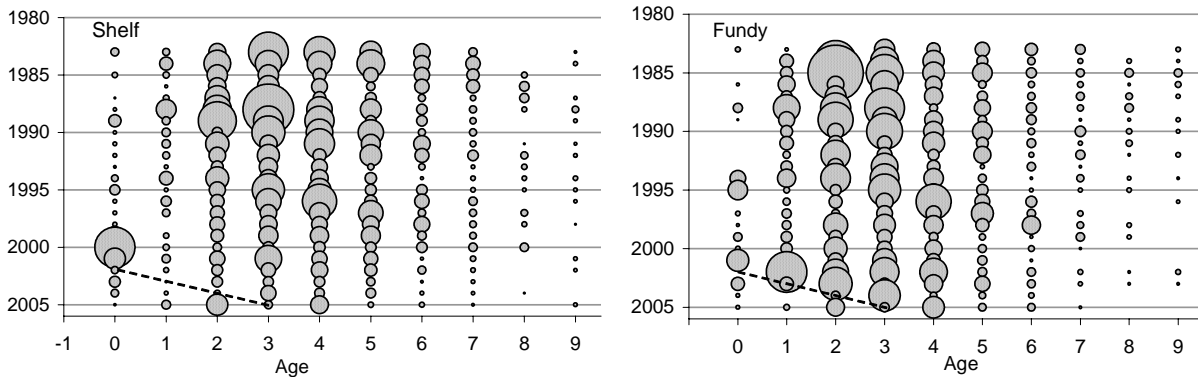


Figure 4. RV survey indices at age by area for 4X cod.

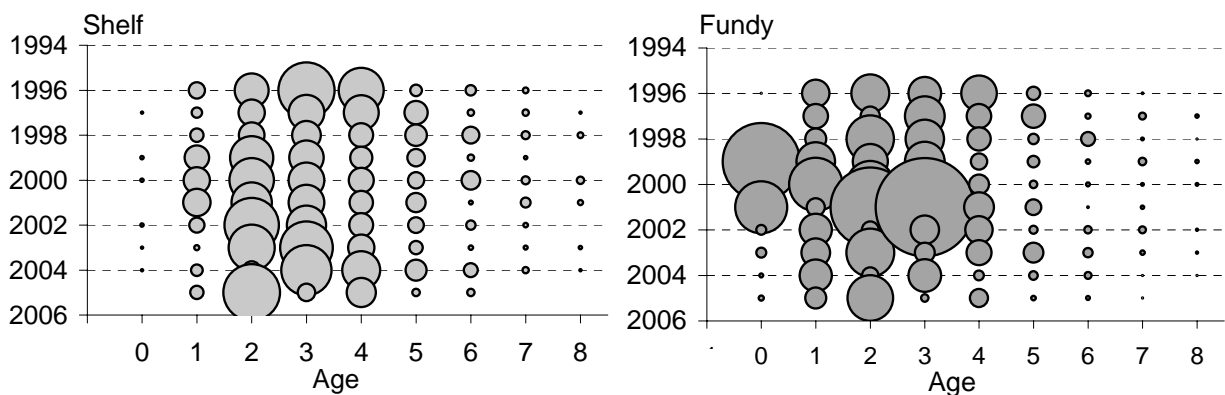


Figure 5. ITQ survey indices at age for 4X cod.

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.

Total mortality (Z), calculated from the RV survey, has high inter-annual variability but has been high in recent years in both the Bay of Fundy and Scotian Shelf. The total mortality calculated for the ITQ survey is variable without trend. 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. The absence of a decline in total mortality or relative fishing mortality indicates that this TAC reduction has not led to a reduction in mortality.

Sources of 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.

Uncertainty about the precise boundaries of the stock components can effect calculations from survey data.

ADDITIONAL STAKEHOLDER PERSPECTIVES

There were a number of observations that landings and effort are both down in 2005. During the RAP data input review meeting in Yarmouth, it was noted that in 2005 there were not as many cod in Georges Basin during April - mid-May. Fixed gear fishermen also noted that there is very little fish inshore, either around Southwest Nova Scotia, or in the Bay of Fundy. Some expressed concern over the reduction in area where cod can be caught, and the lack of old fish in the population.

A combination of the catch rates, the quota and economics (especially high fuel prices, and the monetary exchange rate) make it not worth fishing for cod, and therefore the quota may not be caught in 2005. The fishing industry generally agrees that stock biomass is currently low and needs rebuilding.

CONCLUSIONS AND ADVICE

Biomass has not increased since 2000 when the quota was reduced to 6000 t to promote rebuilding, and instead has likely declined. There has also been no indication of a decline in mortality since 2000.

Rebuilding was expected to be supported by the incoming 1998 and 1999 yearclasses but their abundance declined more rapidly than expected and an increase in biomass did not materialize. Landings of 5,000 t - 6,000 t, given recent recruitment levels, are resulting in high mortality and is not achieving rebuilding. Prospects for rebuilding are very dependent on the incoming 2003 yearclass and it will need to conserved more effectively than was the case for the 1998 cohort. To achieve this, fishery removals should be reduced to the lowest level practicable.

OTHER CONSIDERATIONS

Cod, pollock and haddock are often caught together in groundfish fisheries, although their catchabilities to the fisheries differ and they are not necessarily caught in proportion to their relative abundance. With current fishing practices and cod/other species catch ratios, the achievement of rebuilding objectives for cod and pollock may constrain the harvesting of haddock. Additional efforts to protect the 2003 cod yearclass which, from first indications, is estimated to be larger than has been seen in recent years are warranted. 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

Clark, D.S. 2005. Assessment of cod in Division 4X in 2005. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/078.

DFO, 2005. Proceedings of the Maritime Provinces Regional Advisory Process on Scotia-Fundy Groundfish Stocks; 31 Oct – 3 Nov 2005. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2005/022.

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